UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

December 1, 2003

MEMORANDUM TO: Cornelius F. Holden, Jr., Director
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

FROM: John Boska, Senior Project Manager, Section 2
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

SUBJECT: SUMMARY OF MEETING HELD ON OCTOBER 31, 2003, BETWEEN THE U.S. NUCLEAR REGULATORY COMMISSION (NRC) STAFF AND INDUSTRY GROUPS RELATED TO GRID RELIABILITY

Members of the Nuclear Regulatory Commission (NRC) staff hosted a meeting with representatives of the Nuclear Energy Institute (NEI), the Electric Power Research Institute (EPRI) and the Institute of Nuclear Power Operations (INPO) on October 31, 2003, at NRC Headquarters in Rockville, Maryland. This meeting was open to the public. A list of attendees is provided as Attachment 1. Handouts from the meeting are provided as Attachment 2.

Cornelius Holden (NRC) opened the meeting. Recent events at nuclear plants which resulted in the loss of offsite power have led the NRC to conduct an internal review of the reliability of the electrical grid. Although nuclear plants are designed to cope with the loss of offsite power, risk factors increase due to the dependence on emergency diesel generators (EDGs). Also, the NRC has a requirement in Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 63, "Loss of all alternating current power," that nuclear plants be able to withstand a loss of all alternating current power (including the loss of the EDGs) for a specified duration. Factors which were used to select the plant-specific duration included the expected frequency of the loss of offsite power and the probable time needed to restore offsite power. Although the data show that the frequency of the loss of offsite power may not have increased since 10 CFR 50.63 was implemented, the data suggest that the probable time needed to restore offsite power may have increased.

Alex Marion (NEI) stated that NEI had reviewed a previous NRC draft report on grid reliability and provided comments. He also believes that the current memorandum of understanding between the NRC and EPRI may provide for increased collaboration on the study of grid reliability. John Flack (NRC) discussed how it has become apparent that grid reliability varies from region to region, and the NRC is interested in developing more accurate risk profiles for different regions.

John Maciejewski (INPO) discussed industry actions associated with INPO Significant Operating Experience Report (SOER) 99-01, "Loss of Grid". In this SOER, INPO provided five recommendations for nuclear plants to implement. INPO sends evaluation teams to each nuclear plant about every two years. INPO reports that almost all of the recommendations have been implemented.

Frank Rahn (EPRI) discussed EPRI work related to grid reliability. In particular, EPRI completed a study on double-sequencing of safety-related electrical loads (refer to Attachment 2). EPRI concluded that the impact on core damage frequency is insignificant. He also discussed the EPRI work related to including the risk of losing offsite power in the daily operations risk monitors used at the nuclear plants. These risk monitors were primarily developed to assess and manage the increase in risk from proposed maintenance activities as required by 10 CFR 50.65, "Requirements for monitoring the effectiveness of maintenance at nuclear power plants."

Alex Marion (NEI) said that NEI will form a task force to address recommendations from the Joint Task Force on the August 14, 2003, northeast power outage when the recommendations are issued. Also, he asked what the NRC needed from NEI to close out the industry initiative from NRC Regulatory Issue Summary 00-24, "Concerns About Offsite Power Voltage Inadequacies and Grid Reliability Challenges Due to Industry Deregulation". NRC staff indicated that there may still be some work needed on the initiative to "establish provisions to log and evaluate unplanned post-trip switchyard voltages".

Jim Riccio (Greenpeace) asked the NRC to clarify the frequency of events with loss of offsite power. He understood that the percentage of events involving a long duration loss of power were increasing, but were the overall number of events also increasing? The NRC replied that, considering the average over several years, the number of events were not increasing, just the percentage with a long duration loss of power.

There were no further questions, and the meeting was ended.

Attachments: As stated

cc w/atts: See next page

cc: Mr. Charles Dugger
Vice President, Operations
Nuclear Energy Institute
Suite 400
1776 I Street, NW
Washington, DC 20006-3708

Mr. Alex Marion, Director, Engineering
Nuclear Energy Institute
Suite 400
1776 I Street, NW
Washington, DC 20006-3708

Distribution for Summary of Meeting Held on October 31, 2003, Between NRC Staff and NEI, INPO, and EPRI on Grid Reliability

PUBLIC
PDI-2 Reading File
S. Collins
G. Holahan
L. Marsh
E. Leeds
C. Holden
J. Boska
J. Calvo
R. Jenkins
J. Flack
W. Raughley
M. Kotzalas
E. Benner
S. Jones
T. Koshy
J. Lazevnick
G. Morris
J. Dozier
P. Lohaus
S. Smith (NRC/STP)
J. Jolicoeur, EDO
C. Bixler, RI
ACRS
OGC

Notice: ML032890535
Accession Number:

OFFICE	PDI-2/PM	PDI-2/LA	PDI/PD
NAME	JBoska JB	CRaynor	CHolden
DATE	11-14-03	11/18/03	11/26/03

OFFICIAL RECORD COPY

NRC Public Meeting on Grid Reliability

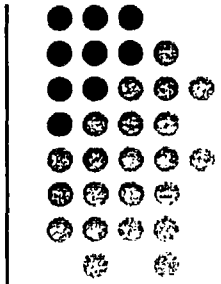
Friday, October 31, 2003
9:00 a.m. - 12:00 p.m.
Conference Room O-9B4

Name	Organization	
John Boska	NRR/NRC	
Thomas Koshy	NRR/NRC	
Jim Riccio	Greenpeace	
Frank Rahn	EPRI	
Joseph DeBur	AeroFlex	
Paige Negus	GE	
Ronald Jenkins	NRR/NRC	
John Macievewski	INPO	
George Morris	NRR/EEIB	
Althea Wyche	SERCH Licensing/Bechtel	
Scott Burnell	OPA	
Cornelius Holden	NRR	
Eric Benner	NRR	
Jim Lazrynick	NRR	
L.B. Marsh	NRR	(301) 415-1453
Dan Stenger	Ballard Spahr	
Roger Huston	Licensing Support Services	
George Lanik	REAHFB/RES	
Christopher Long	NRR	
Tom Harrison	McGraw-Hill	
John Jolicoeur	OEDO/NRC	301-415-1724
Glenn Morris	US DOE	301) 903 9527

NRC Public Meeting on Grid Reliability

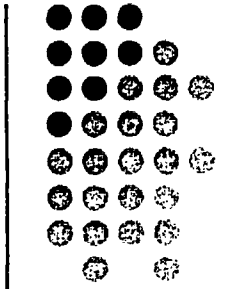
Friday, October 31, 2003
9:00 a.m. - 12:00 p.m.
Conference Room O-9B4

Name	Organization	
CHUCK DUGGER	NEI	202-739-8112 CHD@NEI.ORG
VINCE GILBERT	NEI	202 739 8138 JVGENCI.org
ALEX MARION	NEI	202.739.8080 am@nei.org
Anne Cottingham	Winston & Strawn	202/371-5724 Acotting@winston
Jerry Dozier	NRR	(301) 415-1014
David Elizondo	MPR	(703) 519 0504
Sharon R. Smith	NRC/STP	301-415-2620
donald. Fletch	NRC/REE	301-415-7488
Bill Raughley	NRC/RES.	301-415-7577
José Calvo	NRC/EEIB	301-415-2744
By phone conference:		
David Allard	DEP / Pennsylvania	
Rich Janati	DEP / Pennsylvania	
C. O'Claire	DPS / Ohio	
Jill Lipoti	DEP/ New Jersey	
Rich Penny	DEP/ New Jersey	
Bob Heublein	INPO	



Significant Operating Experience Report (SOER) 99-1 "Loss of Grid"

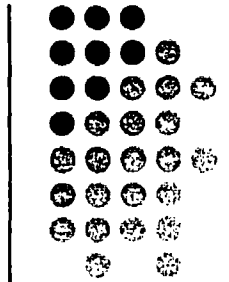
SOER 99-1 "Loss of Grid"



- SOER issued in late 1999 because of events associated with loss of grid

- intent of the SOER recommendations is to help ensure barriers that protect nuclear plants from grid loss or degradation are in place (five recommendations)

Evaluation of SOER Implementation

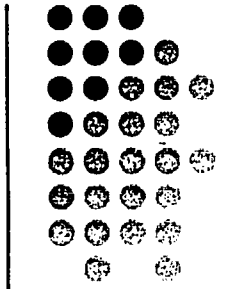


- **Began in June 2000**

  All stations evaluated by June 2002, some of them re-evaluated

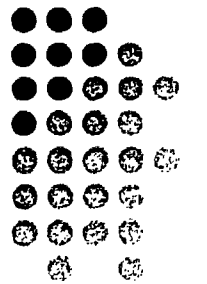
  - 97% of the recommendations are implemented
  - Two recommendations at two stations are in progress
  - Nine recommendations in total are not satisfactorily implemented

Identified Weaknesses



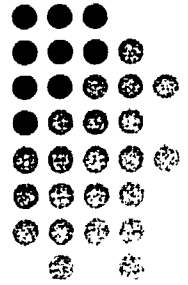
- **Nine recommendations in total are not satisfactorily implemented**
  - Interface procedure and procedure implementation weaknesses existed at two stations.
  - At two stations, implementation of a revised operating procedure for a loss of grid event was delayed or not in place.
  - Weaknesses in the control of switchyard work or the PM program were identified at three stations.
  - One station was conducting a design study but it was not complete.
  - At one station, training associated with the grid was being conducted but not completed.

Recommendations in Progress



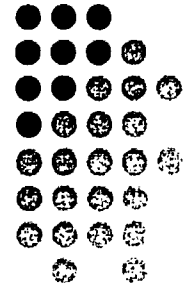
- Preventive maintenance programs being incorporated
- Design assumption verification indicated a modification would be appropriate. The modification is to be implemented.

SOER 99-1 Implementation



- **conclusions based on evaluations**
  - Stations are actively addressing the SOER recommendations.
  - With few exceptions, the stations evaluated have completed implementation of the SOER recommendations.

Other Activities



- Industry meeting including the affected stations was held in September after the blackout.
- SEN 242, "Loss of Grid Event, August 14, 2003" has been issued.
- Continue to evaluate station implementation of the SOER and follow-up.

EPRI Work Related to Nuclear Plant Safety and Grid Reliability

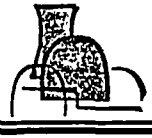
Frank J. Rahn

Industry / NRC Meeting
October 29, 2003

EPRI

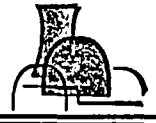
EPRI's *Technology Roadmap*

- A major goal in is Resolving Power Delivery Vulnerability
- Elements include:
  - ongoing LOOP event analysis are the basis of Baysian updating of PRA data bases and other vulnerability studies
  - EPRI Power Delivery Initiatives have the goal of reducing the North American Grid vulnerability to disruption in service, particularly in the near term
  - Integration with nuclear plant CRMP programs supported joint DOE/EPRI funds under NEPO project Potential Nuclear Plant Vulnerabilities Arising from Grid Voltage Inadequacies



Current EPRI Risk/Safety Management Activities related to Loss Of Offsite Power

- **Periodic Loss Of Offsite Power Report**
  - Technical Update for 2002 on EPRIWeb
- **Double Sequencing**
- **Risk & Reliability Workstation Related**
  - 'Environmental' adjustor in EOOS initiating frequency
  - TRIP Monitor
- **Support to NEI on Grid Issues**
  - Review of NRC Report "Operating Experience Assessment – Effect of Grid Events"
  - Support of decoupling LOOP LOCA requirements
- **NEPO Work**
  - Including effects of cascading grid failures
- **Interface with EPRI Power Delivery Sector**



EPRI

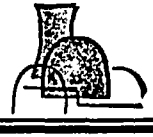
Periodic Loss Of Offsite Power Report
Technical update for 2002

- There were no losses of all offsite power at nuclear plants during 2002

- There were eight events that involved a partial losses of offsite power
  - Most were relative minor; a few were more involved
  - In all events, power was readily available
  - In two of the 8 events, the unit tripped; in the other 6 the unit remained at power

Periodic Loss Of Offsite Power Report
Technical update for first 6 months of 2003

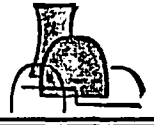
- Examined 15 potential events
- There were no losses of all offsite power at nuclear plants while a unit was at power between January and June 2003
- There was one loss of all offsite power while a unit was in a refueling outage
- There were partial losses of offsite power at 5 units
  - Four were at 100% power prior to the event
  - One was in Mode 3



EPRI

Double Sequencing

- Double Sequencing occurs when safety and accident mitigation loads start, shutdown, and restart in rapid succession
- For example, this might occur if there are the following series of events
  - LOCA occurs
  - Safety loads are energized from off-site
  - The grid is degraded and voltage sags
  - The safety loads trip from offsite power and are reenergized by the diesels generator
- There are similar scenarios that can result in double sequencing
- EPRI Report 1009110 "The Probability and Consequences of Double Sequencing Nuclear Power Plant Safety Loads, Rev. 1"
- EPRI 1007966 "Double Sequencing Analysis for BWRs"



Double Sequencing
Conclusions from EPRI's Investigation

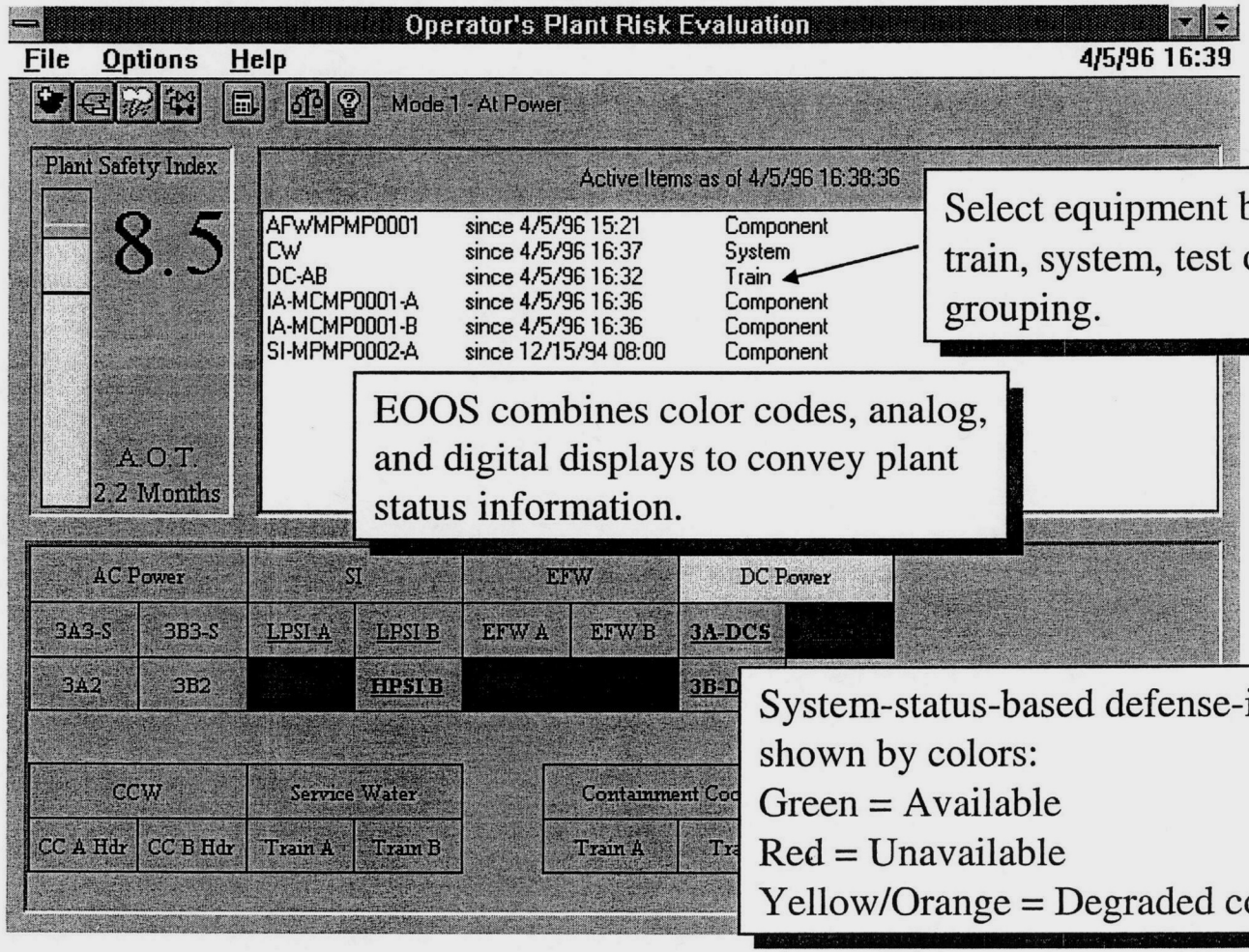
- The probability of a simultaneous LOCA and degraded grid is low
- Critical electrical components are not likely to be damaged or made unavailable by double sequencing
  - The large pumps have low rotational inertias and come up to speed quickly with out excessive motor heating
- Double sequencing is not expected to change the nature or severity of postulated water hammer that might occur on pump starts
- Start of safety injection is delayed only a few seconds
- Impact on core damage frequency is insignificant
- No significant differences between BWRs and PWRs

EPRI

Risk & Reliability Workstation --- EOOS

- Transmission grid and substation initiating events are handled in EPRI Equipment-Out-Of-Service (EOOS) risk monitor
- Grid instability initiating events that degrade power production are handled by the TRIP MONITOR

EOOS - Plant Operator's Panel Showing Plant Risk Status

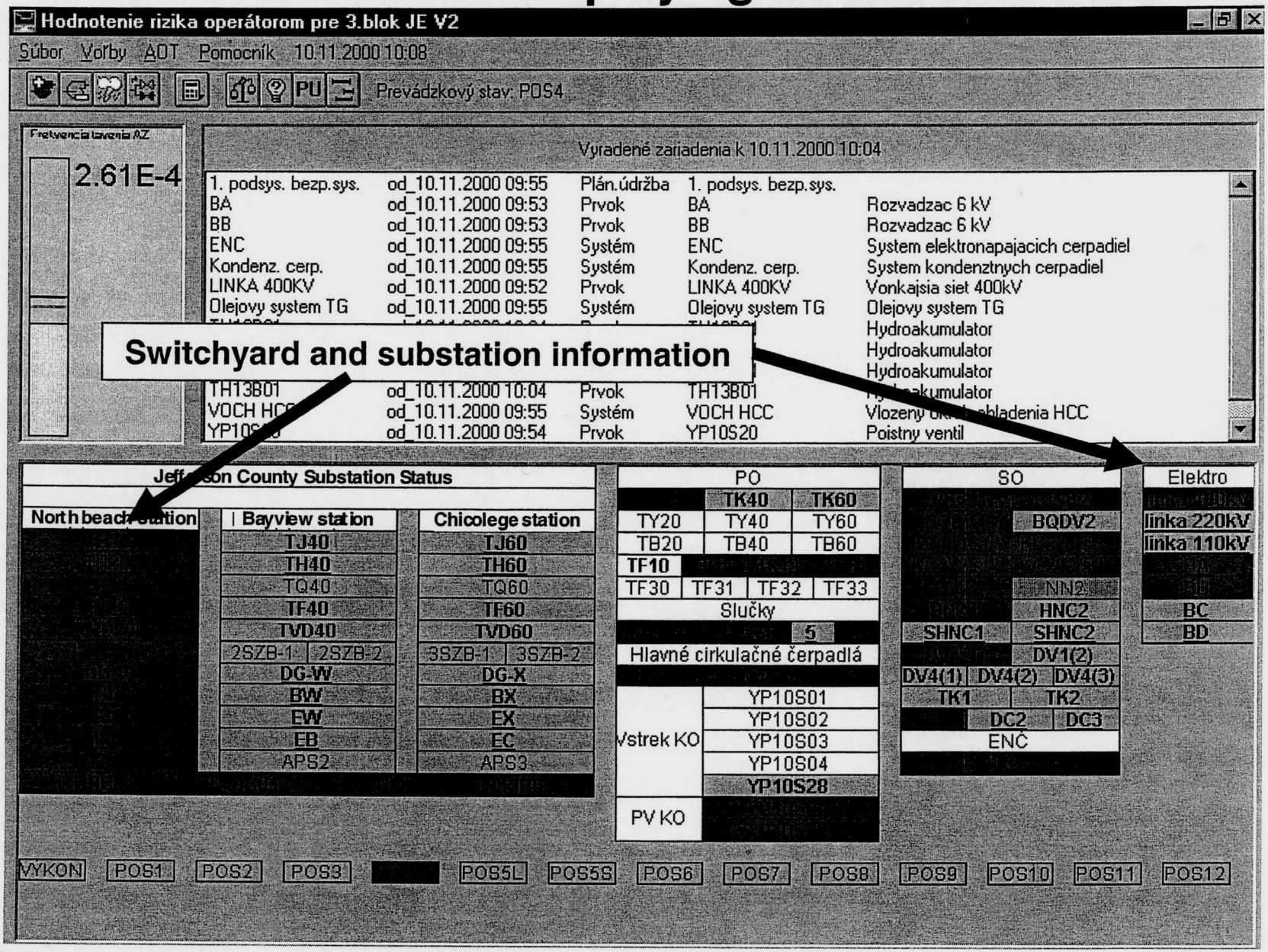


Select equipment by component, train, system, test or other grouping.

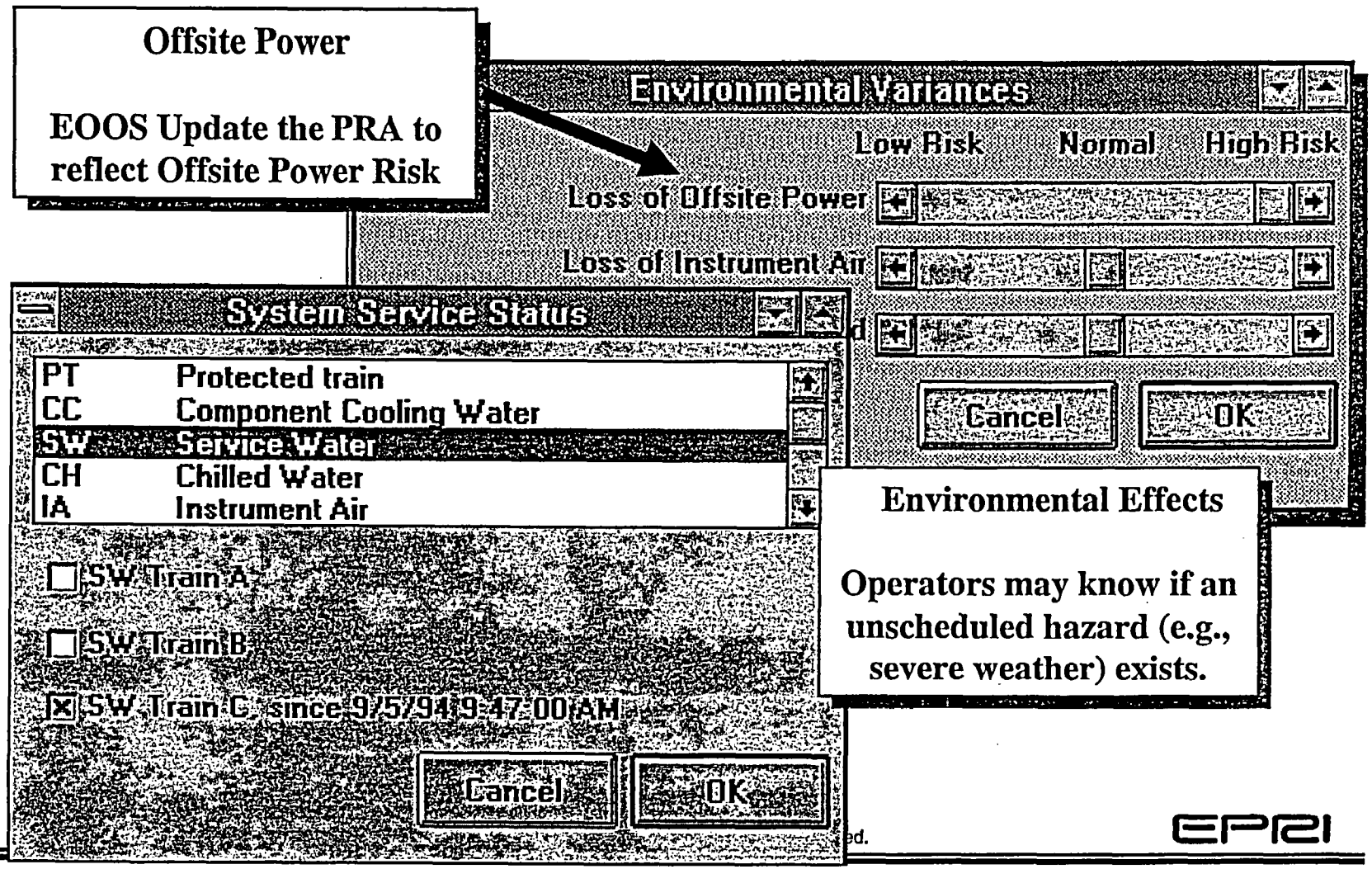
EOOS combines color codes, analog, and digital displays to convey plant status information.

System-status-based defense-in-depth shown by colors:
Green = Available
Red = Unavailable
Yellow/Orange = Degraded condition

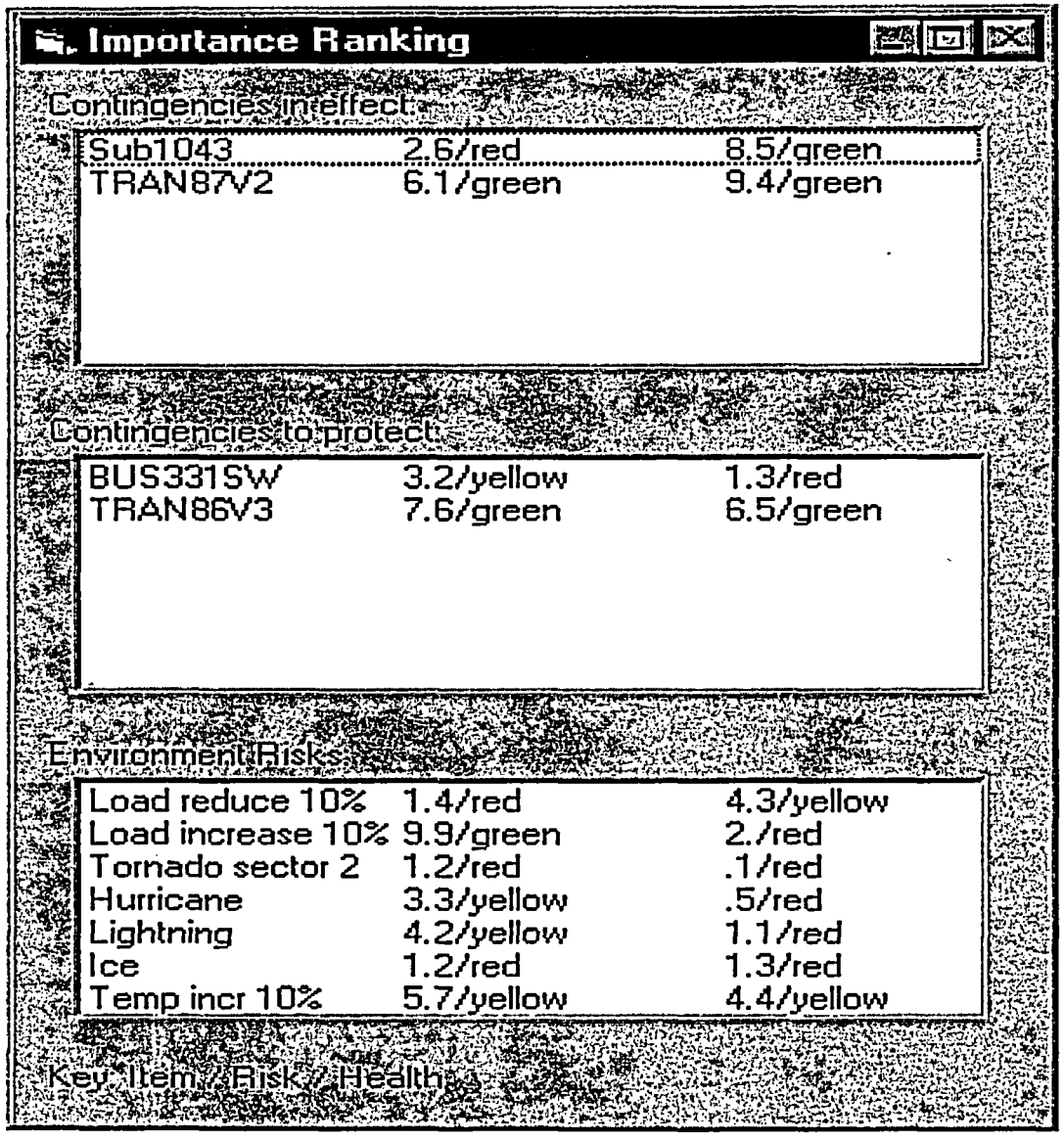
EOOS Risk Monitor displaying Offsite Grid Status



EOOS Risk Monitor
Transmission Grid Factors Affecting Risk



EOOS evaluates plant risk due to loss off transmission assets and weather effects

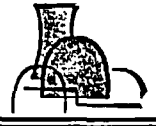


EPRI

DOE NEPO Task

Plant Vulnerabilities due to Transmission Grid Voltage Inadequacies --- Improve Plant Capacity Factors

- **Principle Objective:**
  - Prevent loss of plant capacity due to transmission system instabilities requiring plant trips or reductions in power
- **Status:**
  - Preliminary work was funded in 2001. CY 2003 and 2004 funding will evaluate effectiveness of risk monitors and using grid state estimators to anticipate and mitigate transmission system instabilities
- **2004 Work:**
  - Provide existing plant risk configuration risk/trip monitors (EOOS, Safety Monitor) with operational recommendations to reduce impact of grid instabilities (including technical specifications and action statements)
  - Assess plant-side AC Power reliability relative to projected low voltage sag and fast transients

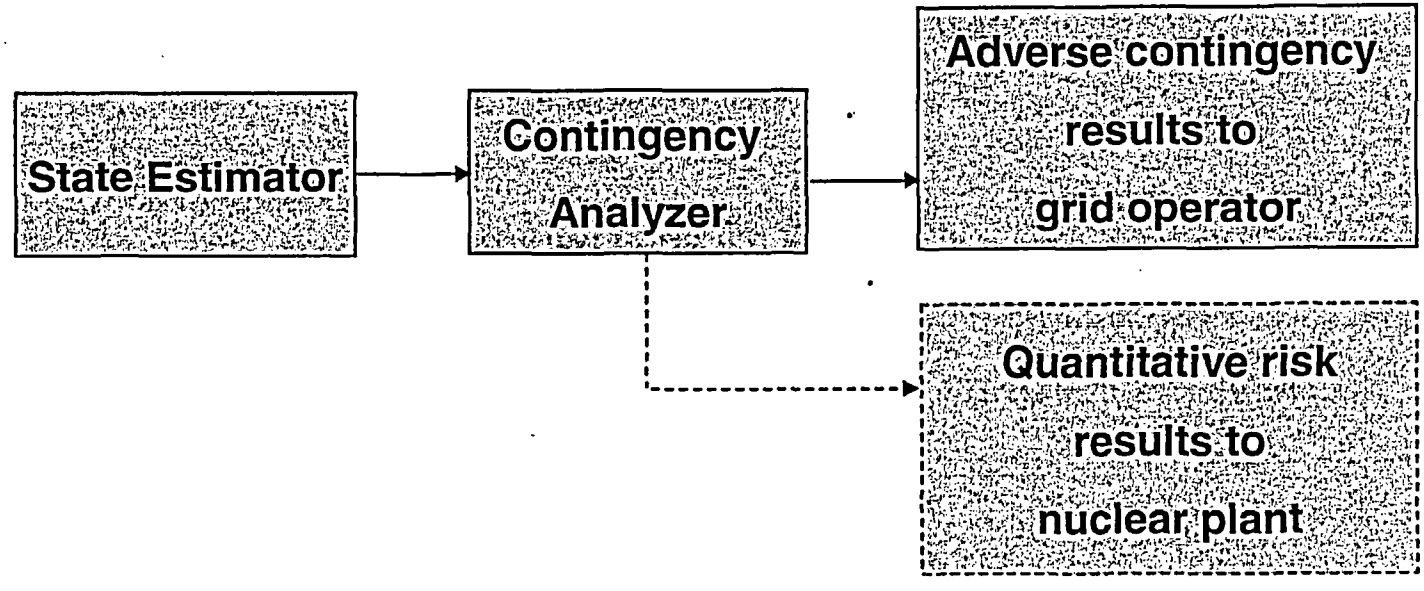


Recent Background

- Grid instability is a accident initiator, and NEI, EPRI, DOE and NRC are interested in how plants are coping with a deregulated transmission system
- Significant progress has been achieved in the first phase of the project (the creation of a TRIP MONITOR) which will allow communication by similar risk models be developed for the grid
- Information needed to be communicated:
  - From plant to grid: probability of a plant trip/power cutback during time of grid instability
  - From grid to plant: probability of voltage sag, local congestion of key power lines, approaching electrical disturbances (e.g., lightning), selective rolling blackouts
- Plant can then take compensatory measures to protect both plant and grid

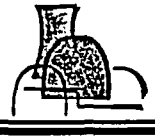
Grid Reliability and Nuclear Safety Risk

- EPRI investigating existing Grid State Estimators and Contingency Analysis Programs as ***risk monitors***
  - in support of NEI and BWROG LOOP-LOCA effort



EPRI Power Delivery Sector
Initiatives

- Consortium for an Electric Infrastructure for a Digital Society (CEIDS)
  - Fast Simulation and Modeling (FSM) System for grid management
- Infrastructure Security Initiative (ISI) Phase 1
  - Secure Communications
  - Recovery Transformers
  - Vulnerability Assessments
  - Red Team Attacks
  - Immediate Countermeasures
- Strategic Management of Security, Quality, Reliability, and Availability



EPRI Power Delivery Sector

Operational Resources for the Industry

- **Grid Operations & Planning**
  - enhance security and reliability, maximize power transfers
- **Transmission Operations**
  - support Regional Transmission Operators or Independent System Operators
- **Enterprise Information Security**
  - critical information sent through corporate LANs and WANs
- **Overhead Transmission**
  - reduce O&M costs, and improve reliability
- **Increased Transmission Capacity**
  - operate existing equipment at higher loads
- **Power Quality Solutions for T&D**
  - monitoring for maintenance, data acquisition devices and metrics for circuit performance

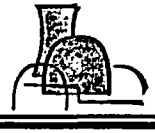
EPRI Power Delivery Sector

Service Resources for the Industry

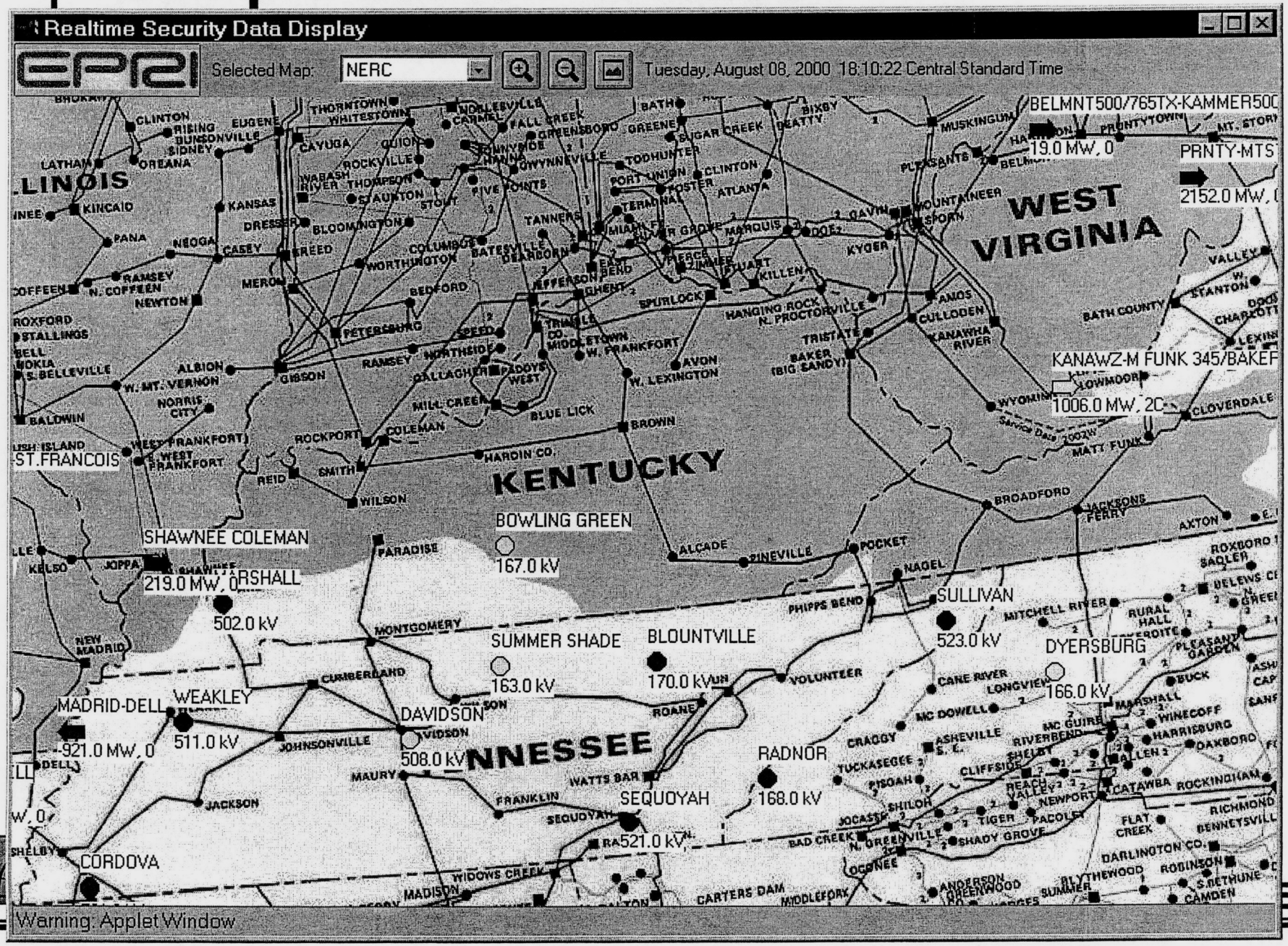
- Transmission System Modeling and Studies
- Reliability Assessment of Power Plants under Grid Disturbances
- T&D Maintenance Optimization
- Transmission System Reliability Improvement
- Electrical Equipment Testing, Design, and Demonstration
- Power System Monitoring, Analysis, and Performance Studies

Real-time Security Data Display (RSDD)

- **Purpose - to provide a bird's eye view of the grid reliability over a wide area (up to entire N. America)**
- **Data Displayed:**
  - Flowgate flows and Transmission Loading Relief (TLR) status
  - Voltages at up to 300 buses
- **Color code (Red, Yellow and Blue)**
  - Voltage below low limit is Red, Marginal is Yellow



Sample Screen of RSDD



Conclusion

- EPRI is assisting NEI and the nuclear industry in:
  - Analyzing the significance of past events
  - Investigating technical aspects of LOOP events
  - Developing tools to monitor potential grid instability
  - Working with DOE in optimizing plant performance
  - Interfacing with the power delivery / transmission providers to improve off site power reliability