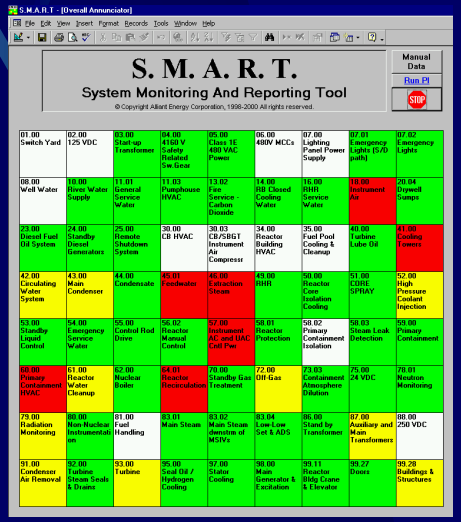
System Monitoring at the DAEC

SysMon

SMART



Teaming up to get the most out of System Monitoring!

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SysMon

- Result of 2 EPRI Task Group efforts published in March 1997 and March 1998.
- Past tendency was to trend a parameter because it *can* be trended.
- EPRI methodology provides a consistent, proactive approach based on the ability to predict degradation and preclude failure of specific system functions.

Basic Methodology

- Focuses on selecting important parameters for monitoring based on primary system functions and degradation mechanisms that can defeat primary functions.
- Stresses system level monitoring by the integrated use of tools, technologies, and data obtained from many sources.

Elements of Effective Programs

- Program Scope Definition
- Define System Performance Goals and Indicators
- Define Importance of System Functions
- Define Degradation Mechanisms and Indicators
- Identify Data Requirements
- Identify Actions Required
- Establish Communication Methods
- System Monitoring Documentation
- Perform System Monitoring

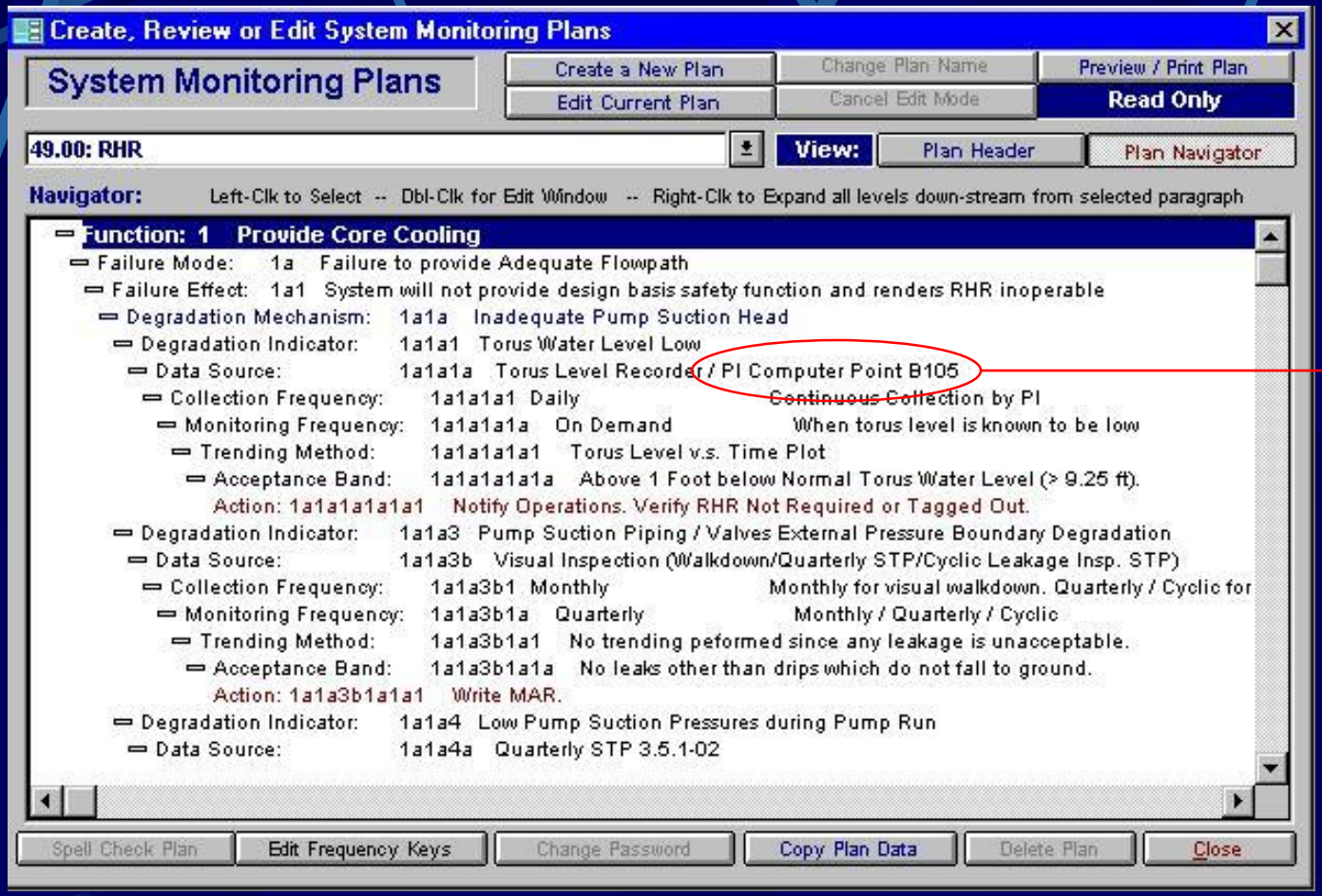
Types of Monitoring

- **Indirect** - The periodic review of historical, programmatic system information for the purpose of predicting future system performance.
- **Direct** - A periodic review of physical parameters to assess current system performance and to identify system degradation.

Layers in Direct Monitoring

- Function
- Failure Modes
- Failure Effects
- Degradation Mechanisms
- Degradation Indicators
- Data Source
- Data Collection Frequency
- Monitoring Frequency
- Trending Method
- Acceptance Bands
- Action Required

Typical SysMon Layout



SMART retrieves the actual data and provides it to the System Engineer.

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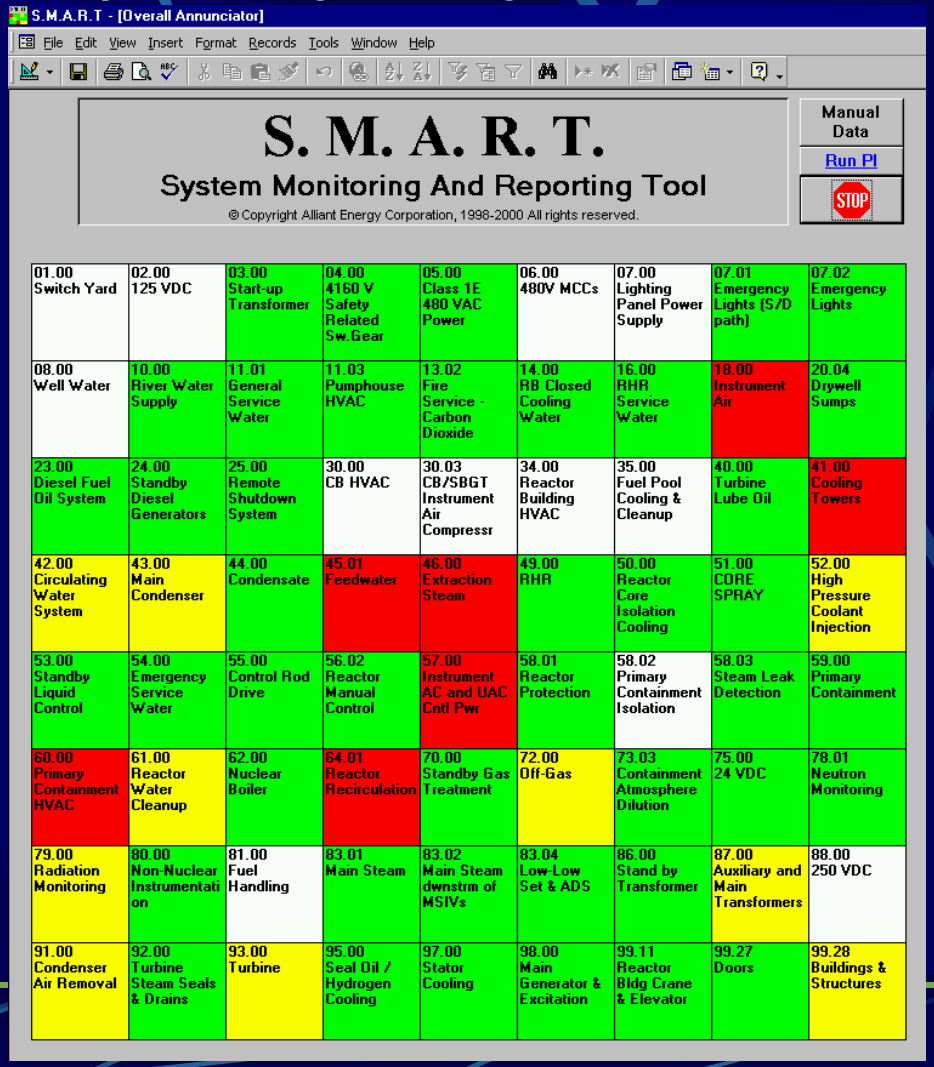
S.M.A.R.T.

An important part of your system monitoring toolbox.



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The History of SMART

- March 1997 - EPRI issues “Guideline for System Monitoring by System Engineers”
- June 1997 - AR written to review effectiveness and use of the System Health and Status reports on the LAN.
- March 1998 - EPRI issues 37 System Monitoring Plans and software.

The History of SMART

- June 1998 - Project Team convenes to develop an effective system monitoring program.
- June 1998 - All system engineers trained on EPRI methodology and SysMon software.
- October 1998 - First system plan declared ready and implemented into SMART.

Requirements for SMART

- Data is easily gathered with little or none performed by the System Engineer
- Use is made of expertise outside of Systems Engineering
- Computer programs are reliable
- Current and historical analyses of trends are included

Requirements for SMART

- The system can be monitored remotely
- The System Engineer and other users are alerted to problem areas
- The System Engineer is properly trained on the program
- Output from the program is well communicated and reported

Requirements for SMART

- Use of the program is uniform across all systems
- The basis for trending specific parameters is documented
- The program is easy to use

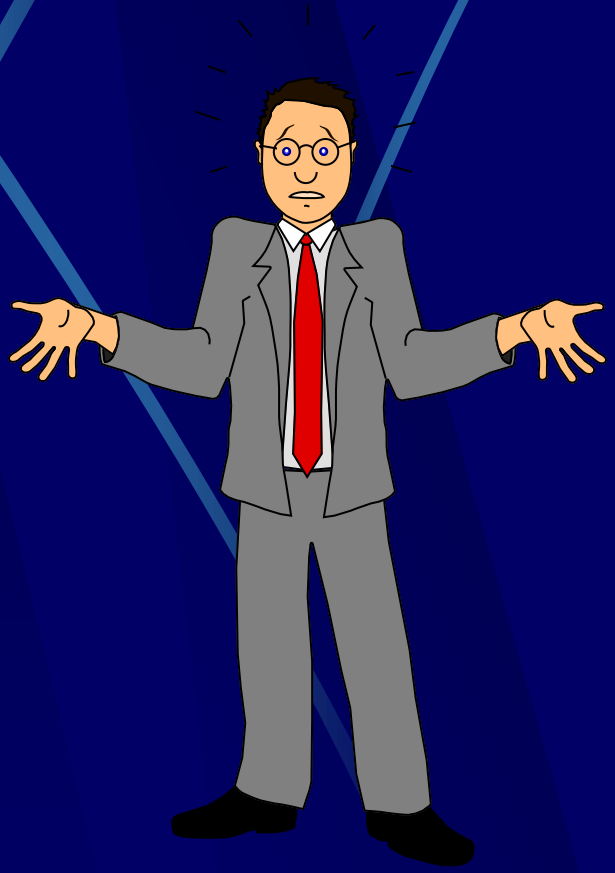
Purposes of SMART

- *Automatically collect and make readily accessible to the System Engineer data which is important to trend (as determined by the EPRI methodology).*
- *Provide the medium for the System Engineer to share subsequent analyses with plant personnel.*

SMART and SysMon

- *SMART taps into the SysMon database to extract stored information regarding monitoring bases.*

How does it work?



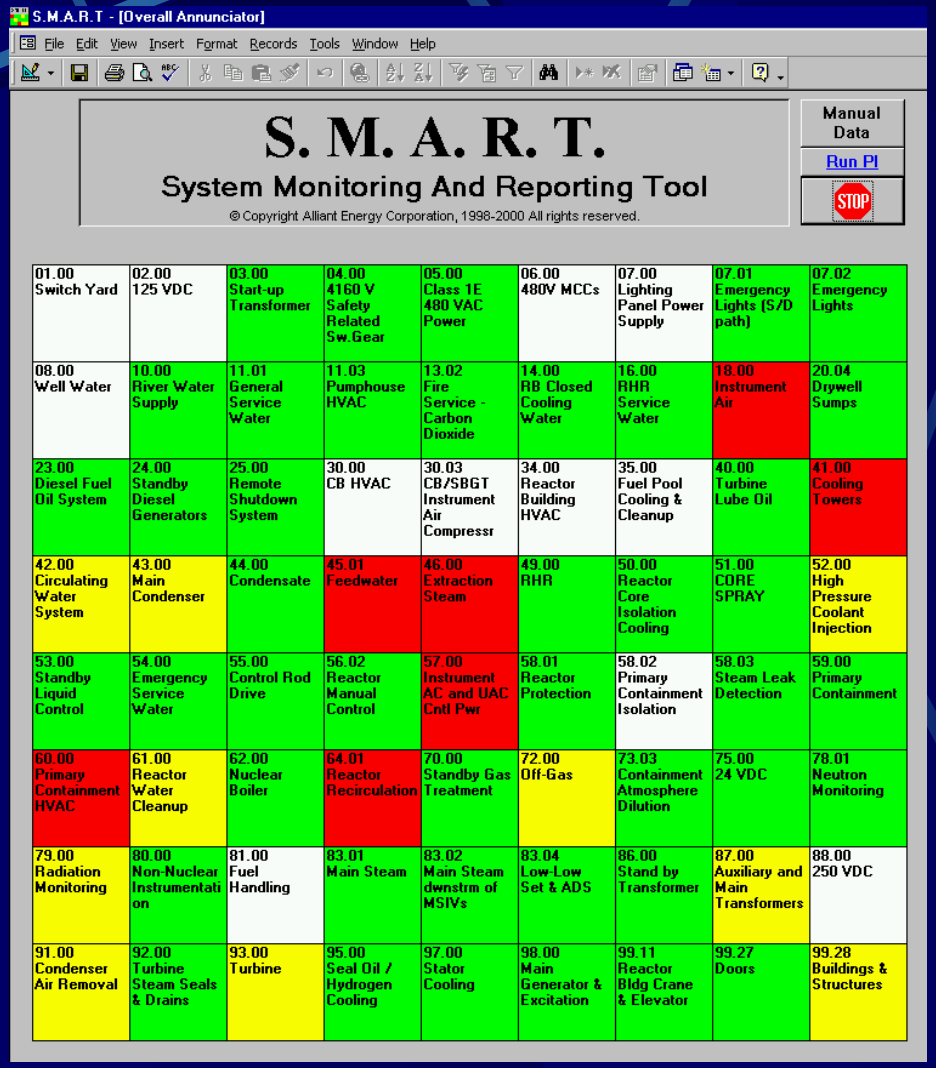
Structure of SMART

- *Main Features Include:*
  - *Main Annunciator Window*
  - *Health & Status (Information)*
  - *Direct Monitoring Annunciator Window*
  - *Direct Monitoring Detail Screen*
  - *Auto (Indirect) Monitoring Screen*
  - *Parameter Maintenance*

Sources of Data

- *Plant Information (PI)*
  - *In-plant Transmitters*
  - *Operator Rounds via Handheld Dataloggers*
- *Equipment Monitoring Database*
  - *Vibration Analysis*
  - *Oil Analysis*
  - *Thermography*
  - *Inservice Testing (IST)*
- *Instrument Trending Program*
- *Surveillance Test Procedures*
- *Manual Input*

Main Screen



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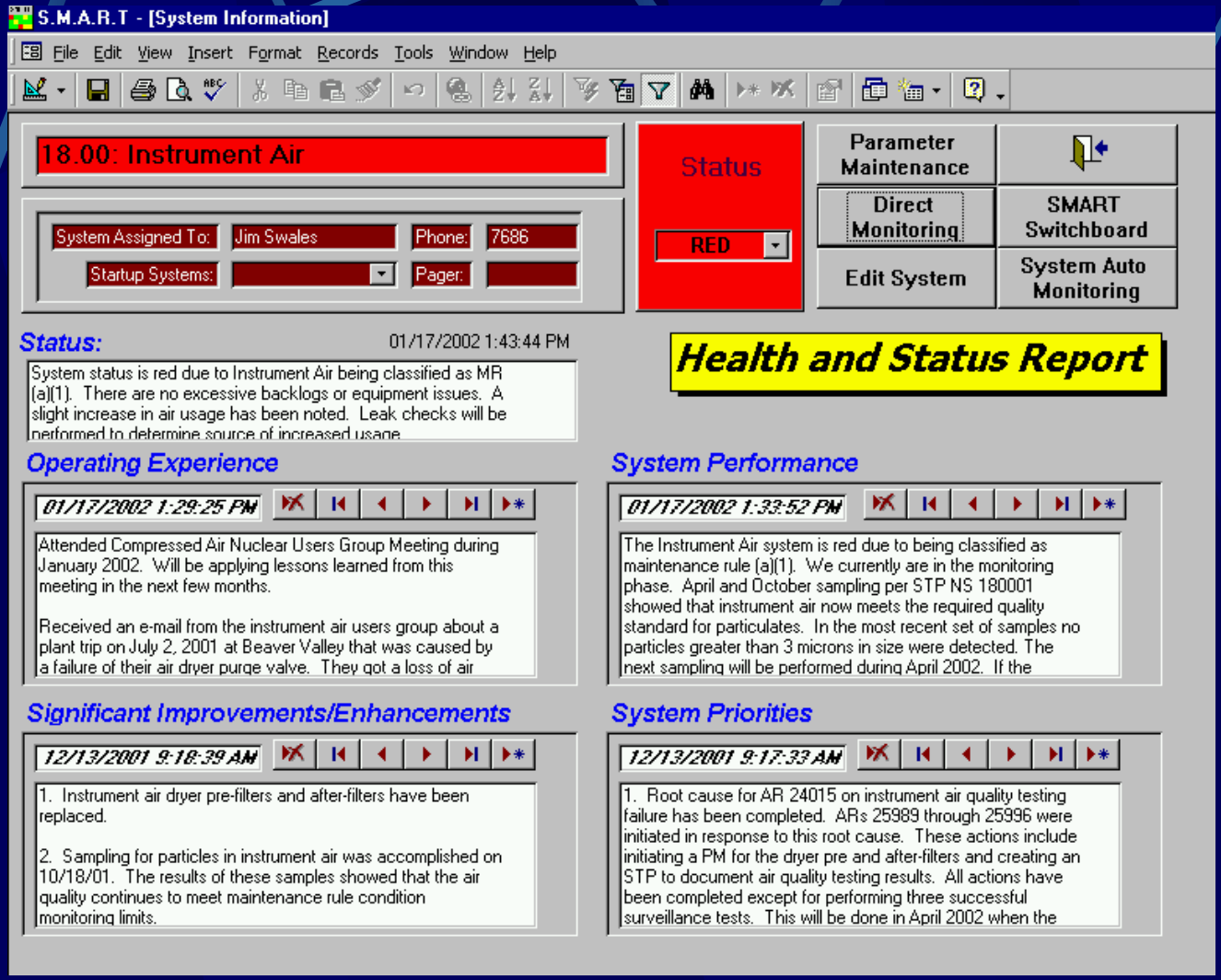
System Health Assessment Rating Guideline

System Health Assessments use a four level rating scheme to evaluate overall health of the system. “Key Parameters” are used to assess the overall health of the system. Consider safety significance of issues involved when selecting a Key Parameter rating. If any Key Parameter is Marginal (Yellow), the overall rating should be Marginal (Yellow) or Needs Improvement (Red). If any Key Parameter is Needs Improvement (Red), the overall rating should be Needs Improvement (Red).

Key Parameter	Exemplary (Green)	Satisfactory (White)	Marginal (Yellow)	Needs Improvement (Red)
Unplanned Reactor Trip	None in previous 2 years due to System equipment	None in previous 2 years due to System equipment	None in previous 12 months due to System equipment	One or more in previous 12 months due to System equipment
Unplanned Safety System Actuation	None in previous 2 years due to System equipment failure	None in previous 2 years due to System equipment failure	None in previous 12 months due to System equipment failure	One or more in previous 12 months due to System Equipment Failure
Unplanned Capability Loss (UCL)	None in previous 2 years due to System equipment	<0.2% UCL in previous 12 months due to system equipment	<0.5% UCL in previous 12 months due to system equipment	>0.5% UCL in previous 12 months due to system equipment
Planned Capability Losses (Excludes down-powers for required testing)	None in previous 2 years due to System equipment	<2500 MW-hr planned losses in previous 12 months are due to System equipment	<20,000 MW-hr planned losses in previous 12 months are due to System equipment	>20,000 MW-hr planned losses in previous 12 months are due to System equipment
System Equipment Issues	Zero (0) Workarounds, Degraded Instruments, Temp Mods, or Long Term Tagouts	Two (2) or less Workarounds, Degraded Instruments, Temp Mods or Long Term Tagouts	Four (4) or less Workarounds, Degraded Instruments, Temp Mods or Long Term Tagouts	Five (5) or more Workarounds, Degraded Instruments, Temp Mods or Long Term Tagouts
NRC Violations/INPO Findings/Significant Adverse Conditions (Level 1 or 2 AR’s) due to System equipment	None in previous 2 years	One (1) in previous 12 months with actions complete and system health trending positively	One (1) in previous 12 months with actions not complete **OR** Two (2) or more in previous 6 months with actions done	One (1) or more in previous 12 months and no actions taken
NRC/WANO Availability Performance Indicators (Applies to SBDG, HPCI, RCIC, RHR only)	WANO score of full credit **AND** NRC performance Green and stable or improving	WANO score of full credit **AND** NRC performance Green and stable or improving	WANO score predicted to be less than full credit **OR** NRC performance indicator trending towards white	WANO score less than full credit **OR** NRC Performance Indicator identified as “White”, “Yellow”, or “Red”
Maintenance Rule	Classified as (a)(2) (Green)	Classified as (a)(2) (Green)	Classified as near (a)(1) (Yellow)	Classified as (a)(1) (Red)
Open Corrective Work Orders	Consider and evaluate the number, age, and type of Corrective Work Orders (CWO’s) Tailor rating based on historical trend, safety significance of issues, System Engineer expectations, etc.			
Open Action Requests	Consider and evaluate the number, age, and type of Action Requests (AR’s) Tailor rating based on historical trend, safety significance of issues, System Engineer expectations, etc.			
Deferred Preventive Work Orders	Consider and evaluate the number, age, and type of Preventive Work Orders (PWO’s) Tailor rating based on historical trend, safety significance of issues, System Engineer expectations, etc.			
SMART Direct Monitoring	Consider and evaluate direct monitoring parameters in SMART Tailor rating based on historical trend, safety significance of issues, System Engineer expectations, etc.			

Information Screen



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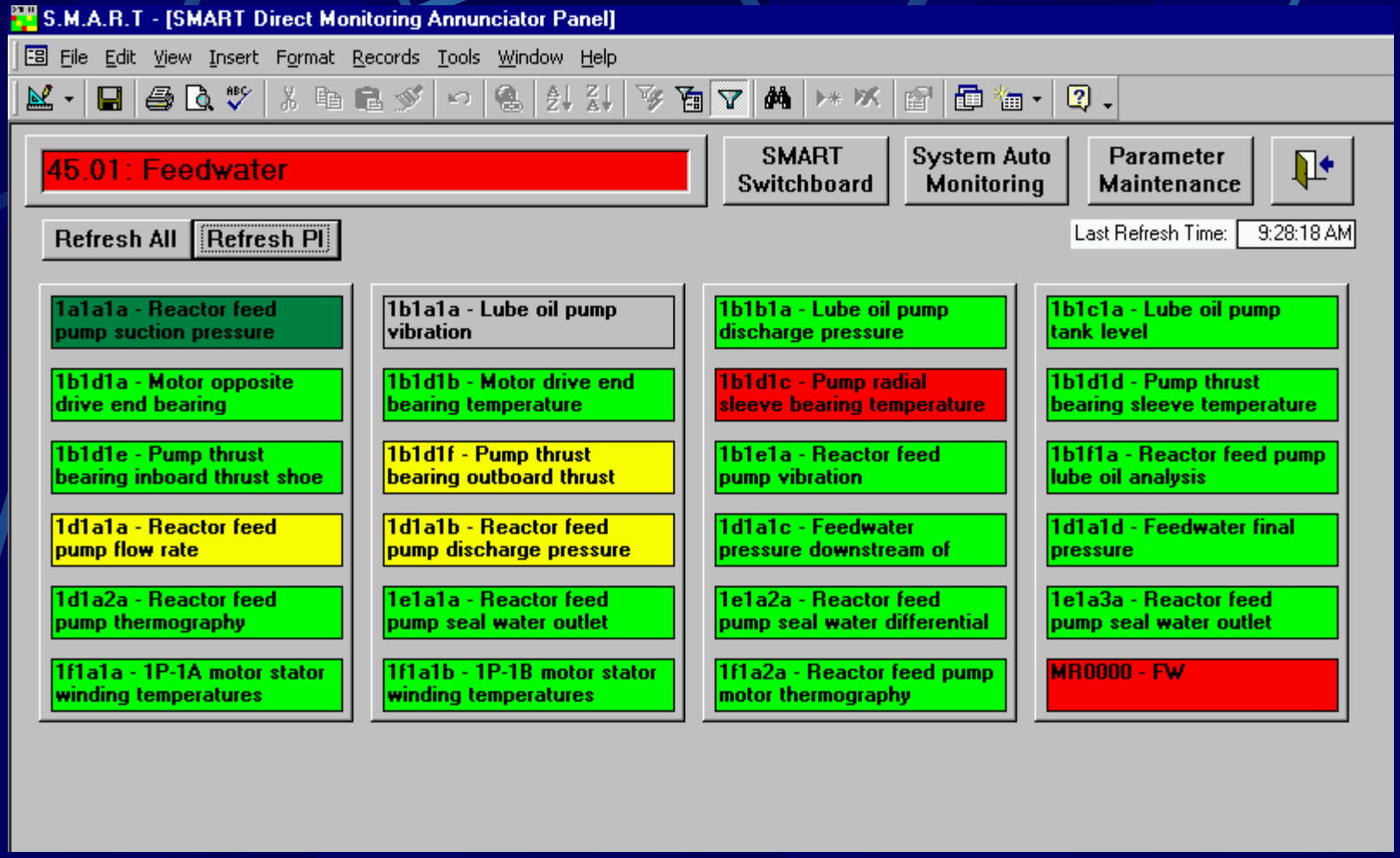
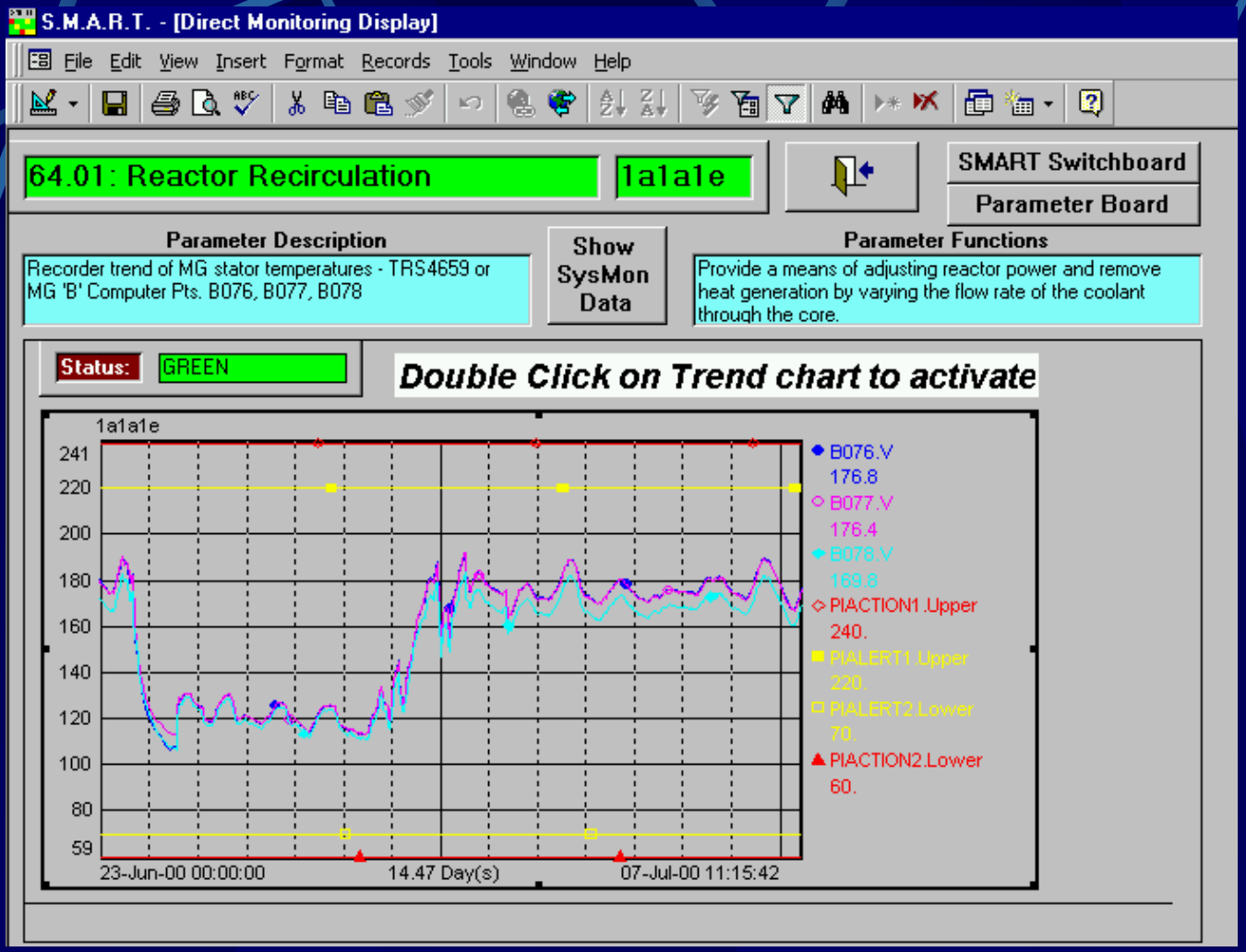
Direct Monitoring



Parameter Window



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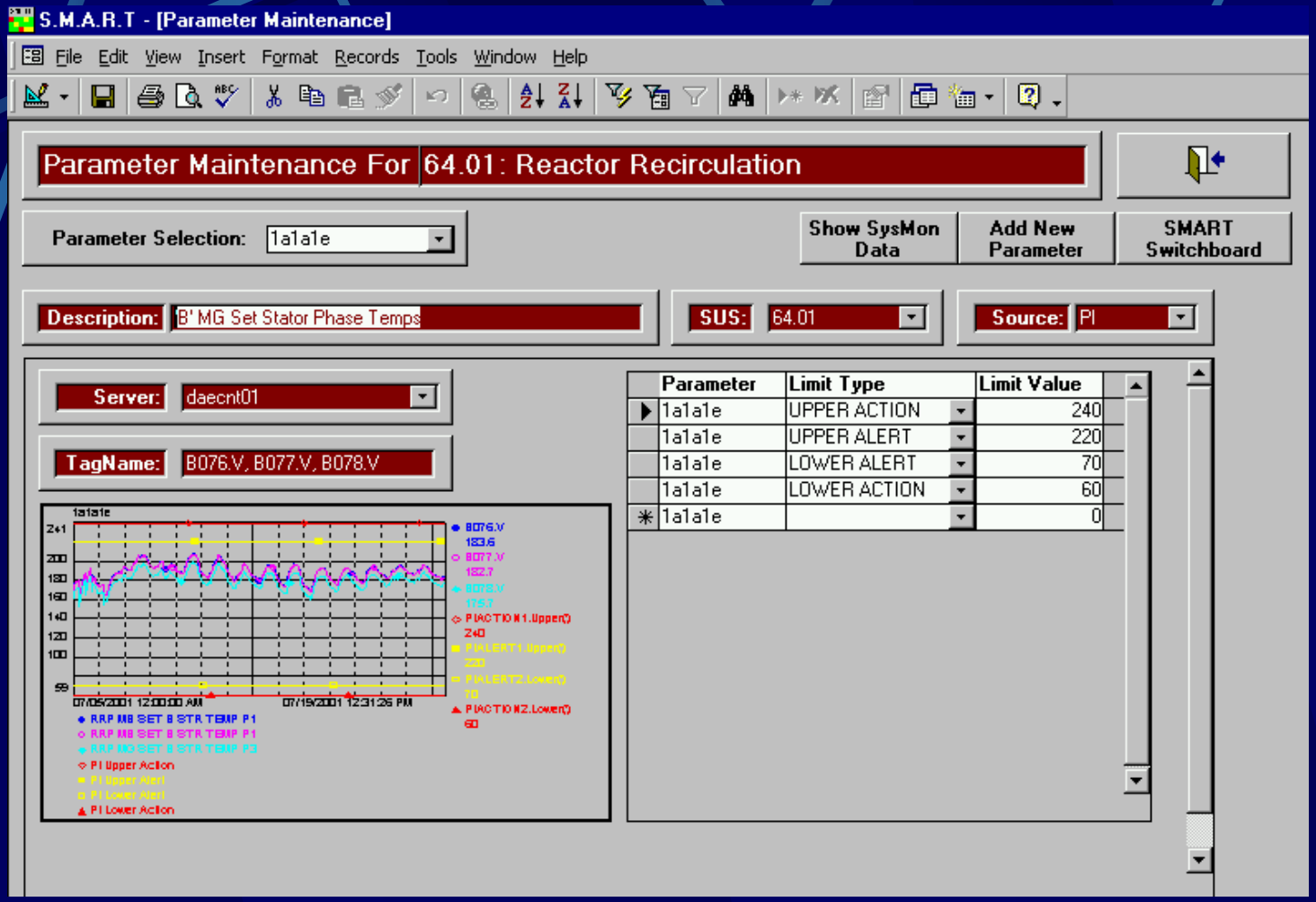
Parameter Maintenance



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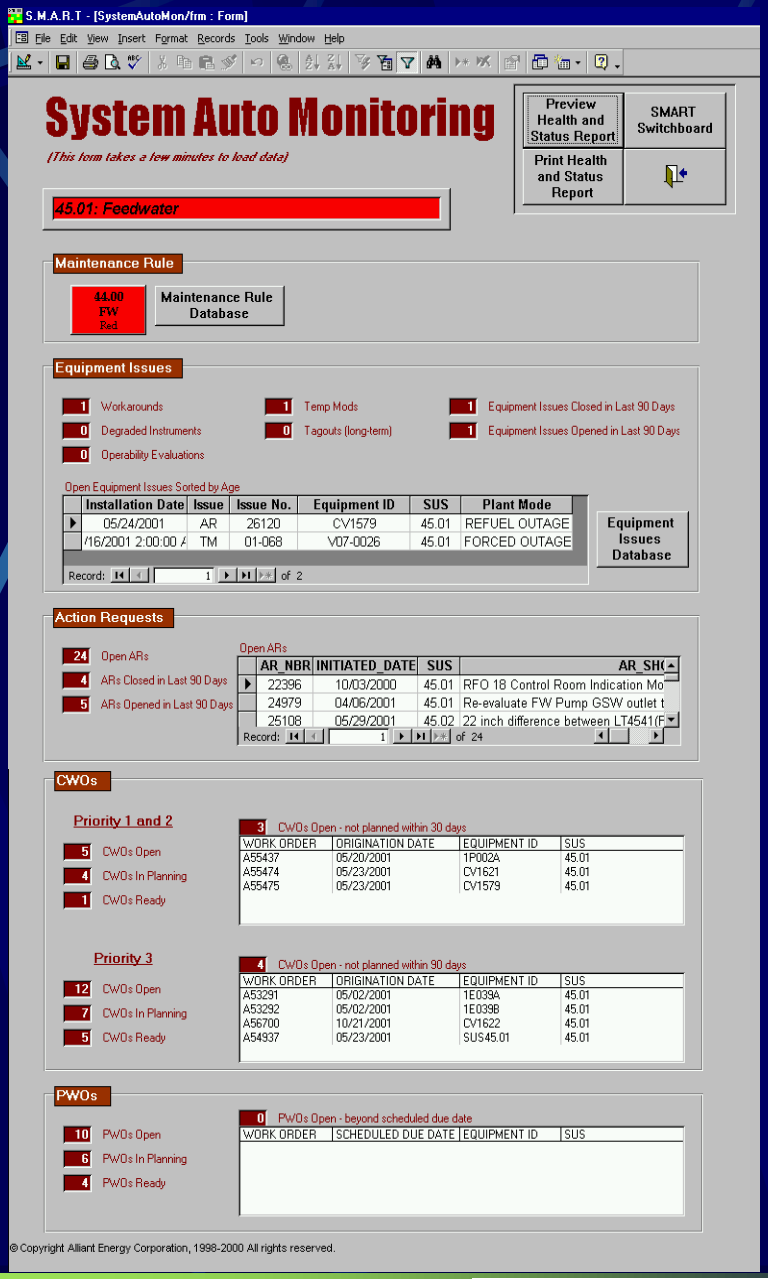
Auto (Indirect) Monitoring



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