# NUREG-0737 Supplement 1

# Safety Parameter Display System

# Safety Analysis

Rochester Gas & Electric Corporation

R.E. Ginna Nuclear Power Plant

Docket 50-244



November 1984

# SAFETY PARAMETER DISPLAY SYSTEM

## Introduction

NUREG-0696 states that the purpose of the safety parameter display system (SPDS) is to assist control room personnel in evaluating the safety status of the plant. The SPDS is to provide a continuous indication of plant parameters or derived variables representative of the safety status of the plant. The primary function of the SPDS is to aid the operator in the rapid detection of abnormal operating conditions.

The SPDS displays to the operator a minimum set of parameters from which the plant safety status can be assessed. The selection of parameters and the display format enhance the operator's capability to assess plant status in a timely manner without surveying the entire control room. The SPDS display compliments the operator's normal survey of conventional control room indicators.

The display will be responsive to transient and accident sequences and will be sufficient to indicate the status of critical plant parameters.

## Requirements

As required by NUREG-0737, Supplement 1, the minimum information to be provided shall be sufficient to provide information to plant operators about:

(i) Reactivity control

(ii) Reactor core cooling and heat removal from the primary system

(iii) Reactor coolant system integrity

(iv) Radioactivity control

(v) Containment conditions

The specific parameters to be displayed are to be determined by the licensee. Following selection of the specific parameters licensees shall prepare a written safety analysis describing the basis on which the selected parameters are sufficient to assess the safety status of each identified function for a wide range of events, which include symptoms of severe accidents.

The purpose of this report is to fulfill the requirement for a written safety analysis for the basis of selection of parameters.

## Ginna SPDS Development

The Ginna SPDS is a subsystem of the larger Safety Assessment System (SAS). The SAS is designed to provide easily understandable information from a computer-based data acquisition system using high resolution multiple-color CRT graphical displays.

Major features of SAS will be:

- o Top-level displays of key parameters used to assess the safety status of the plant (SPDS);
- o Trend graphs of groups of related parameters;
- o An Accident Identification and Display System (AIDS) that graphically informs the operator of the relative likelihood that each of three major PWR accidents may be occurring: Loss of Coolant Accident (LOCA), Steam Generator Tube Rupture (SGTR) and Loss of Secondary Coolant (LOSC).
- o A Critical Safety Function (CSFM) Monitor which defines conditions to assess the status of six critical safety functions; and
- o A message area which indicates the plant operating mode selected, date, time, and the current value of some key parameters, and notifies the operator of certain off-normal conditions.

Two CRTs, a primary and secondary, present multiple displays to the operator using a hierarchical display concept. The primary CRT is normally dedicated to a "top level" display and fulfills the SPDS requirement. The purpose of the secondary CRT is to provide more detailed information by displaying the readiness and performance of selected plant systems, critical safety functions and channel malfunctions.

A relatively large data base is used to support the operation of the SAS. From this data base a reduced set of parameters are selected for continuous display to the operator during plant operation to give an overview of plant safety status. Some "conditioning" of data is performed using SAS algorithms to reduce the number of displays that are required without losing functions that may provide key indication of safety status. Figure 1 shows the top level SAS, or SPDS display. The selection of parameters for display on SPDS is based upon the Westinghouse Owners Group (WOG) Emergency Response Guidelines (ERGs).

A detailed equipment specification developed by a group of utilities including RGE and which describes, among other things, the functional and technical requirements for SAS has been submitted. This additional information was submitted with a letter from John E. Maier to Dennis M. Crutchfield dated June 8, 1981.

[illegible]

Westinghouse Owners Group Emergency Response Guidelines

The Westinghouse Owners Group has analyzed a broad spectrum of event sequences to determine significant risk contributors. Emergency Response Guidelines were then developed to provide full procedural coverage for at least all those sequences with combined functional failure probabilities equal to or greater than $10^{-6}$ per reactor year (including the initiating event). Justification for the selection of this cutoff value was a relative risk evaluation which was provided to the NRC with a WOG letter OG-61 from R. W. Jurgensen to Stephen H. Hanauer dated July 7, 1981. The ERGs provide prioritized operator guidance for recovering the plant from an emergency transient while at the same time ensuring that the plant safety state is explicitly monitored and maintained during recovery. The ERGs are composed of two distinct types of procedures:

- o Optimal Recovery Guidelines, and
- o Critical Safety Function Restoration Guidelines and Status Trees

The Optimal Recovery Guidelines provide guidance for the operator to recover the plant from nominal design basis faulted and upset conditions. The Critical Safety Function restoration Guidelines, when used with the accompanying Critical Safety Function Status Trees, provide a systematic means for addressing any challenge to plant Critical Safety Functions, which is entirely independent of initiating event. The availability of both types of procedural guidance permits the operator to respond to virtually any plant upset condition, including multiple failure conditions, and failures subsequent to initial diagnosis which could require additional operator action beyond that specified in the Optimal Recovery Guidelines for the events which they cover.

During recovery from an event, the operator continually monitors the Critical Safety Functions to assure continued plant safety. If a challenge to a Critical Safety Function occurs, the operator is directed by use of Status Trees to specific Function Restoration Procedures designed to restore the challenged safety function(s) to safe conditions. Upon restoration of all Critical Safety Functions, appropriate optimal recovery actions are continued.

The status trees provide the operator with a systematc and explicit means for determining the safety status of the plant for any emergency situation. Use of the status trees provides independent verification of the attainment and maintenance of safe plant conditions throughout the recovery. Concurrent use of status trees and the appropriate Optimal Recovery Guidelines also provides a method for identifying the mode of Critical Safety Function challenge independent of specific event diagnoses and nominal prescribed recovery actions. Therefore, use of the status trees in conjunction with the Optimal Recovery Guidelines provides a systematic way of identifying and coping with subsequent/multiple failure situations.

Critical Safety Function Restoration Guidelines describe operator actions which could be effective in responding to challenges to the plant critical safety functions. These Critical Safety Function Restoration Guidelines provide guidance for maintaining the plant in a safe state without regard to initiating event or combinations of subsequent or consequential failures after event diagnosis.

The Critical Safety Function Restoration Guidelines are identified by noting the specific mode of failure indicated at the terminus of each Critical Safety Function Status Tree. These terminal failure modes are addressed through the creation of appropriate function restoration guidelines which collect, in each guideline for the operator's use, the potential methods for response to identified failure modes. Critical Safety Function Restoration Guidelines have been developed based upon the following Critical Safety Functions.

Maintenance of SUBCRITICALITY
Maintenance of CORE COOLING
Maintenance of a HEAT SINK
Maintenance of Reactor Coolant System INTEGRITY
Maintenance of CONTAINMENT Integrity
Control of Reactor Coolant INVENTORY

The concept of Critical Safety Function Restoration is based on the premise that radiation release to the environment can be minimized if the barriers to radiation release are protected. Restoration implies returning the plant state to a safe status in which the Critical Safety Functions are satisfied.

Guidance for diagnosis of the plant safety state independent of event sequence is contained in the Critical Safety Function Status Trees. A Status Tree exists for each of the six Critical Safety Functions which, as a set, define the plant safety state. The plant parameters that define the state of each Critical Safety Function are identified on the associated Status Tree. Typically, only a few parameters are required to identify the status of a Critical Safety Function. The Subcriticality Status Tree is reproduced in Figure 2 as an example of these status trees.

Key Plant Instrumentation

Following development of the ERGs, instrumentation was identified that monitors the plant variables which provide the primary information required to permit the Control Room Operating Staff to:

a) Perform the event diagnosis specified in the ERG's.

b) Take the specified preplanned manually controlled actions, for which no automatic control is provided, that are required for safety systems to accomplish their safety function for mitigation of the design base accident; and

c) Reach and maintain a safe shutdown condition.

The instrumentation was identified which monitored those plant variables that provide information to assess the process of accomplishing or maintaining the plant critical safety functions, i.e., reactivity control, reactor core cooling, heat sink maintenance, reactor coolant system integrity, reactor containment integrity and reactor coolant system inventory control. A listing of this instrumentation is given in Table 1.

SPDS Parameters

The list of instrumentation developed from the ERGs includes all the parameters that are necessary to give early indications of potentially adverse safety conditions and includes parameters necessary to monitor proper functioning of mitigating equipment after the response to a transient has been initiated or to assist in long term operator response. The latter group includes auxiliary feedwater flow, refueling water storage tank level and condensate storage tank level. Thus, the relatively small list of instrumentation necessary to implement the ERGs can be further limited. The remaining essential instruments that are "early indicators" are candidates for inclusion on the SPDS. All are either directly displayed, are combined (grouped) through an algorithm to give a common indication for similar parameters or are narrow range instruments used to initiate automatic action and which can be monitored by another wide range instrument. An example of grouping is the combination of containment pressure and containment water level to produce a bistable indication of containment environment. An example of a narrow range instrument which initiates action but which can be monitored by another instrument is pressurizer pressure (1700-2500 psig) which is overlapped by RCS pressure (0-3000 psig).

A discussion of each of the ERG required instruments shown on Table 1 and the Ginna SPDS parameters is given below. Specific analog point parameters used to generate the SPDS display are given on Table 2. Because the SPDS is not yet installed, some of the point parameter IDs may change although the function being monitored will be retained on the display.

Figure 1 is an illustration of the SPDS display. The AIDS section gives the operator a graphical indication of the relative likelihood of three major accidents. A message area is reserved to present information on several parameters as shown on Table 2. The remaining portions of the display area give analog and/or digital indications of selected parameters, or for secondary radiation and containment environment, present bistable alarm indicators.

RCS Pressure

ERG Assumption

The reactor coolant system (RCS) is assumed to have at least two wide range pressure transmitters connected to the residual heat removal (RHR) hot leg suction lines. The range of these channels is typically 0 to 3000 psig. This instrumentation is assumed to be subject to adverse containment conditions.

Ginna Instrument

The reactor coolant system has two wide range pressure transmitters, PT420 and PT420A. PT420 is connected to the RHR hot leg suction and PT420A is connected to an upper tap on the pressurizer.

Both of these wide range pressure indications are included in the SPDS shown on Table 2. They are averaged to provide the SPDS RCS pressure indication shown on Figure 1.

RCS Hot and Cold Leg Temperatures

ERG Assumption

Each RCS hot and cold leg is assumed to have a deep well mounted RTD to monitor wide range RCS temperature. The range of these channels is typically 0 to 700°F. Trending of temperatures is necessary for monitoring RCS natural circulation and cooldown rates.

Ginna Instrumentation

Hot leg RTDs 409 A-1 and 410 A-1 and cold leg RTDs 409B-1 and 410B-1 will be direct immersion type RTDs and will provide input to the SPDS as shown on Table 2. The range of the RTDs is 0° to 700°F.

Reactor Vessel Level

ERG Assumption

For those plants that have a Reactor Vessel Liquid Inventory System (RVLIS), the instrument is used to measure vessel level. The RVLIS system is assumed to have design features typical of a Westinghouse-designed RVLIS. A Westinghouse designed system includes three ranges to provide indication from the bottom to the top of the vessel with any combination of reactor coolant pumps operating.

For those plants without a RVLIS, ERGs have been written to provide appropriate responses without level indication. In some cases alternative indications are used to direct an appropriate response and in other cases a more conservative action is taken by deleting the RVLIS indication altogether.

Ginna Instrumentation

A reactor vessel level instrument does not currently exist at Ginna, however, RGE has committed to install a differential pressure type instrument by the end of the 1986 refueling outage. The instrument will provide an indication from the bottom to the top of the vessel. A description of the proposed instrument was provided in an RGE letter dated August 7, 1984. This instrument is not currently scheduled to be added to the SPDS.

Rochester Gas and Electric has previously stated its position in letters dated July 2, 1980, December 15, 1980, December 30, 1980, January 19, 1982, and August 7, 1984 that an instrument to accurately measure reactor vessel water level could serve a useful purpose, but that such a device is not necessary for proper response to emergency situations. RG&E also is not convinced that reactor vessel water level (inventory trend) instruments provide a clear, unambiguous indication of inadequate core cooling, although they may indicate coolant void formation in the limited span above the vessel piping penetrations.

One consultant with significant experience and direct participation with the Westinghouse Owners Group studied inadequate core cooling situations for RGE (see RG&E letter dated November 29, 1983) and concluded that "existing plant instrumentation and procedures are adequate to advise operators of how to respond to voids in the reactor vessel head or distributed through the reactor coolant system". His finding confirms that the ERGs developed for plants without a RVLIS are viable.

The major reason that RGE objected to installing and using the RVLIS is that several instances have been identified (see the Westinghouse ERG background documents) when the RVLIS may give an ambiguous indication. These include: 1) a break in the upper head, 2) periods of reactor vessel upper plenum injection, 3) periods of accumulator injection into a highly voided downcomer, 4) periods when the reactor vessel upper head behaves like a pressurizer, and 5) periods of void redistribution in the RCS. Several additional instances have been identified which may result in biased RVLIS indications. These include: 1) reverse flows in the reactor vessel, and 2) core blockage. At other times when the operator can determine that these conditions do not exist the instrument should give reasonable results.

The range of break sizes over which the RVLIS will provide useful information is from small leaks to breaks in the limiting small break range. The system conditions will change at a slow enough rate for breaks in this range so that the RVLIS indication will accurately trend with RCS inventory. For larger breaks, the response of the RVLIS may be erratic, due to rapid pressure changes in the vessel in the early portion of the blowdown. The RVLIS reading, however, for large breaks, will be useful for monitoring accident recovery "when other corroborative indications can also be observed".

TABLE 2
SPDS PARAMETERS

| Analog Parameters | Point IDs | Form of Usage on SPDS |
|---|---|---|
| Reactor Coolant Loop Pressure | P0420, P0420A | AA |
| Pressurizer Level | L0426, L0427, L0428 | A |
| Core Exit Thermocouples | TCA07 - TCL10 (Total of 39 TCs) | ATC |
| Containment Pressure | P0945, P0947, P0949 | AB |
| Containment Sump A Level | L2039, L2044 | AB |
| Containment Radiation | R02 | D |
| Air Ejector Radiation | R15 | SB |
| Steam Generator Blowdown Radiation | R19 | SB |
| Steam Generator A Steam Flow | F0464, F0465 | A |
| Steam Generator B Steam Flow | F0474, F0475 | A |
| Steam Generator A Level | L0460 | I |
| Steam Generator B Level | L0470 | I |
| Steam Generator A Pressure | P0468, P0469, P0482 | A |
| Steam Generator B Pressure | P0478, P0479, P0483 | A |
| Steam Generator A Feed Flow | F0466, F0467 | A |
| Steam Generator B Feed Flow | F0476, F0477 | A |
| Power Range Power Level | N41, N42, N43, N44 | M |
| Hot Leg Temperature Loop A | T0409A-1 | I |
| Hot Leg Temperature Loop B | T0410A-1 | I |
| Cold Leg Temperature Loop A | T0409B-1 | I |
| Cold Leg Temperature Loop B | T0410B-1 | I |
| Source Range Detector | N31, N32 | M |
| Intermediate Range Power Level | N35, N36 | M |
| **Digital Parameters** | **Point IDs** | |
| Pressurizer PORV Position | V0430, V0431 | MB |
| Reactor Trip Signal | RXTA1, RXTB1 | MB |
| Main Steam Line Isolation Signal | MSISIGA, MSISIGB | MB |
| Safety Injection Actuation Signal | SISIGA, SISIGB | MB |
| Feedwater Isolation Actuation Signal | FWSIGA, FWSIGB | MB |
| Circulating Water Pump Status | BKR051, BKR052 | MB |
| Reactor Coolant Pump Status | RXT16, RXT17 | MB |
| Source Range High Voltage Status | BLOCK1, BLOCK2 | MB |

Notes

A These parameters are averaged to give a single indication.
AA These parameters are averaged to give a single indication and are also used as input to the subcooling indicators.
AB These parameters are averaged and used as one input to the containment environment bistable indicator.
D This parameter is a direct input to the containment environment bistable indicator.
SB These parameters are used as inputs to a single bistable indicator.
I This parameter feeds an analog indicator.
M These parameters are averaged to print a message in the message block.
MB These bistable indicators produce messages in the message block.
ATC Core exit thermocouples are averaged for display on the SPDS and provide input to the subcooling calculation. Upper head thermocouples are averaged and provide input to the top of head subcooling calculation.

Thus, because ERGs have been written so that the status of all the Critical Safety Functions can be assessed and all operator actions necessary to diagnose events and bring the plant to a safe shutdown condition can be performed without RVLIS indication, the vessel level parameter need not be added to the SPDS indication.

<u>Steam Generator Narrow Range Water Level</u>

ERG Assumption

Each steam generator is assumed to have at least three channels of a narrow range delta P measurement system. The range of the narrow range measurement channels is 0 to 100 percent of span. The narrow range instruments are hot calibrated and provide level indications in the steam generators between the U-tubes and the secondary moisture separators.

Ginna Instrumentation

Each steam generator has three narrow range delta P measurement systems. The range of the narrow range measurement channels is 0 to 100 percent of span. The narrow range instruments are hot calibrated and provide level indications in the steam generators between the U-tubes and the secondary moisture separators.

S/G A level is provided by LT 461, 462, 463
S/G B level is provided by LT 471, 472, 473.

Because the wide range steam generator level indication includes the range of the narrow range instruments, wide range level is adequate for SPDS display and early indication of potentially adverse safety conditions.

<u>Steam Generator Wide Range Water Level</u>

ERG Assumption

Each steam generator is assumed to have at least one wide range delta P measurement system. The wide range instruments are generally cold calibrated (ambient containment conditions, depressurized steam generator and secondary inventory at containment temperature conditions) and are used primarily for performing steam generator "wet layup" following plant shutdown. The instrument provides level indications in the steam generator between the tubesheet and the secondary moisture separators.

Ginna Instrumentation

Each steam generator has one wide range delta P measurement system. The wide range instruments are cold calibrated (ambient containment conditions, depressurized steam generator and secondary

inventory at containment temperature conditions). The instrument provides level indications in the steam generator between the tubesheet and the secondary moisture separators.

S/G A wide range level: LT460
S/G B wide range level: LT470

Both wide range level indications are provided in the form of an analog readout on the SPDS as shown on Table 2 and Figure 1. Even though the wide range level transmitters are cold calibrated, adequate indication accuracy exists to provide an early indication of potentially adverse safety conditions and to assure acceptable operator response required by the ERGs. Setpoints in the ERGs which trigger operator response or establish that critical safety functions are being met will be adjusted to account for the cold calibration and reference leg process errors. In addition, during normal operation the operator is used to seeing a particular wide range level that corresponds to the acceptable narrow range level and will be alert to any changes in this normal level.

Pressurizer Pressure

ERG Assumption

It is assumed that at least three pressure transmitters are connected to the pressurizer. The range of the channels is typically 1700 to 2500 psig.

Ginna Instrumentation

There are four pressure transmitters connected to the pressurizer: PT429, 430, 431, 449. The range of the channels is 1700 to 2500 psig.

All of these pressure channels are included in the SAS inputs but are not displayed on the SPDS. Wide range RCS pressure provides the same monitoring capability and is displayed on the SPDS.

Pressurizer Level

ERG Assumption

The pressurizer is assumed to have at least three channels of a delta P level measurement system. The instruments provide level indications for approximately the total height of the pressurizer. The range of the measurement system is 0 to 100 percent of span.

Ginna Instrumentation

The pressurizer has four channels of a delta P level measurement system. LT 426, 427 & 428 are hot calibrated and provide level indications for approximately the total height of the pressurizer. LT 433 is a cold calibrated transmitter used primarily during plant sutdown. The range of the measurement system is 0 to 100 percent of span.

As shown on Table 2, three channels, LT 426, 427 and 428, are provided on the SPDS.

Steam Generator Pressure

ERG Assumption

Each steam generator is assumed to have at least three pressure transmitters located in its main steamline upstream of the main steamline isolation valve. This instrumentation is not assumed to be subject to adverse containment conditions. Typically, these pressure transmitters are located outside containment in the auxiliary building or steam tunnel area. The range of these instruments is typically 0 to 1300 psig.

Ginna Instrumentation

Each steamline has three channels of pressure measurement upstream of the main steamline isolation valve. These pressure transmitters are located outside containment in the intermediate building. Steam Generator A pressure is indicated by PT468, 469 and 482. Steam Generator B pressure is indicated by PT478, 479, and 483. The range of these instruments is 0 to 1400 psig.

All of these steamline pressure channels are included on the SPDS as shown on Table 2.

Core Exit Temperature

ERG Assumption

Core exit thermocouple (CET) temperatures are necessary for providing an indication of inadequate core cooling and an input in the determination of RCS subcooling. Several of the thermocouples should be located to monitor the most probable highest temperature area of the core. Also, several of the core exit thermocouples should be located in the vicinity of the vessel hot leg nozzle outlets. The range of the core exit thermocouple temperature readout should be from plant cold shutdown conditions to the maximum core temperature following a design basis LOCA. A typical readout range is 100 to 2200°F.

Ginna Instrumentation

The CET system has 36 thermocouples positioned to measure fuel assembly outlet coolant temperatures at preselected core locations including probable highest temperature areas and the vicinities of the hot leg nozzles. Three thermocouples are also provided to measure temperatures in the reactor vessel head area. The range of the CET temperature readout will be 0 to 2300°F following completion of a modification scheduled for 1985.

All CETs will provide input to the SPDS as shown on Table 2.

RCS Subcooling

ERG Assumption

RCS subcooling can either be computed manually using a steam table or using a computer based algorithm. The pressure input can be supplied by RCS wide range pressure and pressurizer pressure. Generally, the pressure value used for determining the system saturation temperature is an auctioneered low value of those inputs. The temperature inputs that can be used in the computation are RCS hot leg temperatures, RCS cold leg temperatures, and core exit thermocouple temperatures. The temperature value used in the ERGs to determine RCS subcooling is typically the core exit thermocouple temperatures.

Ginna Instrumentation

Two calculations are performed by the SAS computer for SPDS subcooling. Core subcooling is calculated by averaging the ten hottest core exit TCs and comparing this temperature to a saturation temperature that is determined using RCS pressure and steam table algorithms. Top of Head Subcooling is calculated by averaging the three top-of-head TCs and comparing this temperature to the same saturation temperature. Both of these subcooling temperatures are displayed on SPDS as shown on Figure 1.

Auxiliary Feedwater Flow

ERG Assumption

The auxiliary feedwater (AFW) supply lines to each steam generator have at least one auxiliary feedwater flow measurement indicated in the control room. If each steam generator is supplied with auxiliary feedwater flow from more than one auxiliary feedwater pump, the flow measuring device indicates total flow to each steam generator. Total auxiliary feedwater flow to all steam generators is determined by adding the auxiliary flow to each of the steam generators.

Ginna Instrumentation

AFW flow to each steam generator can be provided by a main motor driven auxiliary feedwater pump (MAFWP), a standby motor driven auxiliary feedwater pump (SAFWP) or a common turbine driven auxiliary feedwater pump (TAFWP). AFW flow to steam generator A is provided by redundant transmitters FT 2013 and FT 2001 from the MAFWP, FT 2006 from the TAFWP and FT 4084 from the SAFWP. AFW flow to steam generator B is provided by redundant transmitters FT 2014 and FT 2002 from the MAFWP, FT 2007 from the TAFWP and FT 4085 from the SAFWP. Although AFW flow to the steam generators is used elsewhere in SAS, it is not an early indication of potentially adverse safety conditions (such as steam generator level) and is not displayed on SPDS. AFW flow is monitored by SAS to assure the proper operation of mitigating equipment.

RWST Level

ERG Assumption

At least two channels of a delta P measurement system are available to monitor the refueling water storage tank (RWST) level. The instruments provide level indications for at least the minimum required water supply to the SI pumps following a LOCA and key the switchover from the injection to the cold leg recirculation mode. The range of the measurement system is 0 to 100 percent of span.

Ginna Instrumentation

Two channels of a delta P measurement system are available to monitor the RWST level. LT920 and LT921 provide level indications for 0-100% span. Both of these level channels provide input to SAS but are not an early indication of potentially adverse safety conditions and are not displayed on SPDS. They can be monitored on lower level displays to assure adequate SI pump water supply and to monitor the switchover from the injection to the recirculation mode.

CST Level

ERG Assumption

At least two channels of a delta P measurement system are available to monitor the level in each condensate storage tank (CST) that provides the primary water source to the auxiliary feedwater pumps. The instruments should provide level indications for at least the minimum required water supply for the auxiliary feedwater system. The range of the measurement system is 0 to 100 percent of span.

Ginna Instrumentation

Two channels of a delta P measurement system are available to monitor the level in the condensate storage tanks that provide the primary water source to the auxiliary feedwater pumps through a common supply line. The instruments, LT2022A and 2022B, provide level indications for 0-100% of span (0-24 ft) for each tank.

Condensate storage tank level is not a parameter which gives direct indication of safety status or impending adverse safety conditions. It is a parameter used during recovery from a plant transient. CST level is monitored on lower level SAS displays but is not displayed on SPDS.

Containment Pressure

ERG Assumption

At least two channels of containment pressure are available to monitor the containment. The instruments must extend over the range from normal condition containment pressure to containment design pressure. For a dry containment, this range is typically 0 to 65 psig.

Ginna Instrumentation

Six channels of containment pressure are available to monitor the containment. The instruments extend over the range from normal condition containment pressure to three times containment design pressure. PT945, 947, 949 measure 0-60 psig. PT946, 948, 950 measure 10-200 psia.

Three pressure channels provide input to the SPDS Containment Environment bistable indicator to give early warning of potentially adverse safety conditions as shown on Table 2.

Containment Water Level

ERG Assumption

At least two channels of a level measurement system are available to monitor the water level in the containment building. The bottom tap of the measurement system should be located in the cavities or sumps in which water resulting from a loss of reactor or secondary coolant would initially collect. The top tap should be at the maximum expected flood level in the containment building. In some instances, due to the large span of the required level measurement, two channels of narrow range are implemented which only provide an indication of water level in the reactor cavity or sump. Two channels of a wide range level system are then utilized for determining containment flood level. The range of the measurements systems is 0 to 100 percent of span.

Ginna Instrumentation

Containment water level is measured by redundant narrow range and wide range level instruments. Containment narrow range level is provided by LT2039 and LT2044 with a range of 0-30 ft. Narrow range level is Sump A where water would initially collect. Wide range containment level is Sump B and is measured by LT942 and LT943, each of which is a series of qualified float switches. The top switch is at the maximum expected water level.

LT2039 and LT2044 are included on the SPDS, as shown on Table 2, to provide early indication of potentially adverse safety status. Wide range Sump B level indication is part of the SAS Critical Safety Function status displays that can be used during recovery from the plant transient.

Containment Radiation Level

ERG Assumption

At least two channels of radiation detectors are assumed to be available for containment radiation monitoring. The radiation monitor is capable of providing an indication of radiation levels from backgrond levels to a postulated total integrated dose release. As in the case of the containment water level system, a narrow and wide range monitoring system may be installed to increase the sensitivity at the lower radiation levels.

Ginna Instrumentation

Two channels of radiation detectors are available for containment area radiation monitoring. The radiation monitors are capable of providing an indication of radiation levels from background levels to a postulated TID release. RM 29 and RM 30 have a range of 1 to $10^7$ R/hr. RM 2 is a low range radiation monitor which provides input to the SPDS Containment Environment bistable indicator to give early warning of potentially adverse safety conditions. RM 29 and RM 30 provide input to lower level SAS displays for accident monitoring.

Secondary Radiation Level

ERG Assumption

At least two channels of a measurement system for detecting secondary radiation are assumed to be available to the operator. Several means of implementing this monitoring function are available. These may include dedicated steamline radiation monitors, condenser air ejector radiation monitors and steam generator blowdown radiation monitors. Factors that impact the ultimate decision for determining the plant-specific means of monitoring secondary radiation include location of monitoring instrumentation, qualification of installed instrumentation and alternate uses of installed instrumentation (e.g., calculation of effluent release). The

radiation monitoring system adopted must be capable of providing an indication of radiation levels from those levels existing in the secondary side during normal operation with maximum Technical Specification leakage to the level expected following a design basis steam generator tube rupture.

Ginna Instrumentation

Several channels of a measurement system for detecting secondary radiation are available to the operator. These include dedicated steamline radiation monitors RM 31 & 32 ($10^{-1}$ to $10^{3}$ uCi/cc), condenser air ejector radiation monitors (RM 15 & 15A ($10^{-6}$ to $10^{-3}$ uCi/cc and $10^{-6}$ to $10^{5}$ uCi/cc respectively), and a steam generator blowdown radiation monitor R19 (10 to $10^{6}$ CPM).

R15 and R19, the monitors expected to give the first indication of potentially adverse safety conditions, provide input to the SPDS Secondary Radiation bistable indicator as shown on Table 2.

<u>Neutron Flux</u>

ERG Assumption

At least two channels of instrumentation are assumed to be available to monitor core neutron flux. The instrumentation is capable of monitoring neutron flux from source range levels to the maximum expected core return to power levels due to excessive RCS cooldown. Several installed instruments are capable of monitoring the required range. These include the source, intermediate and power range detectors.

Ginna Instrumentation

Neutron flux instrumentation consists of 2 Source Range channels, N31 and N32 (1 to $10^{6}$ CPS), 2 Intermediate Range channels, N35 and N36 ($10^{-11}$ to $10^{-3}$ AMPS) and 4 Power Range channels, N41, 42, 43 and 44 (0 to 120%). All of these neutron flux channels are included on the SPDS display as shown on Table 2.

Conclusion

The minimum set of parameters from which the safety status of the plant can be assessed has been provided on the Ginna SPDS. Important plant functions encompassed by the SPDS parameters include reactivity control, reactor core cooling and heat removal from the primary system, reactor coolant system integrity, radioactivity control and containment conditions. The parameters selected provide the control room operator with a means of rapidly detecting abnormal conditions and evaluating the safety status of the plant. The parameter selection is based upon the WOG ERG list of necessary instrumentation and therefore provides the required indication for a broad spectrum of event sequences.

SPDS Implementation Plan

RGE has previously scheduled installation and operation of the SPDS and the mother SAS to be complete in 1987 and informed the NRC Staff in a letter dated April 6, 1984. Subsequent to that letter, the vendor, Electronic Associates Inc. defaulted on the contract to deliver the SAS. RGE is currently negotiating with several other vendors to complete this work and expects to select a new contractor shortly. RGE has been encouraged that there may not be significant delays resulting from EAI's default. However, RGE cannot make a firm commitment on the SPDS completion date until contract negotiations with a new vendor are complete. RGE is in receipt of an NRC order dated June 12, 1984 and will take appropriate action if an extension of time is required.

TABLE 1

EMERGENCY RESPONSE GUIDELINE INSTRUMENTATION

| | INSTRUMENT | RANGE |
|---|---|---|
| 1. | RCS Pressure | 0-3000 psig |
| 2. | RCS Hot and Cold Leg Temp. | 0-700°F |
| 3. | Reactor Vessel Level* | 0-100% |
| 4. | Steam Generator Narrow Range Level | 0-100% |
| 5. | Steam Generator Wide Range Level | |
| 6. | Pressurizer Pressure | 1700-2500 psig |
| 7. | Pressurizer Level | 0-100% |
| 8. | Steamline Pressure | 0-1300 psig |
| 9. | Core Exit Temp. | 100-2200°F |
| 10. | RCS Subcooling | |
| 11. | Auxiliary Feed Flow** | |
| 12. | RWST Level** | 0-100% |
| 13. | CST Level** | 0-100% |
| 14. | Containment Pressure | 0-65 psig |
| 15. | Containment Water Level | Bottom of sump to maximum flood level |
| 16. | Containment Radiation Level | |
| 17. | Secondary Radiation Level | |
| 18. | Neutron Flux | |

* Optional Instrumentation. Emergency Response Guidelines have been prepared both with and without reactor vessel level.

** These parameters are not required to give an early indication of potentially adverse safety conditions but are used to monitor the proper functioning of mitigating equipment or to assist in long term operator response.

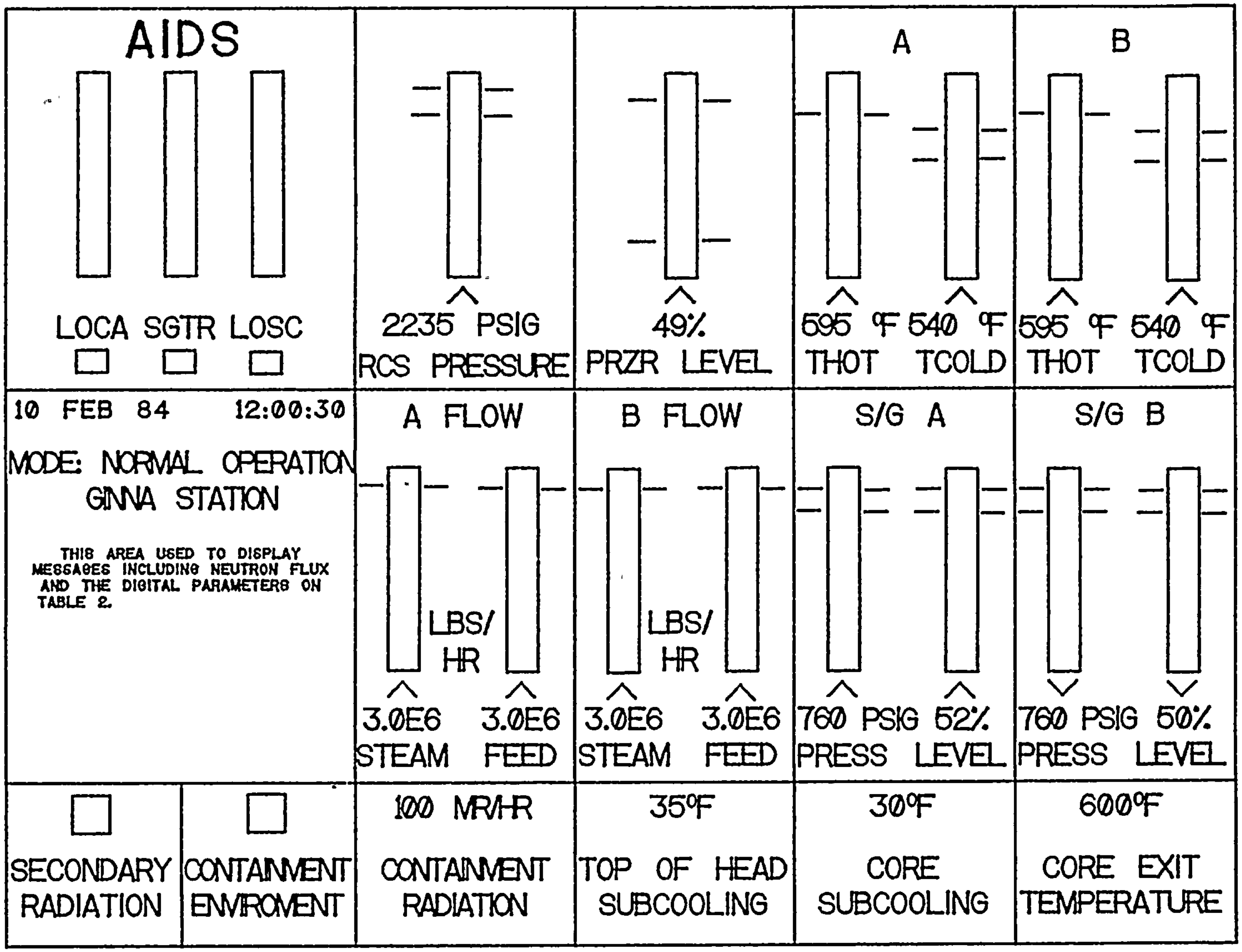


FIGURE 1

Notes

1. The parameter values shown on this Figure are for illustration only and may not be representative of any given plant condition.
2. The horizontal markers are normal operating ranges for the parameters and are SPDS alarm points.
3. Parameter ranges represented on the analog indicators are discussed in the report text.
4. Arrows (∧∨) indicate whether a parameter is increasing or decreasing.

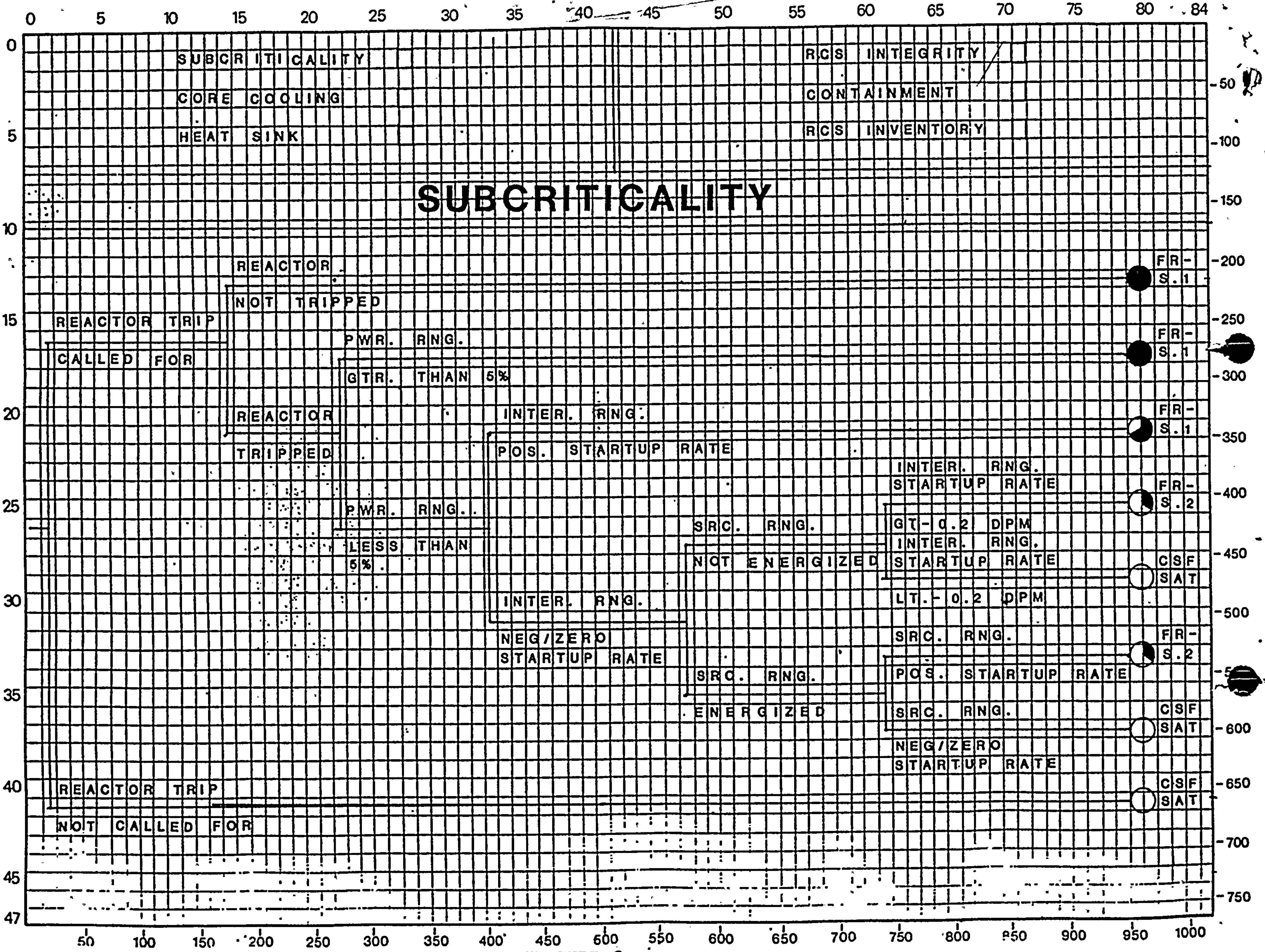


FIGURE 2

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Setpoints on this Figure are for illustration only and may change on the final Critical Safety Function Status Tree