WESTINGHOUSE CLASS 3

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Revision 0

Key Safety Parameter Selection for the Beaver Valley Units 2 Safety Parameter Display System (SPDS)

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INTRODUCTION

This document is a plant specific version of the generic Westinghouse SPDS Key Safety Parameters listed in WCAP 10170 Appendix C.

The following variables are on the Westinghouse Generic SPDS but are not included in the Beaver Valley Unit 2 SPDS.

- The containment sump discharge liquid radiation and RCS sample liquid radiation are available to the control room operating staff via information from the Post Accident Sampling System (PASS).

- RCS drain tank discharge radiation is available to the control room operating staff via information from the routine nuclear sampling procedure.

- The site boundary area radiation and hydrogen recombiner status is available to the control room operating staff via other instrumentation display in the control room.

- TSC area radiation is only available in Technical Support Center (TSC).

- Radwaste Vent Collection Discharge Gaseous Radiation is available to the control room operating staff via information from the airborne radioactivity effluent release assessment system.

C.0 BEAVER VALLEY UNIT 2 SPDS KEY SAFETY PARAMETERS

The goal of a safety parameter display system is to decrease the potential for operator cognitive errors by aiding operators in detecting deviations from safe plant conditions. An understanding of the task of detection is required in order to design an effective SPDS. From a simplistic view point detection usually refers to the initial detection of a plant abnormality. In terms of operator detection needs, detection also refers to the subsequent detections, in the sense of feedback, i.e., verification that operator actions are achieving safety goals and intended operator actions are successfully executed. In the sense of multiple failure emergencies detection also means detecting a second, third, etc., failure after initial detection of the first.

The detection process can be broken into stages:

- Activation - the operators determine that some abnormal condition exists that demands further investigation.

- Observation/data collection - data are collected, from control room instruments or other sources, to help investigate the nature of the abnormal condition.

- Recognition - recognize plant state in terms of a familiar pattern; usually leads directly to selection of a sequence of actions.

- Identification of system state - the data previously collected are abstracted into a coherent representation of the current sate of the plant; at this point, the crew will identify what is wrong, but not why or how the abnormal conditions developed.

These stages cover the operators detection process from the initial activation that an abnormal condition exists to his resulting knowledge of what is wrong in terms of his understanding of the state of the plant.

In other words the role of concept-driven observation must be recognized in the detection process. This means that, once activated, observation is a guided

process -- looking for something. The quality of operator observations then depends on his recognition or identification of plant state.

The result is that to support the operator's ability to detect departures from safe plant conditions, an SPDS should support: (a) subsequent as well as initial detections of abnormal conditions; (b) feedback to the operator on the success of actions both in terms of successful action execution and in goal achievement; (c) observation, recognition and identification of plant state; and (d) guidance to the operator for further data collection activities (concept-driven observation).

The two top level displays (the Narrow Range Iconic and the Wide Range Iconic) are intended to aid the operator in the activation step of the detection process by making the operator aware that some abnormal condition exists that demands further investigation. The parameters used on these two top level displays are placed in the five safety functions itemized in NUREG-0737, Supplement 1 in Tables C-1 and C-2, respectively.

The second level display aids the operator in the observation/data collection and recognition stages of the detection process and focuses his data collection activities into the approprite plant system so that he might accomplish the identification of system state step in this detection process. These steps in the detection process effectively translate the abstract issues of safety functions and the awareness that some abnormal conditions exists into the practical language of plant operations, i.e., from safety functions to pressures, temperatures, levels, etc. This display provides more detailed information on the entire plant.

The identification of system state step is accomplished by the use of the individual system displays. The systems that are depicted in these displays are mapped into the safety functions itemized in NUREG-0737, Supplement 1 in Table C-3.

To complete the mapping, the parameters that appear in the Beaver Valley Unit 2 SPDS are individually mapped into the NUREG-0737, Supplement 1 safety functions in Table C-4.

TABLE C.1

Beaver Valley Unit 2 Top Level (Narrow Range) SPDS Variables
Mapped into NRC Safety Functions (NUREG-0737, Supplement 1) to Aid the
Activation Step in the Counting Process of Deletion

Reactivity Control

Power Mismatch (Nuclear-Turbine)

Reactor Core Cooling & Heat Removal From the Primary System

Pressurizer Pressure
RCS T_{avg}
Steam Generator Level (Narrow Range)

Reactor Coolant System Integrity

Pressurizer Level
Net Charging Flow
Radiation Monitoring
Containment Monitoring

Radioactivity Control

Radiation Monitoring

Containment Condition

Containment Monitoring (Temperature, Pressure, Sump Level)
Radiation Monitoring

TABLE C.2

Beaver Valley Unit 2 Top Level (Wide Range) SPDS Variables
Mapped into NRC Safety Functions (NUREG-0737, Supplement 1) to Aid
the Activation Step in the Cognitive Process of Detection

Reactivity Control

Start-Up Rate

Reactor Core Cooling & Heat Removal from the Primary System

RCS Pressure
Core Exit Temperature
Steam Generator Level (Wide Range)

Reactor Coolant System Integrity

Pressurizer Level
Reactor Vessel Level
Containment Pressure
Radiation Monitoring

Radioactivity Control

Radiation Monitoring

Containment Conditions

Containment Pressure
Radiation Monitoring

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TABLE C.3

Westinghouse PWR Systems Appearing in the Beaver Valley Unit 2 SPDS Mapped into NRC Safety Functions (NUREG-0737, Supplement 1) to Aid the Identification of System State Step in the Cognitive Process of Detection

Reactivity Control

Rod Control
Nuclear Instrumentation
Reactor Coolant
Chemical and Volume Control
Rod Position Indication
Main Steam (Nuclear)
Steam Dump (Atmospheric and Condenser)

Reactor Core Cooling and Heat Removal from the Primary System

Reactor Coolant
Chemical and Volume Control
Residual Heat Removal
Main Steam (Nuclear)
Main Feedwater (Nuclear)
Steam Dump
Aux. Feedwater
Rod Control
Rod Position Indication
Nuclear Instrumentation
Safety Injection
Core Exit Thermocouples
Loop RTD's

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TABLE C.3 (Cont.)

Westinghouse PWR Systems Appearing in the Beaver Valley Unit 2 SPDS Mapped into NRC Safety Functions (NUREG-0737, Supplement 1) to Aid the Identification of System State Step in the Cognitive Process of Detection

Reactor Coolant Integrity

Reactor Coolant
Chemical and Volume Control
Residual Heat Removal
Safety Injection
Containment Monitoring
Radiation Monitoring

Radioactivity

Radiation Monitoring
Containment Isolation

Containment Conditions

Containment Monitoring
Containment Spray
Containment Fan Coolers
Hydrogen Concentration
Radiation Monitoring

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TABLE C.4
Beaver Valley Unit 2
SPDS Safety Concern Variables
Mapped into NRC Safety Functions (NUREG-0737 Supplement 1)

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