

SIMULATOR OPERATIONS/MAINTENANCE INSTRUCTION - 010
REVISION 16
07/24/94

SIMULATOR CERTIFICATION TESTING

The purpose of this instruction is to implement the simulator test requirements as identified by NTP-603 and provide guidance for the development and performance of simulator certification testing and testing required as a result of changes to the simulator configuration.

This instruction applies to all personnel involved in activities related to the maintenance of the simulator certification. This includes those personnel who make software or hardware changes, review modifications, test changes or perform certification testing. The person performing the test is responsible for test acceptance.

Testing to achieve and maintain simulator certification may normally be divided into two distinct but inseparable categories:

1. Simulator Modification Testing - this is the testing associated with a change made to the simulator configuration as a result of changes in the reference unit configuration or to simulation problems identified during training or testing.

Changes or problems are identified and documented on a Simulator Action Request (SAR) and resolved using the process described in SOMI-009.

The individual performing the change should identify the scope of changes made to the configuration. The Simulator Test Coordinator will utilize this information to determine the scope of testing required.

The Simulator Test Coordinator specifies the scope of testing required based upon knowledge of the change and the impact of that change on the overall simulator configuration. Depending upon the complexity of the change, the test process may or may not require detailed test instructions to describe and document the testing required.

2. Simulator Certification Testing - this is the testing necessary to ensure the simulator remains a high fidelity training device through the performance of a series of regularly scheduled tests which provide documentary evidence of the simulators capability to support the primary training mission.

The certification tests encompass the full range of power plant operations utilizing controlled plant operating procedures as the test document. Off normal and emergency events are conducted and compared to similar events at the reference unit, best estimate data (such as RETRAN computer code), similar events at other related plants or an objective evaluation and judgement by the Program Review Board.

If problems are identified during certification testing, they are documented on the SAR form and resolved using the process described in SOMI-009.

The Simulator Test Coordinator develops, schedules and coordinates the performance of the certification testing in accordance with the approved certification test schedule.

Certification testing requires a fully dedicated simulator. No other activities, which could influence test results, may take place while certification tests are in progress.

Manipulation of controls or other uses of the simulator, including the use of terminals or other

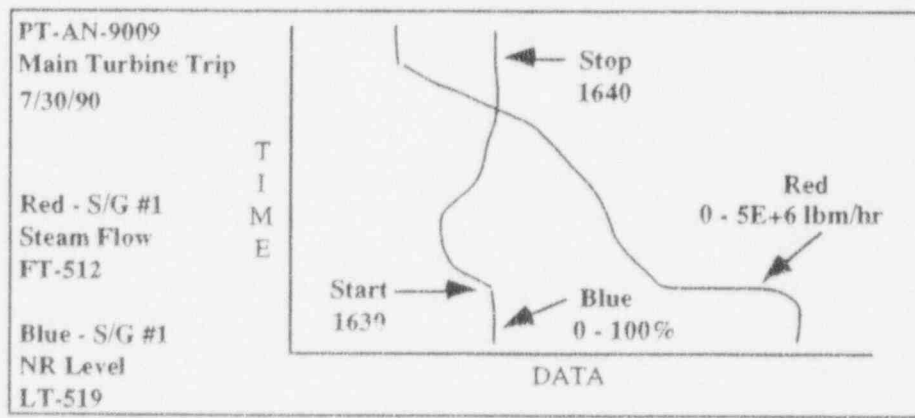
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peripheral devices connected to the computer being used to conduct the certification test, are not allowed without the specific permission of the SRO certified individual in charge of the certification test being conducted.

If charts contain preprinted times which do not correspond with the time of testing, the preprinted time should be stricken, initialed and dated by the individual collecting the data.

Graphical data printed or recorded in color (i.e.; CRT screen prints and main control board (MCB) charts recorded with colored pens) and collected to provide documentary evidence of test results should be marked like the example below to identify the color and placement of each recorded line.



ANSI / ANS-3.5 - 1985 and Regulatory Guide 1.149 will be used to identify:

- tests or types of tests to be performed
- data points to be recorded for evaluation
- test frequencies
- test acceptance criteria

Attachment 1 establishes the schedule to test approximately 25% of the malfunctions each year during the certification period. The listed malfunctions will be tested according to this schedule. If the malfunction does not list any options, then all the options will be tested. For example, "CC01" means both "CC01A" and "CC01B" will be tested in the same year. "ED08E" means only option "E" will be tested. Options are usually combined for efficiency when the test is simple and the options are almost identical. An "IN DEVELOPMENT" malfunction is one that is not yet ready for training usage. It will be added to the schedule in the year that it is completed and delivered for usage. This type of malfunction automatically generates a "Simulator Trouble" alarm whenever used (annunciator, audible, computer alarm). It is also marked appropriately in the Malfunction Cause and Effect List.

Attachment 2 lists the tests to be conducted annually which demonstrate the simulator's ability to perform and accurately represent the reference unit design (or actual) response to the transients listed in ANSI/ANS-3.5 - 1985, Appendix B2.2.

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For the transients listed in Attachment 2, data must be sampled and collected using the smallest time-step achievable in order to obtain the highest resolution possible. High resolution enhances test evaluation by portrayal of a clearer picture of the transient and anomalies in the simulation models are more likely to be picked up at higher resolutions. When specified in the test instruction, any of the following methods may be used to collect and report critical parameter data.

- MCB chart recordings
- Computer printouts and data files
- CRT screen prints
- Graphical plots of the numerical data obtained from computer printouts and data files

MCB chart recorders will record at a 0.5 second resolution and may be used for the parameters specified in the test instruction. The simulation computer data collection routines gather at a 0.5 second resolution. The Plant Computer System can be considered at a 1 second resolution. The Instructor Station collection has a minimum of about a 1 second resolution.

Attachment 3 lists the annual performance tests to be conducted to demonstrate the simulator's ability to perform at a level of steady state performance and stability representative of the reference unit, and a test of the simulator's ability to represent the reference unit in real time (per ANSI/ANS-3.5-1985).

Attachment 4 lists the annual normal operations tests to be conducted to demonstrate the simulator's ability to perform normal plant operations over the entire range of expected reference unit operations (per ANSI/ANS-3.5-1985).

The Program Review Board should normally review the Annual Transient Performance Test results and any other tests as may be requested.

During the conduct of a test, annunciators, bistables or other visual information sources may operate or indicate differently than expected. ODA-401 contains guidance on determining the validity of the information being presented. If the status of an annunciator, bistable or other visual information source is questionable, the test operator should record the current plant status and the condition of the object in question in the test instruction or in an attachment to the test instruction for subsequent review and resolution. The test operator may also take a "snapshot" of the simulation for later review. If the status of the object in question is or was incorrect for the plant status, the resolution should be noted in the test instruction or in an attachment to the test instruction.

Attachments:

Four Year Malfunction Test Schedule - Attachment 1

Annual Transient Performance Test List - Attachment 2

Annual Steady State Performance Test List - Attachment 3

Annual Normal Operations Test List - Attachment 4


J.M. Stavely, Jr.

FOUR YEAR MALFUNCTION TEST SCHEDULE

<u>Malfunction</u>	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>In Development</u>
AN01	X				
AN02		X			
AN03			X		
AN04				X	
CC01	X				
CC02		X			
CH03				X	
CH04		X			
CR01			X		
CR02					X
CS01				X	
CS02	X				
CS03		X			
CS04			X		
CS05				X	
CS06	X				
CS07				X	
CS08				X	
CS09	X				
CV01	X				
CV02			X		
CV03	X				
CV04	X				
CV05		X			
CV06				X	
CV07				X	
CV08	X				
CV09		X			
CV13		X			
CV14		X			
CV15			X		

FOUR YEAR MALFUNCTION TEST SCHEDULE

<u>Malfunction</u>	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>In Development</u>
CV16		X			
CV17				X	
CV18	X				
CV19		X			
CV20			X		
CV21				X	
CV22	X				
CV23		X			
CV24			X		
CV25	X				
CV26		X			
CV27				X	
CV28				X	
CV29				X	
CW01			X		
CW02				X	
CW03	X				
CW04	X				
ED01		X			
ED02			X		
ED03	X				
ED04A		X			
ED04B		X			
ED04C		X			
ED04D		X			
ED04F			X		
ED04G			X		
ED04H			X		
ED04I			X		
ED05A				X	
ED05B				X	
ED05C				X	

FOUR YEAR MALFUNCTION TEST SCHEDULE

<u>Malfunction</u>	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>In Development</u>
ED05D				X	
ED05E	X				
ED05F	X				
ED05G					X
ED06A		X			
ED06B		X			
ED06C			X		
ED06D			X		
ED06E		X			
ED06F			X		
ED06G			X		
ED07A	X				
ED07B	X				
ED07C	X				
ED07D	X				
ED07E				X	
ED07F				X	
ED07G					X
ED07H					X
ED07I		X			
ED07J					X
ED07K					X
ED07L					X
ED08A	X				
ED08B	X				
ED08C		X			
ED08D		X			
ED08E				X	
ED08F				X	
ED08G				X	
ED08H				X	
ED08I				X	

FOUR YEAR MALFUNCTION TEST SCHEDULE

<u>Malfunction</u>	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>In Development</u>
ED08J				X	
ED08K				X	
ED08L				X	
ED08M				X	
ED08N				X	
ED08O				X	
ED08P				X	
ED09	X				
ED10	X				
ED11	X				
ED14					X
ED15					X
ED16					X
ED17					X
ED18					X
ED19					X
EG01		X			
EG02			X		
EG03				X	
EG04	X				
EG05		X			
EG06			X		
EG07				X	
EG08	X				
EG09		X			
EG10			X		
EG11				X	
EG12	X				
EG13		X			
EN01				X	

FOUR YEAR MALFUNCTION TEST SCHEDULE

<u>Malfunction</u>	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>In Development</u>
FW01				X	
FW02		X			
FW03	X				
FW04			X		
FW05				X	
FW06	X				
FW07				X	
FW08			X		
FW09	X				
FW10A		X			
FW10B		X			
FW10C			X		
FW10D			X		
FW11A	X				
FW11B	X				
FW11C		X			
FW11D		X			
FW12A			X		
FW12B			X		
FW12C				X	
FW12D				X	
FW14A	X				
FW14B	X				
FW15		X			
FW16				X	
FW17	X				
FW18		X			
FW19			X		
FW20				X	
FW21	X				
FW22		X			
FW23			X		

FOUR YEAR MALFUNCTION TEST SCHEDULE

<u>Malfunction</u>	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>In</u> <u>Development</u>
FW24				X	
FW25	X				
IA01		X			
IA02			X		
IA03				X	
IA04A	X				
IA04B	X				
IA05			X		
IA06			X		
MS01		X			
MS02			X		
MS03				X	
MS04	X				
MS05		X			
MS06A			X		
MS06B			X		
MS07				X	
MS08	X				
MS09		X			
MS10A1/B1/C1/D1			X		
MS10A2/B2/C2/D2			X		
MS10A3/B3/C3/D3			X		
MS10A4/B4/C4/D4			X		
MS10A5/B5/C5/D5			X		
MS11	X				
MS12		X			
MS13			X		
NI01	X				
NI02		X			
NI03	X				
NI04		X			
NI05			X		

FOUR YEAR MALFUNCTION TEST SCHEDULE

<u>Malfunction</u>	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>In Development</u>
NI06				X	
NI07			X		
NI09				X	
NI10	X				
NI11		X			
NI12			X		
NI13				X	
PC01					X
PC02					X
PC03					X
PC04					X
PC05					X
PC06					X
RC01		X			
RC02			X		
RC03				X	
RC04	X				
RC05		X			
RC06			X		
RC07				X	
RC08A1/B1/C1/D1		X			
RC08A2/B2/C2/D2			X		
RC09A1/B1/C1/D1		X			
RC09A2/B2/C2/D2			X		
RC10		X			
RC11				X	
RC12		X			
RC13	X				
RC14	X				
RC15				X	
RC16				X	

FOUR YEAR MALFUNCTION TEST SCHEDULE

<u>Malfunction</u>	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>In Development</u>
RD01	X				
RD02		X			
RD04				X	
RD05	X				
RD06		X			
RD07				X	
RD08				X	
RD09	X				
RD10		X			
RD11			X		
RD12			X		
RD13			X		
RD14	X				
RH01	X				
RH02		X			
RH03			X		
RH04				X	
RH05	X				
RH06		X			
RM01A			X		
RM01B			X		
RM02A1	X				
RM02A2		X			
RM02A3			X		
RM02A4				X	
RM02A5	X				
RM02A6		X			
RM02A7			X		
RM02A8				X	
RM02A9	X				

FOUR YEAR MALFUNCTION TEST SCHEDULE

<u>Malfunction</u>	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>In Development</u>
RM02B1		X			
RM02B2			X		
RM02B3				X	
RM02B4	X				
RM02B5		X			
RM02C1			X		
RM02C2				X	
RM02C3	X				
RM02C4		X			
RM02C5			X		
RM02C6				X	
RM02C7	X				
RM02C9			X		
RM02D1				X	
RM02D2	X				
RM02D3		X			
RM02D4			X		
RM02D5				X	
RM02D6	X				
RM02E2		X			
RM02F1			X		
RM03A1				X	
RM03A2	X				
RM03A3		X			
RM03B1			X		
RM03B2				X	
RM03B3	X				
RM03C		X			
RM03D			X		
RM03E				X	
RM03F	X				

FOUR YEAR MALFUNCTION TEST SCHEDULE

<u>Malfunction</u>	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>In Development</u>
RM03G		X			
RM03Q			X		
RM03R				X	
RM03U1	X				
RM03U2		X			
RM03U3			X		
RM03U4				X	
RM03V	X				
RM03H		X			
RM03I			X		
RM03J1				X	
RM03J2	X				
RM03J3		X			
RM03K1			X		
RM03K2				X	
RM03L	X				
RM03M		X			
RM03N			X		
RM03O				X	
RM03P3			X		
RM03S				X	
RM03T	X				
RM04		X			
RP01			X		
RP02				X	
RP03	X				
RP04		X			
RP05			X		
RP06				X	

FOUR YEAR MALFUNCTION TEST SCHEDULE

<u>Malfunction</u>	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>In Development</u>
RP07	X				
RP08		X			
RP09			X		
RP10				X	
RP11	X				
RP12		X			
RP13				X	
RP14	X				
RP15		X			
RP16			X		
RP17			X		
RP18		X			
RP19		X			
RP20		X			
RP21		X			
RX01			X		
RX02				X	
RX03	X				
RX04		X			
RX05	X				
RX06				X	
RX07		X			
RX08		X			
RX09	X				
RX10			X		
RX11				X	
RX12	X				
RX13		X			
RX14			X		
RX15				X	

FOUR YEAR MALFUNCTION TEST SCHEDULE

<u>Malfunction</u>	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>In Development</u>
RX16	X				
RX17		X			
RX18			X		
RX19			X		
SG01			X		
SI01				X	
SI02	X				
SI03		X			
SI04			X		
SW01	X				
TC01		X			
TC02			X		
TC03	X				
TC04		X			
TC05			X		
TC06				X	
TC07	X				
TC08			X		
TC09	X				
TC10	X				
TC11	X				
TP01		X			
TP02			X		
TP03				X	
TP04	X				
TP05		X			
TU01			X		
TU02	X				
TU04		X			
TU05			X		
TU06				X	

FOUR YEAR MALFUNCTION TEST SCHEDULE

MALFUNCTION TEST DISTRIBUTION

YEAR 1	89	24.1%
YEAR 2	87	23.5%
YEAR 3	88	23.8%
YEAR 4	87	23.5%
<u>IN DEVELOPMENT</u>	<u>19</u>	<u>5.1%</u>
TOTAL	370	100.0%

ANNUAL TRANSIENT PERFORMANCE TEST LIST

- Manual Reactor Trip (PT-AN-04)
- Simultaneous Trip Of All Feedwater Pumps (PT-AN-05)
- Simultaneous Closure Of All Main Steam Isolation Valves (PT-AN-06)
- Simultaneous Trip Of All Reactor Coolant Pumps (PT-AN-07)
- Trip Of Any Single Reactor Coolant Pump (PT-AN-08)
- Main Turbine Trip (from the maximum power level which does not result in an immediate Reactor Trip) (PT-AN-09)
- Maximum Rate Power Ramp (from 100% power down to approximately 75% power and back up to 100% power) (PT-AN-10)
- Maximum Size Reactor Coolant System Rupture Combined With A Loss Of Off Site Power (PT-AN-11)
- Maximum Size Unisolable Main Steam Line Rupture (PT-AN-12)
- Slow Primary System Depressurization To Saturation Conditions Using A Stuck Open Pressurizer Relief Or Safety Valve (PT-AN-13)

ANNUAL STEADY STATE PERFORMANCE TEST LIST

- 25% Rated Thermal Power Heat Balance Test (PT-AN-01)
- 75% Rated Thermal Power Heat Balance Test (PT-AN-02)
- 100% Rated Thermal Power Heat Balance And 60 Minute Stability Test (PT-AN-03)
- Simulator Real Time Test (PT-AN-14)

ANNUAL NORMAL OPERATIONS TEST LIST
(PT-AN-15)

- Plant Startup - Cold Shutdown To Hot Standby
- Nuclear Startup From Hot Standby To Rated Power
- Turbine Startup And Generator Synchronization
- Reactor Trip Followed By Recovery To Rated Power
- Operations At Hot Standby
- Load Changes
- Plant Shutdown From Rated Power To Hot Standby And Cooldown To Cold Shutdown
- Core Performance
- Operator Conducted Surveillance Testing On Safety-Related Equipment Or Systems