ATTACHMENT I TO IPN-93-007

PROPOSED TECHNICAL SPECIFICATION CHANGES

RELATED TO

SURVEILLANCE REQUIREMENTS FOR REACTOR PROTECTION SYSTEM (RPS)

NEW YORK POWER AUTHORITY
INDIAN POINT 3 NUCLEAR POWER PLANT
DOCKET NO. 50-286
DPR-64

(5) Overpower ΔT

$$\Delta T \leq \Delta T_o \left(K_4 - K_5 \frac{dTavg}{dt} - K_6(T_{avg} - T')\right)$$

where:

ΔT_o $\leq$ measured full power ΔT for the channel being calibrated, °F

T_{avg} = measured average temperature for the channel being calibrated, °F (input from instrument racks)

T' = measured full power T_{avg} for the channel being calibrated, °F (can be set no higher than 573.3 °F)

K_4 ≤ 1.073

K_5 = 0 for decreasing average temperature

≥ 0.175 sec/°F for increasing average temperature

K_6 = 0 for $T \leq T'$

≥ 0.00116 for $T > T'$

K_4 is a constant which defines the overpower ΔT trip margin during steady state operation if the temperature term is zero.

K_5 is a constant determined by dynamic considerations to compensate for piping delays from the core to the loop temperature detectors; it represents the combination of the equipment static gain setting and the time constant setting.

K_6 is a constant which defines the dependence of the overpower ΔT setpoint to T_{avg}.

$\frac{dTavg}{dt}$ = rate of change of T_{avg}

(6) Low reactor coolant loop flow:

(a) $\geq$ 90% of normal indicated loop flow
(b) Low reactor coolant pump frequency – $\geq$ 57.2 cps

(7) Undervoltage – $\geq$ 70% of normal voltage

TABLE 4.1-1 (Sheet 1 of 5)

MINIMUM FREQUENCIES FOR CHECKS, CALIBRATIONS AND TESTS OF INSTRUMENT CHANNELS

Channel Description	Check	Calibrate	Test	Remarks
1. Nuclear Power Range	S	D (1) M (3)*	Q (2)** Q (4)	1) Heat balance calibration 2) Bistable action (permissive, rod stop, trips) 3) Upper and lower chambers for axial offset 4) Signal to Δ T
2. Nuclear Intermediate Range	S (1)	N.A.	P (2)	1) Once/shift when in service 2) Verification of channel response to simulated inputs
3. Nuclear Source Range	S (1)	N.A.	P (2)	1) Once/shift when in service 2) Verification of channel response to simulated inputs
4. Reactor Coolant Temperature	S	18M (1) 24M (2)	 Q(2)	1) Engineered safety cicuits only 2) Reactor protection circuits only
5. Reactor Coolant Flow	S	24M	Q	
6. Pressurizer Water Level	S	18M	Q	
7. Pressurizer Pressure	S	18M	Q	High and Low
8. 6.9 KV Voltage 6.9 KV Frequency	N.A. N.A.	18M 24M	Q Q	Reactor protection circuits only Reactor protection circuits only
9. Analog Rod Position	S	24M	M	

TABLE 4.1-1 (Sheet 2 of 5)

Channel Description	Check	Calibrate	Test	Remarks
10. Steam Generator Level	S	18M (1) 24M (2)	Q	1) Indicating circuits only 2) Reactor protection circuits only
11. Residual Heat Removal Pump Flow	N.A.	18M	N.A.	
12. Boric Acid Tank Level	S	18M	N.A.	Bubbler tube rodded during calibration
13. Refueling Water Storage Tank Level	W	18M	N.A.	Low level alarms
14. Containment Pressure	S	18M	Q	High and High-High
15. Process and Area Radiation Monitoring Systems	D	18M	Q	
16. Containment Water Level Monitoring System:				
a. Containment Sump	N.A.	18M	N.A.	Narrow Range, Analog
b. Recirculation Sump	N.A.	18M	N.A.	Narrow Range, Analog
c. Containment Water Level	N.A.	18M	N.A.	Wide Range
17. Accumulator Level and Pressure	S***	18M	N.A.	
18. Steam Line Pressure	S	18M	Q	
19. Turbine First Stage Pressure	S	18M	Q	
20. Reactor Protection Relay Logic	N.A.	N.A.	TM	
21. Turbine Trip Low Auto Stop Oil Pressure	N.A.	18M	N.A.	
22. Boron Injection Tank Return Flow	S	18M	N.A.	

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TABLE 4.1-1 (Sheet 4 of 5)

Channel Description	Check	Calibrate	Test	Remarks
34. Plant Effluent Radioiodine/ Particulate Sampling	N.A.	N.A.	18M	Sample line common with monitor R-13
35. Loss of Power				
a. 480v Bus Undervoltage Relay	N.A.	18M	M	
b. 480v Bus Degraded Voltage Relay	N.A.	18M	M	
c. 480v Safeguards Bus Undervoltage Alarm	N.A.	18M	M	
36. Main Steam Line Radiation Monitors	D	18M	Q	R-62A, B, C, D
37. Containment Hydrogen Monitors	D	Q	M	
38. Wide Range Plant Vent Monitor	D	18M	Q	R-27
39. High Range Containment Radiation Monitors	D	18M	Q	R-25, R-26
40. Core Exit Thermocouples	D	N.A.	N.A.	
41. Overpressure Protection System (OPS)	D	18M	18M	
42. Reactor Trip Breakers	N.A.	N.A.	TM (1)	1) Independent operation of under-voltage and shunt trip attachments
			24M(2)	2) Independent operation of under-voltage and shunt trip from Control Room manual push-button

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TABLE 4.1-1 (Sheet 5 of 5)

Channel Description	Check	Calibrate	Test	Remarks
43. Reactor Trip Bypass Breakers	N.A.	N.A.	(1)	1) Manual shunt trip prior to each use
			24M(2)	2) Independent operation of under-voltage and shunt trip from Control Room manual push-button
			24M(3)	3) Automatic undervoltage trip
44. Reactor Vessel Level Indication System (RVLIS)	D	18M	N.A.	
45. Ambient Temperature Sensors Within the Containment Building	D	18M	N.A.	
46. River Water Temperature # (installed)	S	18M	N.A.	1) Check against installed instrumentation or another portable device
47. River Water Temperature # (portable)	S (1)	Q (2)	N.A.	2) Calibrate within 30 days prior to use and quarterly thereafter

* By means of the movable incore detector system

** Quarterly when reactor power is below the setpoint and prior to each startup if not done previous month.

*** If either an accumulator level or pressure instrument channel is declared inoperable, the remaining level or pressure channel must be verified operable by interconnecting and equalizing (pressure and/or level wise) a minimum of two accumulators and crosschecking the instrumentation.

\# These requirements are applicable when specification 3.3.F.5 is in effect only.

S - Each Shift
P - Prior to each startup if not done previous week
NA - Not Applicable
D - Daily
TM - At least every two months on a staggered test basis (i.e., one train per month)
24M - At least once per 24 months
W - Weekly
M - Monthly
Q - Quarterly
18M - At least once per 18 months

ATTACHMENT II TO IPN-93-007

SAFETY EVALUATION FOR

TECHNICAL SPECIFICATION CHANGES RELATED TO

SURVEILLANCE REQUIREMENTS FOR REACTOR PROTECTION SYSTEM (RPS)

NEW YORK POWER AUTHORITY
INDIAN POINT 3 NUCLEAR POWER PLANT
DOCKET NO. 50-286
DPR-64

Section I - Description of Changes

This application for amendment to the Indian Point 3 (IP3) Technical Specifications proposes to change surveillance requirements for the Reactor Protection System (RPS) to accommodate a 24 month operating cycle. In addition, a change is proposed to Specification 2.3.1.B(6)(b) to increase the minimum reactor coolant pump low frequency trip setting to 57.2 cps (cycles per second or hertz (Hz)).

The specific RPS surveillance requirements listed in Table 4.1-1 of Appendix A to the IP3 Technical Specifications that will be changed by this application are:

- calibration frequency of the reactor coolant loop temperature channels (Table 4.1-1, item 4),
- calibration frequency of the reactor coolant loop flow instrumentation channels (Table 4.1-1, item 5),
- calibration frequency of the 6.9 kV underfrequency relays (Table 4.1-4, item 8),
- calibration frequency of the steam generator level instrumentation channels (Table 4.1-1, item 10), and
- testing frequency of the reactor trip (Table 4.1-1, item 42) and bypass breakers (Table 4.1-1, item 43).

The change to Specification 2.3.1.B(6)(b) is required as a result of loop accuracy/setpoint calculations for the 6.9 kV underfrequency relays.

Generally, the proposed changes to Table 4.1-1 presented in Attachment I of this application are shown as changing the notation "18M" (at least once per 18 months) to "24M" (at least once per 24 months). For items 4, 8, and 10 of Table 4.1-1, however, both 18M and 24M notations are shown for the following reasons. The proposed changes to extend the calibration intervals for the reactor coolant loop temperature channels (item 4), and the steam generator level instrumentation channels (item 10) apply to reactor protection circuits only. For this reason, each of these two items (4 and 10) have been broken down into two lines specifying the length of the calibration interval; 24M for reactor protection circuits and 18M for all other circuits associated with the listed item. The calibration intervals for other circuits which are not reactor protection circuits but are included in items 4 and 10 to Table 4.1-1 are not being changed at this time because evaluation of these circuits has not been completed. The format of Table 4.1-1 may again change, and will be submitted for NRC approval, at a later date as the completion of all extension evaluations are accomplished. Item 8 to Table 4.1-1 is also being split into two lines because the New York Power Authority's (NYPA or the Authority) evaluations show that only the calibration interval for the 6.9 kV underfrequency relays can be extended. The calibration interval for the 6.9 kV undervoltage relays will remain at least once per 18 months.

Section II - Evaluation of Changes

Starting with cycle nine (August, 1992), Indian Point 3 began operating on 24 month cycles instead of the previous 18 month cycles. To avoid either an 18 month surveillance outage or an extended mid-cycle outage, extending calibration and surveillance test intervals to be consistent with the length of the operating cycle is desired. This application for amendment to the IP3 Technical Specifications proposes to extend the calibration intervals for the RPS instrumentation channels actuating the overpower delta-temperature, overtemperature delta-temperature, low reactor coolant flow, 6.9 kV underfrequency, and low-low steam generator level trips from a nominal 18 month interval to a nominal 24 month interval. Extension of the testing interval for the reactor trip and bypass breakers is also proposed.

In evaluating the extension of calibration intervals for the RPS, the following factors were considered: past equipment performance and the effect on system safety functions, the importance of the calibration procedure or refueling test in demonstrating equipment operability, and the results of loop accuracy/setpoint calculations and the effect on safety system setpoints. In evaluating the extension of surveillance test intervals for the RPS, only the first two factors were considered.

Since all of the proposed changes involve the RPS, a brief discussion of the RPS follows.

Reactor Protection System (RPS)

The RPS monitors parameters related to safe operation and trips the reactor to protect the reactor core against fuel rod cladding damage caused by a departure from nucleate boiling (DNB). The RPS also protects against reactor coolant system (RCS) damage caused by high system pressure. The system consists of instrumentation which monitors the process variables and initiates a reactor trip when a measured plant variable exceeds predetermined limits. The system includes, but is not limited to, sensing elements, transmitters, converters, relays, actuating devices, interlocks, and alarms.

The RPS automatically trips the reactor under any one of the following conditions:

- temperature rise across the core, as determined from loop delta-temperature, reaches a limit either from an overpower delta-temperature setpoint or an overtemperature delta-temperature setpoint;
- loss of reactor coolant flow is indicated by flow instrumentation in the reactor coolant piping, loss of pump power (sensed by reactor coolant pump bus underfrequency or undervoltage conditions), or detection of reactor coolant pump breaker in open position;
- low-low steam generator level;
- pressurizer pressure reaches an established minimum limit;
- pressurizer pressure or level trips the reactor to protect the primary coolant boundary when the pressurizer pressure or level reaches an established maximum limit;
- reactor power, as measured by neutron flux, reaches a preset limit;
- safety injection system actuation;
- turbine generator trip; and
- steam/feedwater flow mismatch coincident with low steam generator water level.

The trips function to provide rapid reduction of reactivity by the insertion of full length Rod Cluster Control (RCC) assemblies under free fall into the reactor core. (The full length RCC assemblies must be energized to remain withdrawn from the core.)

Reactor trip can also be initiated manually from the Control Room by depressing either one of the two manual reactor trip pushbuttons. Either pushbutton energizes the trip coils and de-energizes the undervoltage coils of the reactor trip and bypass breakers.

Extension Program

The NRC staff has determined that licensees should address a number of issues in providing an acceptable basis for extending the calibration interval for instruments that are used to perform safety functions. NRC Generic Letter 91-04, Enclosure 2 (Reference 3) specifies the licensee actions to be taken to address these issues. The "actions" include:

1) confirming that instrument drift as determined by as-found and as-left calibration data from surveillance and maintenance records has not, except on rare occasions, exceeded acceptable limits for a calibration interval;

2) confirming that the values of drift for each instrument type (make, model and range) and application have been determined with a high probability and a high degree of confidence; and providing a summary of the methodology and assumptions used to determine the rate of instrument drift with time based upon historical plant calibration data;

3) confirming that the magnitude of instrument drift has been determined with a high probability and a high degree of confidence for a bounding calibration interval of 30 months for each instrument type and application that performs a safety function; and providing a list of the channels by technical specification section that identifies these instrument applications;

4) confirming that a comparison of the projected instrument drift errors has been made with the values of drift used in the setpoint analysis, providing proposed technical specification changes to update trip setpoints if the comparison indicates the need to revise setpoints to accommodate larger drift errors, and providing a summary of the updated analysis conclusions to confirm that safety limits and safety analysis assumptions are not exceeded;

5) confirming that the projected instrument errors caused by drift are acceptable for control of plant parameters to effect a safe shutdown with the associated instrumentation;

6) confirming that all conditions and assumptions of the setpoint and safety analyses have been checked and are appropriately reflected in the acceptance criteria of plant surveillance procedures for channel checks, channel functional tests, and channel calibrations; and

7) providing a summary description of the program for monitoring and assessing the effects of increased calibration surveillance intervals on instrument drift and its effect on safety.

To satisfy the requirements of Enclosure 2 to Generic Letter 91-04, the general approach taken by the Authority in evaluating the proposed calibration extensions includes the comparison and analysis of actual versus theoretical instrument performance, the statistical projection of actual past drift values to arrive at maximum expected future drift values over a 30 month interval, and the performance of loop accuracy/setpoint calculations. The RPS Instrument Drift Analysis (Reference 4) documents actual past and predicted future drift calculations used to evaluate actual and expected performance, and addresses most of the requirements of action items 1, 2, and 3 listed above. The loop accuracy/setpoint calculations address parts of action items 4 and 6. The monitoring program established in response to action item 7 is described later in this evaluation. (Action item 5 is not applicable to the RPS.) The RPS Surveillance Test Extensions report (Reference 5) brings the results of the drift analysis and the loop accuracy/setpoint calculations together to complete the requirements of action items 3, 4, and 6. The report evaluates the results, identifies the technical specification changes required, and presents/documents justification for the proposed extensions. Brief descriptions of the instrument drift analysis and the loop accuracy/setpoint calculations are provided below.

Instrument Drift Analysis

A plant specific instrument drift analysis was completed for the RPS (Reference 4) and a copy is included with Attachment III. Field calibration data for RPS components currently calibrated once every 18 (plus 25% for a maximum of 22.5) months was evaluated to assess the acceptability of extending the component's calibration interval to 24 (plus 25% for a maximum of 30) months. The instrument drift evaluation (IDE) for each RPS component is comprised of two phases. Phase 1 compares past instrument performance to theoretical acceptance limits (vendor drift allowance, VDA, or calibration tolerance, CT). Phase 2 predicts future drift by statistically extrapolating the component's derived drift data to arrive at a value for maximum expected drift over a 30 month interval (MED30). (Reference 4 provides a detailed description of the methodology and assumptions used to assess field calibration data and to predict maximum expected instrument drift.)

Past performance is indicated by instrument "drift," which is derived from field calibration data by taking the absolute value of the difference between the "as-found" and "as-left" calibration values. The derived value actually encompasses instrument accuracy, measuring and test equipment uncertainties, and the effects of ambient environmental conditions (temperature, pressure, humidity, and radiation) in addition to instrument drift. Therefore, the term "drift" that is used throughout this evaluation and in the RPS instrument drift analysis (Reference 4) is a misnomer and actually represents total instrument calibration uncertainties.

Generally, if phase 1 of the IDE shows that a component's derived drift data falls within the vendor drift allowance or the calibration tolerance (with the exception of rare occurrences), past performance is considered acceptable. Deviations from the VDA or the CT are explained on a case-by-case basis. Phase 2 predicts future instrument performance over a maximum 30 month period (MED30) using data obtained from phase 1. The MED30 value bounds hardware performance with a 95% probability at a 95% confidence level (i.e., there is a 95% probability that 95% of all past, present and future calibration results will be less than the maximum expected drift). Loop accuracy/setpoint calculations are then updated to include 30 month calibration uncertainties.

Loop Accuracy/Setpoint Calculations

Enclosure 2 to Generic Letter 91-04 requires the licensee to evaluate the effects of an increased calibration interval on instrument errors in order to confirm that drift will not result in instrument errors that exceed the assumptions of the safety analysis.

Loop accuracy calculations establish total channel uncertainties by accounting for instrument inaccuracies consistent with industry methods described in ISA RP67.04 (Reference 6). The loop accuracy calculation for an instrument channel uses conservative values for 30 month calibration uncertainties (vendor specified uncertainties or MED30, whichever is larger). If MED30 is the worst projected value of instrument drift but the value is unrealistic, vendor specified uncertainty values may be used in the calculation. The value calculated for MED30 is considered unrealistic or overly conservative if too few data points are available, resulting in a high statistical multiplier. The loop accuracy/setpoint calculations must show that sufficient margin exists between the analytical limit and the existing field trip setting in order to be consistent with the assumptions of the safety analysis. The calculations also verify whether technical specification setpoint limits provide sufficient margin over the analytical limit to allow for instrument inaccuracies.

The results of the loop accuracy/setpoint calculation hold the greatest weight in determining whether a calibration interval can be safely extended or not. If the loop accuracy/setpoint calculations indicate that sufficient margin exists and the assumptions of the safety analysis are not violated, reasonable assurance exists that the calibration interval may be extended.

The results of the drift analysis and the loop accuracy/setpoint calculations for the instruments used in performing the functions required by the technical specifications in question are discussed in the technical specification evaluation sections that follow. Attachment III provides a summary description of the methodology used to perform the drift analysis, and Attachment IV provides copies of loop accuracy/setpoint calculations for the reactor coolant flow instrumentation, the 6.9 kV underfrequency relays, and the steam generator level instrumentation. These calculations are representative of those performed for RPS components/circuits.

The results of the Authority's calibration extension program show that RPS trip settings were conservatively selected in the mid 1970s, leaving adequate safety margins between the analytical and the field trip settings even after accounting for instrument loop inaccuracies resulting from the extended calibration intervals. The Authority confirmed these margins by performing loop accuracy calculations in accordance with ISA RP67.04, using the statistically adjusted field drift data to account for the additional instrument uncertainties associated with the extended calibration intervals.

Drift Monitoring Program

In accordance with Generic Letter 91-04, a program to monitor future calibration data will be established to assess the effect a longer calibration interval has on instrument drift. The intent of the program is to confirm that actual future drift values are within projected limits. The program will identify instrumentation whose drift is not within the assumed values used in the loop accuracy/setpoint calculations.

The calibration procedure for each RPS component or instrument channel receiving approval for extension of its calibration interval will be revised to specify an as-found acceptance criterion which reflects the projected limit. A component showing as-found conditions beyond the specified acceptance tolerance may indicate a faulty or degrading device. Data for this instrument will be evaluated over a series of calibration intervals to more closely monitor instrument performance. Exceeding the as-found acceptance criteria, however, does not necessarily result in a technical specification violation or a safety concern since the loop accuracy/setpoint calculations show additional margin exists between the safety analysis assumptions and the field trip settings even after accounting for instrument loop inaccuracies resulting from the extended calibration intervals.

Calibration of Reactor Coolant Loop Temperature Channels

Table 4.1-1 of Appendix A to the IP3 Technical Specifications requires calibration of the reactor coolant loop temperature instrumentation channels at least once per 18 months. Each reactor coolant loop has a temperature channel, and each temperature channel develops an average temperature (T_{avg}) and a differential temperature (delta-T) signal. Delta-T is used as a measure of reactor power and is measured as the difference between the loop's hot and cold leg temperatures. T_{avg} is the arithmetic average of the loop's hot and cold leg temperatures. Each channel consists of RTDs, a E/I convertor (dynamic compensator), a special lag unit, resistance voltage (R/E) convertors and voltage isolation devices. These instruments are used to develop the delta-T and T_{avg} signals, and the procedures used to calibrate the instruments involve the adjustment of the instrument channel such that it responds with the required range and accuracy to a known input process variable.

Two RPS trip functions which use signals from the reactor coolant temperature channels are overpower (OP) delta-T and overtemperature (OT) delta-T. The OP delta-T trip is designed to protect against a high fuel rod power density and subsequent fuel rod cladding failure. The OP delta-T trip setpoint is continuously calculated for each channel and varies with loop T_{avg}. If the indicated loop delta-T exceeds the OP delta-T trip setpoint, the channel is tripped. Tripping of two of the four channels causes a reactor trip.

The OT delta-T trip is designed to protect against a departure from nucleate boiling (DNB). At DNB, the fuel rods become sheathed in a thin film of superheated steam. Loss of contact with the cooling water causes a large decrease in the heat transfer coefficient between the fuel rods and the reactor coolant, resulting in high fuel clad and fuel pellet temperatures. The OT delta-T trip setpoint is continuously calculated for each channel and varies with loop T_{avg}, pressurizer pressure and axial flux difference. If the indicated loop delta-T exceeds the OT delta-T trip setpoint, the channel is tripped. Tripping of two of the four channels causes a reactor trip.

Factors considered in evaluating the extension of the calibration interval for the reactor coolant loop temperature channels include the results of the drift analysis, the results of safety system loop accuracy/setpoint calculations, and the importance of the calibration procedure in demonstrating equipment operability.

The RPS instrument drift analysis shows field drift values for the reactor coolant loop temperature devices to be within vendor specified allowances with the exception of one drift value involving a special lag unit. For the R/E convertors, voltage isolation devices, and E/I convertors, the maximum expected drift or MED30 was within the vendor drift allowance for 30 months (VDA30).

However, MED30 for the special lag units exceeded VDA30 because one data point was so large, it could be considered to have been caused by a calibration error. Excluding this drift point from the sample yields an MED30 value within VDA30.

Generic Letter 91-04 requires that projections of instrument drift for increased calibration intervals be consistent with the values of drift errors used in determining safety system setpoints. Licensee performed calculations, taking the additional drift or uncertainties due to the extension of the plant operating cycle to a maximum of 30 months into consideration, confirm that sufficient margin exists between the analytical limits and the existing field trip settings for the OP delta-T and OT delta-T trip functions.

In addition to calibration at least once per 18 months, the Technical Specifications require channel checks once per shift, reactor protection (RP) relay logic functional tests every two months on a staggered basis, and quarterly channel functional tests. The channel check includes monitoring, from the control room, the average temperature of the reactor coolant (RC) loops to ensure that the temperature remains in the normal range. The logic functional tests verify operability of the coincidence relays while the channel functional tests verify that the bistable (OP delta-T and OT delta-T) trip points, annunciation, and trip status lights operate as required. The comprehensive on-line surveillance program demonstrates the operability of the RPS instrumentation and readily detects potential instrument failures. As a result, the importance of the channel calibration is to correct for instrument drift, if it is occurring, and to "tune up" the instrument loop components.

In summary, there is reasonable assurance that calibration of the reactor coolant loop narrow range temperature instrumentation and the reactor coolant loop resistance temperature detectors can safely be extended to accommodate the longer operating cycle because:

- assessments of actual past instrument drift and predicted future instrument drift support extension of the calibration interval,
- licensee calculations confirm that sufficient margin exists for the existing OP delta-T and OT delta-T trip settings even when accounting for the postulated drift or uncertainties associated with the longer cycle, and
- channel checks and on-line functional tests provide assurance that the RC loop temperature instrumentation and the associated RP logic relays function as required.

Calibration of Reactor Coolant Flow Instrumentation Channels

Table 4.1-1 of Appendix A to the IP3 Technical Specifications requires calibration of the reactor coolant flow instrumentation channels at least once per 18 months. Three flow measuring circuits monitor each reactor coolant loop and are arranged in a 2-out-of-3 logic. Each circuit consists of a flow transmitter located in the intermediate leg of the reactor coolant loop, a flow indicator located on panel SAF in the control room, a computer input and a low flow comparator (bistable). At 93% of normal flow the comparator generates a low flow trip signal and an alarm on the control room panel. If 2-out-of-3 flow comparators associated with a given loop trip, then the coincident logic generates a loop low flow signal.

The loss of flow in any two loops causes a reactor trip above approximately 10% power. Above approximately 50% power, the loss of flow in any one loop causes a reactor trip. The low flow trip protects the core from DNB following a loss of coolant flow accident.

Factors considered in evaluating the extension of the calibration interval for the reactor coolant flow instrumentation channels include the results of the drift analysis, the results of safety system loop accuracy/setpoint calculations, and the importance of the calibration procedure in demonstrating equipment operability.

The RPS instrument drift analysis shows past performance around the actuation (trip) point of the reactor coolant flow transmitters to be within vendor specified allowances. The analysis also shows MED30 to be within VDA30.

Also, licensee performed calculations, taking the additional drift or uncertainties due to the extension of the plant operating cycle to a maximum of 30 months into consideration, confirm that sufficient margin exists between the analytical limit and the trip setting for the RC low flow trip function.

In addition to calibration at least once per 18 months, Technical Specifications require channel checks once per shift, RP relay logic channel functional tests every two months on a staggered basis, and quarterly channel functional tests. The channel check shows the flow transmitters are operable and have not drifted significantly. Logic functional tests establish the operability of the reactor protection system coincident relays, while channel functional tests demonstrate the operability of the reactor coolant flow bistables. The comprehensive on-line surveillance program demonstrates the operability of the RPS instrumentation and readily detects instrument failures. As a result, the importance of the channel calibration is to correct for instrument drift, if it is occurring, and to "tune up" the instrument loop components.

In summary, there is reasonable assurance that calibration of the reactor coolant flow instrumentation can safely be extended to accommodate the longer operating cycle because:

- assessments of actual past instrument drift and predicted future instrument drift support extension of the calibration interval,
- licensee calculations confirm that sufficient margin exists for the existing reactor coolant low flow trip setting even when accounting for the postulated drift or uncertainties associated with the longer cycle, and
- channel checks and on-line functional tests provide assurance that the RCS loop flow instruments and the associated RP logic relays function as required.

Calibration and Technical Specification Trip Setting of 6.9 kV Underfrequency Relays

Table 4.1-1 of Appendix A to the IP3 Technical Specifications requires calibration of the 6.9 kV underfrequency relays at least once per 18 months. The calibration procedure also records the underfrequency relay's time delay.

The reactor coolant pump underfrequency trip protects against low reactor coolant flow. Bus underfrequency conditions are sensed by relays with a trip setting of 57.5 Hz and a specified time delay to avoid any spurious trips due to transient conditions. The four underfrequency relays are arranged in a 2-out-of-4 logic. A decrease in frequency below 57.5 Hz on any two buses trips all four RCP breakers. The trip of the RCP breakers initiates a reactor trip.

Factors considered in evaluating the extension of the calibration interval for 6.9 kV underfrequency relays include the results of the drift analysis, the results of the safety system loop accuracy/setpoint calculations, and the importance of the calibration procedure in demonstrating equipment operability.

The RPS instrument drift analysis shows past performance of the underfrequency relays to be within the calibration tolerances specified by the calibration procedure (since information regarding instrument drift was not specified in the vendor manual, vendor drift allowance could not be determined) for the trip settings and for the time delay requirement.

In addition to assessing past instrument drift, field calibration data was used to predict future instrument drift. A highly conservative MED30 value was used to represent the additional drift due to the extension of the plant operating cycle to a maximum of 30 months. The setpoint calculation confirms that sufficient margin exists between the analytical limit and the field trip setting for the underfrequency trip function. The calculation also shows that the current Technical Specification minimum trip setting for the low reactor coolant pump frequency should be increased.

Currently, Technical Specification 2.3.1.B(6)(b) specifies the trip setting for low reactor coolant pump frequency to be greater than or equal to 55.0 Hz. The specified minimum setting is the same as the analytical limit. It is proposed that the minimum technical specification setting be increased to 57.2 Hz to ensure that sufficient margin is maintained above the analytical limit to account for instrument inaccuracies. Since IP3 procedures specify a field trip setting of 57.5 Hz, the technical specification change does not adversely affect RP system functions.

In addition to channel calibration at least once per 18 months, Technical Specifications require quarterly channel functional tests, and RP relay logic functional tests every two months on a staggered basis. The comprehensive on-line surveillance program demonstrates the operability of the underfrequency relays and readily detects potential instrument failures. As a result, the importance of the channel calibration is to correct for instrument drift, if it is occurring, and to "tune up" the instrument loop components.

In summary, there is a reasonable assurance that calibration of the 6.9 kV underfrequency relays can safely be extended to accommodate the longer operating cycle because:

- assessment of actual past instrument drift supports extension of the calibration interval,
- licensee calculations confirm that sufficient margin exists for the existing underfrequency relay trip setting even when accounting for and using the highly conservative postulated drift (MED30) associated with the longer cycle, and
- on-line functional testing provides assurance that the 6.9 kV underfrequency circuits and the associated RP logic relays function as required.

In addition to the proposed change in calibration frequency for the underfrequency relays, a change is proposed to the minimum trip setting specified by Technical Specification 2.3.1.B(6)(b) for these relays in order to ensure that sufficient margin is maintained above the analytical limit to account for instrument inaccuracies.

Calibration of Steam Generator Level Instrumentation Channels

Table 4.1-1 of Appendix A to the IP3 Technical Specifications requires calibration of the steam generator level instrumentation channels at least once per 18 months. Three (3) level channels are provided for each steam generator and are arranged in a 2-out-of-3 logic. An indication of 8% of steam generator narrow range level on 2 of the 3 channels for any one steam generator initiates a steam generator low-low level trip signal. This signal simultaneously initiates both the auxiliary feedwater actuation signal and a reactor trip signal to provide the necessary protection against a loss of normal feedwater or a loss of offsite power.

Factors considered in evaluating the extension of the calibration interval for steam generator level transmitters include the results of the drift analysis, the results of the safety system loop accuracy/setpoint calculations, and the importance of the calibration procedure in demonstrating equipment operability.

The RPS instrument drift analysis shows past performance of the steam generator level transmitters to have been unacceptable for the three calibration intervals between August 1985 and September 1990. Poor instrument performance has been attributed to sediment buildup in the transmitters' reference legs during steam generator cleaning. Revised steam generator cleaning methods, instituted since replacement of the steam generators, isolate the reference legs prior to steam generator lancing work. A review of 1990 and 1992 calibration data shows significantly improved transmitter performance. The 1990 and 1992 data show drift values around the actuation point for the steam generator low-low level trip function to be within vendor allowances. Consequently, future drift values are expected to be within vendor allowables rather than the unrealistic MED30 which was calculated based on pre-1990 data. The vendor specified drift allowance was taken as representative of the additional drift due to extension of the plant operating cycle to a maximum of 30 months and used in the total channel uncertainty calculation. The calculation confirms that a large margin exists between the analytical limit and the trip setting for the steam generator low-low level trip function. It should be noted that this margin can accommodate the unrealistic MED30 in the channel uncertainty calculation without creating a safety concern.

In addition to calibration at least once per 18 months, Technical Specifications require steam generator level channel checks once per shift, RP logic channel functional tests every two months on a staggered basis, and quarterly steam generator level channel functional tests. The channel check includes monitoring and recording, from the control room, steam generator level each shift. The steam generator level channel functional test demonstrates operability of the steam generator level bistables, verifies the required trip for each test signal, and also verifies indication and annunciation of the appropriate alarms on the control panel. The comprehensive on-line surveillance program demonstrates the operability of the RPS instrumentation and readily detects potential instrument failures. As a result, the importance of the channel calibration is to correct for instrument drift, if it is occurring, and to "tune up" the instrument loop components by adjusting or aligning each component to nominal conditions. The channel calibration is more appropriately considered a maintenance activity rather than an operability check.

In summary, there is a reasonable assurance that calibration of the steam generator level transmitters can safely be extended to accommodate the longer operating cycle because:

- assessment of 1990 and 1992 calibration data supports extension of the calibration interval,
- licensee calculations confirm that sufficient margin exists for the existing steam generator low-low level trip setting even when accounting for the unrealistic MED30 calculated based on pre-1990 data, and
- channel checks and on-line functional testing provides assurance that the steam generator level transmitters and the associated RP logic relays function as required.

<u>Testing of Reactor Trip and Bypass Breakers</u>

Table 4.1-1 of Appendix A to the IP3 Technical Specifications requires testing of the reactor trip and bypass breakers at least once per 18 months. The test procedure verifies independent operation of the undervoltage trip and shunt trip mechanisms when activated from either manual trip pushbutton in the Control Room, and automatic operation of the undervoltage trip for the bypass breakers. The procedure also verifies breaker trip responses times. The reactor trip and bypass breakers are considered operable if both the shunt and undervoltage trip the reactor trip breakers in less than 150 ms, and if the shunt trip coil and the undervoltage coil of each breaker demonstrate their ability to independently trip their respective breakers.

Factors considered in evaluating the extension of the reactor trip and bypass breaker surveillance tests include past performance (as shown by IP3 operating experience data, operational occurrence reports, and surveillance test data) of the breakers, and the importance of the refueling test in demonstrating equipment operability.

A review of IP3 reactor trip breaker operating experience (as documented by IP3 Licensee Event Reports (LERs) and information collected for input into the Nuclear Plant Reliability Data System (NPRDS) database) and IP3 operational occurrence reports (from September 1987 through May 1992) substantiate increased reactor trip breaker reliability as a result of changes made to plant equipment and procedures following the Salem ATWS event. The operational occurrence reports show that although one rare failure of the undervoltage trip mechanism occurred, no concurrent failures of the undervoltage and shunt trip mechanisms have occurred.

Additionally, a review of reactor trip and bypass breaker surveillance test data shows satisfactory results for the past three refueling outages. The reactor trip and bypass breaker response time test data does not show any time dependency for the undervoltage and shunt trip coils. In addition, a significant margin between the actual response times and the acceptance criteria limit (150 ms) exists for all of the breakers.

Potential RPS operability problems can be detected by on-line testing. Monthly functional tests ensure the operability of RP logic channels A and B by confirming that the logic coincidence relays are functioning properly. The tests also cycle the reactor trip and bypass breakers by individually demonstrating the ability of the shunt trip and undervoltage coils to trip their respective breakers. Therefore, the primary objective of the refueling test is to determine the breaker trip response time via the undervoltage and shunt trip attachments, while the monthly RP relay logic functional test ensures overall system operability.

In summary, there is a reasonable assurance that the reactor trip and bypass breaker response time and trip verification surveillance test can safely be extended to accommodate the longer operating cycle because:

- the changes made in plant equipment and procedures following the Salem ATWS event have increased RPS reliability and ensure that a backup method for tripping the reactor trip and bypass breakers exists in the event of failure of the undervoltage trip mechanism,
- IP3 NPRDS data, LERs, operational occurrence reports and surveillance test records confirm the reliability of the reactor trip and bypass breakers,
- operational occurrence reports indicate that concurrent failures of the undervoltage and shunt trip mechanisms (which would prevent the breakers from performing their safety function) have not occurred,
- the reactor trip and bypass breaker response time test data does not show any time dependency for the undervoltage and shunt trip coils, and
- potential reactor protection system operability problems involving relays and the reactor trip breakers are detected by monthly RP relay logic functional tests.

Calibration Frequencies Remaining at 18 Month Interval

Based on the results of instrument drift evaluations, the following RPS surveillance requirements listed in Table 4.1-1 of Appendix A to the IP3 Technical Specifications are not being changed by this application.

- calibration frequency of the pressurizer water level transmitters,
- calibration frequency of the pressurizer pressure transmitters, and
- calibration frequency of the 6.9 kV undervoltage relays.

Past performance of the above listed components did not meet NYPA's acceptance criteria for the extension of surveillance requirements.

However, extension of the calibration interval for the pressurizer pressure transmitters may be sought in the future. Poor past performance of the pressurizer pressure transmitters has been attributed to faulty zero suppression kits. These kits were replaced in November, 1990. Extension of this calibration interval is being postponed until a repeatable pattern of acceptable drift values can be established.

Similarly, extension of the calibration intervals for the pressurizer water level transmitters and the 6.9 kV undervoltage relays may be sought if a repeatable pattern of acceptable drift values is observed in the future.

Section III - No Significant Hazards Evaluation

Consistent with the criteria of 10 CFR 50.92, the enclosed application is judged to involve no significant hazards based on the following information:

(1) Does the proposed license amendment involve a significant increase in the probability or consequences of any accident previously evaluated?

Response:

The proposed changes do not involve a significant increase in the probability or consequences of any accident previously evaluated. The proposed changes extend the calibration intervals for the reactor coolant loop narrow range and RTD temperature instrumentation, the reactor coolant loop flow instrumentation, the 6.9 kV underfrequency relays, and the steam generator level transmitters. Extension of the surveillance test intervals for the reactor trip and bypass breakers is also proposed. These changes are being made to accommodate a 24 month operating cycle. Additionally, a change to Technical Specification 2.3.1.B(6)(b) is proposed, increasing the minimum reactor coolant pump low frequency trip setting to 57.2 Hz. The proposed changes are consistent with NRC guidelines published in Generic Letter 91-04.

Extension of the calibration and surveillance test intervals in question were evaluated and the results documented in the Reactor Protection System (RPS) Surveillance Test Extensions report (Reference 5). An RPS Instrument Drift Analysis (Reference 4) was performed to evaluate actual past and projected future instrument drift. Safety system loop accuracy/setpoint calculations, which include any additional instrument uncertainties resulting from the proposed calibration interval extensions, show that sufficient margin exists between the analytical and field trip settings for the overpower (OP) delta-T, the overtemperature (OT) delta-T, the reactor coolant (RC) low flow, the 6.9 kV underfrequency, and the steam generator (SG) low-low level trip functions. Reference 5 documents that none of the proposed extensions of calibration and surveillance test intervals degrade performance of the RPS. Additionally, a comprehensive on-line surveillance program demonstrates the operability of the RPS instrumentation and readily detects potential instrument failures.

The proposed changes to the length of the calibration intervals for the reactor coolant loop narrow range and RTD instrumentation, the reactor coolant loop flow instrumentation, and the steam generator level transmitters do not involve hardware modifications or changes to existing safety system setpoints. The changes in the length of the surveillance intervals for the reactor trip and bypass breakers do not involve hardware modifications.

The proposed change in the length of the calibration interval for the 6.9 kV underfrequency relays involves a change to the currently specified minimum trip setting. The field trip setting is 57.5 Hz while the analytical setpoint is 55 Hz. Since current Technical Specification 2.3.1.B(6)(b) specifies a minimum field trip setting equal to the analytical limit, an increase to 57.2 Hz is proposed to ensure sufficient margin is maintained to allow for instrument inaccuracies. No change is being proposed to the field trip setting. The proposed change to the minimum setting specified in the Technical Specifications does not adversely affect RPS operability. The change constitutes an additional limitation.

(2) Does the proposed license amendment create the possibility of a new or different kind of accident from any previously evaluated?

Response:

The proposed changes do not create the possibility of a new or different kind of accident from any previously evaluated. The proposed changes extend the calibration intervals for the reactor coolant loop narrow range and RTD temperature instrumentation, the reactor coolant loop flow instrumentation, the 6.9 kV underfrequency relays, and the steam generator level transmitters. Extension of the surveillance test intervals for the reactor trip and bypass breakers is also proposed. These changes are being made to accommodate a 24 month operating cycle. Additionally, a change to Specification 2.3.1.B(6)(b) is proposed, increasing the minimum reactor coolant pump low frequency trip setting to 57.2 Hz. The proposed changes are consistent with NRC guidelines published in Generic Letter 91-04.

Extension of the calibration and surveillance test intervals in question were evaluated and the results documented in the RPS Surveillance Test Extensions report (Reference 5). An RPS Instrument Drift Analysis (Reference 4) was performed to evaluate actual past and projected future instrument drift. Safety system loop accuracy/setpoint calculations, which include any additional instrument uncertainties resulting from the proposed calibration interval extensions, show that sufficient margin exists between the analytical and field trip settings for the OP delta-T, the OT delta-T, the RC low flow, the 6.9 kV underfrequency, and the SG low-low level trip functions. Reference 5 documents that none of the proposed extensions of calibration and surveillance test intervals degrade performance of the RPS. Additionally, a comprehensive on-line surveillance program demonstrates the operability of the RPS instrumentation and readily detects potential instrument failures.

The proposed changes to the length of the calibration intervals for the reactor coolant loop narrow range and RTD instrumentation, the RC loop flow instrumentation, and the SG level transmitters do not involve hardware modifications or changes to existing safety system setpoints. The changes in the length of the surveillance intervals for the reactor trip and bypass breakers do not involve hardware modifications.

The proposed change in the length of the calibration interval for the 6.9 kV underfrequency relays involves a change to the currently specified minimum trip setting. The field trip setting is 57.5 Hz while the analytical setpoint is 55 Hz. Since current Technical Specification 2.3.1.B(6)(b) specifies a minimum field trip setting equal to the analytical limit, an increase to 57.2 Hz is proposed to ensure sufficient margin is maintained to allow for instrument inaccuracies. No change is being proposed to the field trip setting. The proposed change to the minimum setting specified in the Technical Specifications does not adversely affect RPS operability. The change constitutes an additional limitation.

(3) Does the proposed amendment involve a significant reduction in a margin of safety?

Response:

The proposed changes extend the calibration intervals for the reactor coolant loop narrow range and RTD temperature instrumentation, the reactor coolant loop flow instrumentation, the 6.9 kV underfrequency relays, and the steam generator level transmitters. Extension of the surveillance test interval for the reactor trip and bypass breakers is also proposed. These changes are being made to accommodate a 24 month operating cycle. Additionally, a change to Specification 2.3.1.B(6)(b) is proposed, increasing the minimum reactor coolant pump low frequency trip setting to 57.2 Hz. The proposed changes are consistent with NRC guidelines published in Generic Letter 91-04.

As required by Generic Letter 91-04, loop accuracy/setpoint calculations must show that sufficient margin exists between the analytical limit and the existing field trip setting in order to be consistent with the assumptions of the safety analysis. The calculations also verify whether technical specification setpoint limits provide sufficient margin over the analytical limit to allow for instrument inaccuracies.

The calculations show that sufficient margin exists between safety system analytical setpoint limits and the field trip settings for the OP delta-T, OT delta-T, RC low flow, 6.9 kV underfrequency, and SG low-low level trip functions even when accounting for and using the conservatively postulated 30 month drift values associated with the longer cycle. Additionally, the calculations show that no changes in safety system setpoints are required for the OP delta-T, OT delta-T, RC low flow, and steam generator low-low level trip functions. Therefore, the proposed changes to extend the calibration interval for the reactor coolant loop narrow range and RTD temperature instrumentation, the reactor coolant loop flow instrumentation, and the steam generator level transmitters do not involve significant reductions in margins of safety assumed in the safety analysis.

However, the calculations show that the currently specified minimum trip setting for the 6.9 kV underfrequency relays must be increased. The field trip setting is 57.5 Hz while the analytical setpoint is 55 Hz. Since current Technical Specification 2.3.1.B(6)(b) specifies a minimum field trip setting equal to the analytical limit, an increase to 57.2 Hz is proposed to ensure sufficient margin is maintained to allow for instrument inaccuracies. No change is being proposed to the field trip setting. The proposed change to the minimum setting specified in the Technical Specifications does not adversely affect RPS operability. The change ensures sufficient margin is maintained to account for instrument inaccuracies and constitutes an additional limitation. Therefore, the proposed change to the minimum specified trip setting ensures that the proposed change to the length of the calibration interval does not involve a significant reduction in the margin of safety assumed in the safety analysis.

The proposed changes to the surveillance test intervals for the reactor trip and bypass breakers do not affect safety system setpoints, and, therefore, do not involve significant reductions in margins of safety.

Section IV - Impact of Changes

These changes will not adversely impact the following:

ALARA Program
Security and Fire Protection programs
Emergency Plan
FSAR and SER Conclusions
Overall Plant Operations and the Environment

Section V - Conclusions

The incorporation of these changes: a) will not increase the probability nor the consequences of an accident or malfunction of equipment important to safety as previously evaluated in the Safety Analysis Report; b) will not increase the possibility for an accident or malfunction of a different type than any evaluated previously in the Safety Analysis Report; c) will not reduce the margin of safety as defined in the bases for any technical specification; d) does not constitute an unreviewed safety question; and e) involves no significant hazards considerations as defined in 10 CFR 50.92.

Section VI - References

1) IP3 SER
2) IP3 FSAR
3) NRC Generic Letter 91-04, Enclosure 2, "Guidance for Addressing the Effect of Increased Surveillance Intervals on Instrument Drift and Safety Analysis Assumptions," dated April 2, 1991.
4) Instrument Drift Analysis for Reactor Protection System (RPS), NYPA document No. IP3-RPT-RPC-00357, dated November 10, 1992.
5) Reactor Protection System Surveillance Test Extensions, NYPA document No. IP3-RPT-RPC-00401, dated January 5, 1993.
6) ISA RP67.04, Part II, Draft 9, "Methodologies for the Determination of Setpoints for Nuclear Safety-Related Instrumentation," Dated March, 1991.

Attachment III to IPN-93-007

(NON-PROPRIETARY VERSION*)

*Proprietary Information has been omitted

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INDIAN POINT 3 NUCLEAR POWER PLANT
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DPR-64