your energy partner®
OPPD
Omaha Public Power District

444 South 16th Street Mall
Omaha NE 68102-2247

July 5, 2001
LIC-01-0065

Mr. Ryan Lantz, Chief Examiner
U. S. Nuclear Regulatory Commission
Region IV
611 Ryan Plaza Drive, Suite 1000
Arlington, TX 76001

Reference: Docket No. 50-285

Dear Mr. Lantz:

Subject: Technical Review of the Reactor Operator (RO) and Senior Reactor Operator (SRO) Licensing Written Examinations

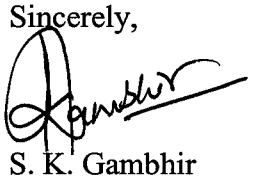
The Omaha Public Power District (OPPD) has evaluated the RO and SRO licensing examinations that OPPD administered at Fort Calhoun Station on June 22, 2001. In accordance with NUREG-1021 (Operator Licensing Examination Standards for Power Reactors), OPPD's comments justifying changes made to the examination answer keys are attached. Additional training was provided on questions missed by 50% or more of the license candidates. An evaluation will be conducted to determine if changes to the licensed operator initial training program are required as a result of student performance on the examination.

The following items are also attached to this letter:

- The graded written examinations and clean copies
- The master examinations and answer keys
- Question asked by and answers given to the applicants during the written examinations
- The written examination seating chart
- A completed form ES-403-1
- An analysis of the preliminary and final examination results
- A copy of the examination security agreement with signatures obtained thus far (the original will be sent when we have obtained all of the required signatures)

If you should have any questions, please contact myself or Mr. Dave Weaver at 402-533-6056.

Sincerely,



S. K. Gambhir
Division Manager
Nuclear Operations

SKG/JEK/epm

Attachments

c: E. W. Merschoff, NRC Regional Administrator, Region IV (w/o Enclosures)
A. B. Wang, NRC Project Manager (w/o Enclosures)
W. C. Walker, NRC Senior Resident Inspector (w/o Enclosures)
Document Control Desk (w/o Enclosures)
Winston & Strawn (w/o Enclosures)

Attachment

Justification for changes made to the exam keys for the RO and SRO written exams conducted at Fort Calhoun Station on 6/22/01

Question # 2 (# 2 RO exam & # 76 for SRO)

The Shift Manager has the responsibility for temporarily downgrading the level of use of a Fort Calhoun procedure when he is present in the control room. The Control Room Supervisor has that responsibility when the Shift Manager is absent from the Control Room. Standing Order SO-O-1, "Conduct of Operations," states:

> *Normally, the Shift Manager (SM) has the senior license responsibilities identified in the Fort Calhoun Operating License and 10 CFR 54. However, in the absence of the Shift Manager from the main Control Room, said senior license responsibilities rest with the Control Room Supervisor (CRS) until such time as the Shift Manager returns.*

The Shift Manager's office is located outside of the main control room, so the Shift Manager is frequently absent from the control room with the Control Room Supervisor performing the duties of "Acting Shift Manager." The term "Acting Shift Manager" is used at FCS to designate an individual who can act on the behalf of the Shift Manager of Record. Operations Department Policy And Directives OPD-2-06, "Operations Department Duties And Responsibilities," states:

> *Personnel holding a valid NRC Senior Reactor Operator License can be designated to perform the duties of an Acting Shift Manager. These duties shall be at the discretion of the Shift Manager of record and may include, however not be limited to the authorization of activities normally approved for the Shift Manager for the following:*
>
> - *Standing Order SO-G-21; Modification Control*
> - *Standing Order SO-G-23; Surveillance Test Program*
> - *Standing Order SO-M-2; Preventive Maintenance Program*
> - *Standing Order SO-M-26; Calibration Procedure*
> - *Standing Order SO-M-101; Maintenance Work Control*
> - *Standing Order SO-O-1; Conduct of Operation*
>
> *Personnel designated to perform as an Acting Shift Manager will be appointed by the Supervisor - Operations.*

The list of those appointed as Acting Shift Managers includes all of the Control Room Supervisors as well as the Operations Control Center Supervisors. The Shift Manager of record is present on site when these persons perform Acting Shift Manager duties.

During their on-shift time, the candidates observed temporary level of use changes to procedures being approved by both Shift Managers and Control Room Supervisors.

Therefore, choice 'D' is the correct answer.

Question # 10 (# 83 for SROs only)

SO-O-1 states: "Breakers ... that have had Preventive Maintenance (PMs) performed on them must be operated in the test position prior to declaration of operability." But some breakers, such as the Boric Acid Pump breakers, do not have a test position. According to SO-O-1, "If a test position is not provided, the breaker shall be cycled with its load to prove operability." Therefore, the key is correct for breakers that have a test position. However, 'D' is the correct choice for breakers that are not provided with a test position.

Therefore, the key was changed to indicate that choices 'C' and 'D' are both correct.

Question # 16 (# 11 for RO's only)

According to SO-G-7, "Operating Manual," reference use procedures "require having the procedure available at the work-site for reference and using the procedure to validate completion of required actions when procedural segments are completed." Information use procedures "allow performing the activity without referring to the procedure or having the procedure at the work-site."

Unlike the Operating Procedures (OPs) and the Operating Instructions (OIs), the Annunciator Response Procedures (ARPs) do not indicate the procedure level of use within the procedures themselves. The Annunciator Response Procedures are classified as reference use procedures in SO-G-7. However, ARP-1 allows operators to carry out the actions of expected ARPs without referencing the procedure. This practice is consistent with the definition of information use procedures. Therefore, ARPs are treated as "reference use" procedures for unexpected alarms and "information use" procedures for expected alarms.

Therefore, the key was changed to indicate that choices 'B' and 'C' are both correct.

Question # 29 (# 22 for RO exam & # 100 for SRO)

The question stem does not specify if decay heat is to be removed by boiling or once through cooling. Abnormal Operating Procedure, AOP-19, "Loss of Shutdown Cooling," provides two values: 55 gpm for boiling supporting choice 'B,' and 575 gpm for once through cooling supporting choice 'D'.

Therefore, the key was changed to indicate that choices 'B' and 'D' are both correct.

Question # 56 (# 25 SRO exam)

AOP-6, "Fire Emergency," supports choice 'D,' tripping the reactor, isolation of hydrogen to the generator, and venting the generator to the turbine building roof. However, the next step of AOP-6 directs lining up of CO_2 to the generator as stated in choice 'C.'

Therefore, the key was changed to indicate that choices 'D' and 'C' are both correct.

Question # 92 (# 72 for RO exam)

In this question, the statement "positive deviation" is open to interpretation. The stem of the question states there is a "large positive deviation". Some operators interpret a positive deviation as level being above the setpoint supporting choice 'D.' Other operators interpret "positive deviation" to mean that the demanded valve position is greater than the actual valve position supporting choice 'C'. Level indicating controller LIC-903Y/906Y has a deviation indicator that reads "10 – 0 – 10" with NO reference to positive or negative indicated on the meter. The system training manual (attached) only states, "A deviation indicator is provided on the controller."

The reference materials that we use for Generic Fundamentals Training disagree with each other on what is meant by a positive deviation (error).

The General Physics material (attached) states, "The error indicating pointer moves to display the value of the measured variable and the deviation of the measured variable from the setpoint. If the pointer deflects above the hairline, an error above setpoint is indicated." This supports choice 'D.'

However, the Department of Energy (DOE) training material (also attached) states, "If the measured variable drops below the setpoint, a positive error is developed." This supports choice 'C.'

Therefore, it is clear that no convention exists as to what constitutes a "positive deviation." An informal poll of licensed instructors revealed that they would need clarification on what constitutes a "positive deviation" before they could answer the question.

Choices 'A' and 'B' are clearly wrong because changing the setpoint would have no effect with the controller in manual. Therefore, the question was retained and the key was changed to indicate that choices 'C' and 'D' are both correct.

Question # 112 (# 89 for RO exam & # 65 for SRO exam)

The ARP supports the key answer 'C.' However, Operating Instruction, OI-WDG-1, "Waste Gas Disposal System Normal Operation," contains the following caution: "To prevent pump rotor failure, a Waste Gas Compressor must not be operated until seal water is aligned and proper Moisture Separator Tank level is established." Proper level is given as "above the casing bottom and below the pump rotor centerline." The tech manual also states (see attached), "Never start pump when filled above casing centerline. This can lead to rotor blade damage." With these cautions in place, tripping the Waste Gas Compressor prior to investigating the source of the high water level would be a prudent and conservative action supporting choice 'A.'

Therefore, the key was changed to indicate that choices 'C' and 'A' are both correct.

Question Number 2

System/Mode 000000 **Stem**

Generic Knowledges and Abilities

KA No 2.1.20 **Description** Ability to execute procedure steps.

Question

Who must give permission for a temporary level of use downgrade for a procedure that is repeatedly performed by the same person on the same day?

A. The Operations Manager or an Operations Supervisor.

B. The Shift Manager.

C. The Control Room Supervisor.

D. The Shift Manager or the Control Room Supervisor.

Answer ~~B~~ D **CFR Section** 41.10 / 43.5 / 45.12

Higher Level ☐ **RO** ☑ 4.3 **SRO** ☑ 4.2

LP Number 0762-01 **LP Objective** 02.00

STATE some of the activities, covered by Standing Orders, which require written procedures per Regulatory Guide 1.33.

Question Source New

Reference SO-O-1 page 66

Attachment None

Comments

COPY

5. PROCEDURE

5.1 Control Room Watchstanding Requirements

5.1.1 All on-shift NRC Licensed Operators and Shift Managers must be aware of and responsible for the plant status at all times. This includes managers being responsible for the performance of all personnel assigned to their shift who could affect plant safety regardless of specialty affiliation. Knowledge of the plant's status must be assured during shift changes by a formal watch turnover and relief.

5.1.2 All on-shift Control Room Operators and Equipment Operators must be alert and aware of the status of their immediate areas of responsibility until properly relieved, and be particularly attentive to the instrumentation and controls located within these areas. Sleeping is not allowed and anyone guilty of same is subject to severe disciplinary action.

5.1.3 Normally, the Shift Manager (SM) has the senior license responsibilities identified in the Fort Calhoun Operating License and 10 CFR 54. However, in the absence of the Shift Manager from the main Control Room, said senior license responsibilities rest with the Control Room Supervisor (CRS) until such time as the Shift Manager returns.

5.1.4 Only Licensed Operators (CRS's or LO's) are permitted to manipulate the controls that directly affect the reactivity or power level of the reactor. The manipulation of all controls as defined in 10 CFR 55 (Operators' Licenses), will be done by and/or under the direction of licensed personnel. Licensed Operator Trainees are allowed to operate controls for training purposes provided they are properly supervised by a Licensed Operator trainer.

5.1.5 Licensed Operator positions shall only be filled by active NRC operator license holders. Active NRC license requirements include satisfactory completion of requalification training, quarterly on-shift time requirement, and fitness for duty (i.e., medical/physical limitations or concerns). It is the responsibility of each Licensed Operator to maintain his/her qualifications current.

5.1.6 All Operators are required to provide the Shift Manager with marked up changes to plant procedures when errors/deficiencies are discovered.

Control Room Supervisor (CRS)

1. Personnel holding a valid NRC Senior Operator License can be given senior license responsibilities identified in the Fort Calhoun Operating License.

2. Personnel holding a valid NRC Senior Reactor Operator License can be designated, to perform the duties of an Acting Shift Manager. These duties shall be at the discretion of the Shift Manager of record and may include, however not be limited to the authorization of activities normally approved by the Shift Manager for the following:

   - Standing Order SO-G-21; Modification Control
   - Standing Order SO-G-23; Surveillance Test Program
   - Standing Order SO-M-2; Preventive Maintenance Program
   - Standing Order SO-M-26; Calibration Procedure
   - Standing Order SO-M-101; Maintenance Work Control
   - Standing Order SO-O-1; Conduct of Operations

   Personnel designated to perform as an Acting Shift Manager will be appointed by the Supervisor - Operations.

3. To safely and efficiently operate the unit in accordance with established procedures, authorizing license, and good operating practice under the supervision of the Shift Manager.

4. Perform the functions necessary for the proper, safe, and efficient care and operation of the unit including the reactor, steam generators, turbine, and related equipment.

5. Assist in the development of good operating practices in fellow Operators.

6. Assist the Shift Manager in directing and checking the work performed by other Operators.

7. Maintain all logs and records necessary to properly document the operation of the station.

8. Maintain a record of Maintenance Rule Equipment out of service per SO-G-96.

9. Coordinate proper communications inside and outside the station.

10. Coordinate the performance of assigned Surveillance Tests (STs) for Operations and other STs requiring Operations involvement.

DESIGNATION OF INDIVIDUALS AS ACTING SHIFT MANAGER

Individuals holding a valid NRC Senior Reactor Operator's license can be designated to perform duties as an Acting Shift Manager. The extent of the duties will be solely at the discretion of the Shift Manager of record and may include, however not be limited to, authorizing/approving Maintenance Work Documents, Preventative Maintenance Orders, Calibration Procedures and Surveillance Tests. The OCC Supervisor or OCC Coordinator may also be designated to approve all Maintenance Work Documents, PMOs, Calibration Procedures and Surveillance Tests. The expectation is that the Acting Shift Manager acts on the behalf of the Shift Manager of record. Hence, operationally significant authorization/approvals performed by the Acting Shift Manager, OCC Supervisor or OCC Coordinator would eventually be communicated to the Shift Manager of record.

The following individuals can act in the capacity as an Acting Shift Manager.

M.J. Anielak
S.H. Benham
W. Blessie
J.N. Borger
A. Christensen
J.A. Drahota
M.D. Ferm
T.E. Giebelhausen
F.T. Klauzer
J.D. Kecy
D.J. Matthews
A.S. Pallas
A.R. Peters
D.M. Pier
R.E. Ward

Question Number 10

System/Mode 000000 **Stem**

Generic Knowledges and Abilities

KA No 2.2.24 **Description** Ability to analyze the affect of maintenance activities on LCO status.

Question

What is the minimum level of testing required following electrical breaker preventive maintenance?

A. The breaker must be visually inspected.

B. The breaker must be operated in the electrical shop.

C. The breaker must be operated in the test position.

D. The breaker must be operated to power its load.

Answer C or D **CFR Section** 43.2 / 45.13

Higher Level ☐ **RO** ☐ 2.6 **SRO** ☑ 3.8

LP Number 0762-08 **LP Objective** 05.00

Given a copy of Technical Specifications, APPLY the requirements to a given condition covered by an LCO.

Question Source New

Reference SO-O-1 page 13

Attachment None

Comments

5.3.2 Breakers associated with equipment identified in of SO-G-20A that have had Preventive Maintenance (PMs) performed on them must be operated in the 'test' position prior to declaration of operability. If a test position is not provided the breaker shall be cycled with its load to prove operability. This type of testing is not expected to produce system transients.

5.3.3 Equipment that has undergone maintenance potentially affecting operability (e.g., oil change, seal replacement, etc.) must be run to verify operability.

During the Shift Manager's post work review of the work control document, the adequacy of the proposed PMT must be verified. The primary purpose of the Shift Manager review is to ensure that the specified testing will restore Technical Specification operability and impose no adverse affects on the system or equipment. The Shift Manager at his discretion may specify additional/other testing to ensure this operability.

PMT's shall be completed following the release of tags on a component. The testing must be successfully completed prior to the equipment being declared operable or redundant equipment being taken out-of-service. An exception can be made if the Shift Manager determines that testing the equipment will produce an unacceptable transient or an alternate means of determining operability is provided (e.g., an Operability Determination per NOD-QP-31, or other means).

If a PMT cannot be completed immediately, the equipment in question should remain inoperable until adequate testing can be performed or an alternate means (i.e. NOD-QP-31) is provided. Logging of pending PMT status in the Official Control Room Log is optional. In Modes 4 and 5 logging of inoperable equipment in either the Shift Turn Over or Official Control Room Log is optional, however good operating practices require that component operability should be tracked.

The Shift Manager must not sign off the Work Task, PMO, or PRC approved procedure until the PMT is successfully completed. The Shift Manager will be notified by the appropriate craft when the work is complete. When a piece of equipment fails its specified PMT the equipment, component, or system shall remain Deficiency Tagged to indicate that a deficiency still exists. The Shift Manager at his discretion may re-Danger Tag or Local Control Tag the component out of service; declare it inoperable (if not already previously done); or, depending on the test results and significance of the deficiency, return the equipment to service with the deficiency documented in the Official Control Room Log.

Question Number 16

System/Mode 000000 **Stem**

Generic Knowledges and Abilities

KA No 2.4.10 **Description** Knowledge of annunciator response procedures.

Question

How are the Annunciator Response Procedures (ARPs) classified for level of use at FCS:

A. Continuous use procedures

B. Reference use procedures

C. Information use procedures

D. They are not classified for level of use

Answer B or C **CFR Section** 41.10 / 43.5 / 45.13

Higher Level ☐ **RO** ☑ 3.0 **SRO** ☐ 3.1

LP Number 0762-11 **LP Objective** 01.00

USE the ARPs to diagnose plant problems.

Question Source New

Reference SO G-7 5.5.9

Attachment None

Comments

NRC Comment - Not discriminating enough for SRO. OK for RO

Changed to RO Only question. New SRO only question added using same K/A (question 127)

3.4 Official Copy - A copy of the operating manual uniquely identified as controlled.

3.5 Procedure - An approved Operating Manual document which provides specific instructions on how to conduct activities.

3.6 Procedure Adherence - Following the intent and direction provided by a procedure in the step-by-step fashion in which it is written.

3.7 Procedure Change - A change (Regular, Blanket, or Temporary) to an existing Operating Manual procedure.

3.8 Routine Performance (of a procedure) - A scheduled procedure (especially a surveillance test) intended to be performed in its entirety to satisfy the performance frequency required by the Technical Specification or PM program. These procedures are usually copied on colored paper or accompanied by a PMO task sheet and are listed on one of several schedules or scheduling reports.

3.9 Verbatim Compliance - Step by step completion of a procedure or standing order as written, with due regard for quality and safety. **[AR 09376]**

3.10 Level of Use - The designation of the minimum required reference to a procedure during performance of a task.

3.10.1 The following represent the three Level of Use classifications:

A. Continuous Use - Requires having the procedure in hand, reading each step, performing each step in the sequence specified, and where required, signing off each step as completed before proceeding to the next step.

B. Reference Use - Requires having the procedure available at the work-site for reference and using the procedure to validate completion of required actions when procedural segments are completed.

C. Information Use - Allows performing the activity without referring to the procedure or having the procedure at the work site.

4. RESPONSIBILITIES

4.1 All personnel are responsible for strict adherence to the provisions of the Operating Manual.

4.2 Document Control is responsible for the preparation, organization, and distribution of any changes made to the operating manual.

5.5.7 C. Performance of activity is within the knowledge and skills of qualified personnel.

D. The activity has no immediate consequences to nuclear safety and reliability.

5.5.8 Level-of-Usage Designation - Procedures, Procedure Sections, and Attachments within Operating Manual Procedures will each have their own Level-of-Use classification and be designated as such on the first page or on each page of the procedure for multiple level-of-use procedures per the requirements of FCSG-8 or FCSG-9. Procedures with a blanket Level-of-Use classification need not be designated since the usage classification is the same for all the procedures within the category.

A. The Level-of-Use classification should be reviewed periodically to ensure that the procedure classification has not changed. This is especially true for Information Use procedures.

B. Any procedure (except those having a blanket level-of-use designed in Step 5.5.9A which is not identified with a level of use shall be considered a Continuous Use procedure with the following exceptions:

1) Emergency Operating Procedures (EOPs) or Abnormal Operating Procedures (AOPs) usage guidance is provided in the Operations Department Policy and Directives Manual Section OPD-04-09, EOP/AOP Users Guide.

2) Chemistry Department procedures usage guidance is provided in CH-AD-0001.

5.5.9 Level-of-Use Applicability

A. The following procedures have blanket Level-of-Use classification as indicated:

1) Standing Orders - Information Use

2) Technical Data Book - Information Use

3) Surveillance Tests - Continuous Use, unless otherwise identified

4) Annunciator Response Procedures - Reference Use

5) Alignment Checklists - Continuous Use

4.5 Annunciator windows that are normally on during power operation are designated with a bold B on the Annunciator Lampbox Drawing. Normally on annunciators are designated on the individual response pages by having the Window outlined with a double line; in addition, normally on annunciators have a small blue dot located in the lower right hand corner of the annunciator window.

4.6 The ANNUNCIATOR MASTER SILENCE push-button should only be used with the permission of the Shift Manager (SM) or Control Room Supervisor (CRS). Its use should be minimized and limited to events such as plant transients, ESF testing, component testing or instrument maintenance/calibrations that will create numerous distracting alarms. When utilized, appropriate compensatory measures should be taken to monitor the annunciator panels.

5. PROCEDURE

5.1 ARP Philosophy of Use

5.1.1 The appropriate ARP(s) should be referenced whenever one of the following criteria is met:

A. When an annunciator alarm is infrequent or unexpected.

B. When the Operator recognizes the initiating device(s) causing the annunciator alarm but is unsure or unclear of the corrective/restorative actions required by the ARP.

C. When the Operator is unsure of the annunciator alarm initiating device(s) and as a result is unsure of the Operator response actions required by the ARP.

5.1.2 The ARP need not be referenced by the Operator for any expected alarms if any of the following criteria are met:

A. The Operator understands the cause of the annunciator alarm, understands the annunciator initiating device(s), and is knowledgeable of each action step for the desired Operator response(s). This would normally be the case for frequently received annunciator alarms.

B. The cause of the annunciator alarm is known to be a direct result of an Operator action or preplanned operational activity and is fully understood by the Operator (i.e., equipment/plant startup or shutdown, surveillance test, calibration procedure, etc.).

5.1.2 C. When multiple annunciator alarms are received as a result of a single event (i.e., reactor trip). However, ARPs are useful to an Operator and should be referenced whenever possible once the plant is stable as an aid to event diagnosis.

5.1.3 Following the receipt of any alarm, the Operator is expected to use problem solving and diagnostic skills to properly implement corrective actions. A conservative approach towards alarm response must always be maintained. Unexpected alarms must be treated as valid unless independent indications or field investigations reveal the initiating device to be defective.

5.1.4 The guidance in any ARP is recognized as not being all inclusive due to the potential for wide variance in event circumstances. Whenever practical the ARP should be followed as written. If a deviation from an ARP is necessary then that deviation must be approved by the SM or CRS. If the deviation is due to other than event circumstance or procedural error, then that deviation must be logged in the Official Control Room log. If the deviation is due to procedural error or an unrecognized probable cause, then the operating crew will ensure a procedure change is submitted.

5.2 Acknowledgment of Annunciator Alarms

5.2.1 Unexpected alarms: During normal plant operations (Modes 1-5), a Control Room Licensed Operator (LO) will communicate to the Control Room crew the receipt of any alarm which is unexpected.

A. The LO will verbalize the annunciator (Either a verbatim statement or a paraphrase). It is the responsibility of the LO to ensure another member of the Control Room crew acknowledges the verbalization.

B. The SM, CRS or other RO shall acknowledge their awareness of the unexpected alarm to the LO.

C. The LO shall communicate simultaneous, multiple unexpected alarms to the Control Room crew as soon as possible and in an order consistent with their priority.

Question Number 29

System/Mode 000011 **Stem** Ability to determine or interpret the following as they apply to a Large Break LOCA:

Large Break LOCA

KA No EA2.05 **Description** Significance of charging pump operation

Question

What is the minimum number of charging pumps that would be required to provide adequate makeup flow to remove heat 24 hours after a large LOCA that occurred from full power?

A. One charging pump

B. Two charging pumps

C. Three charging pumps

D. More than the flow from three charging pumps is required

Answer B or D **CFR Section** 43.5 / 45.13

Higher Level ☑ **RO** ☑ 3.3 **SRO** ☑ 3.7*

LP Number 0707-42 **LP Objective** 03.07

RCS makeup flowrates for available success paths

Question Source New

Reference AOP 19 page 3, CVCS STM page 22

Attachment None

Comments

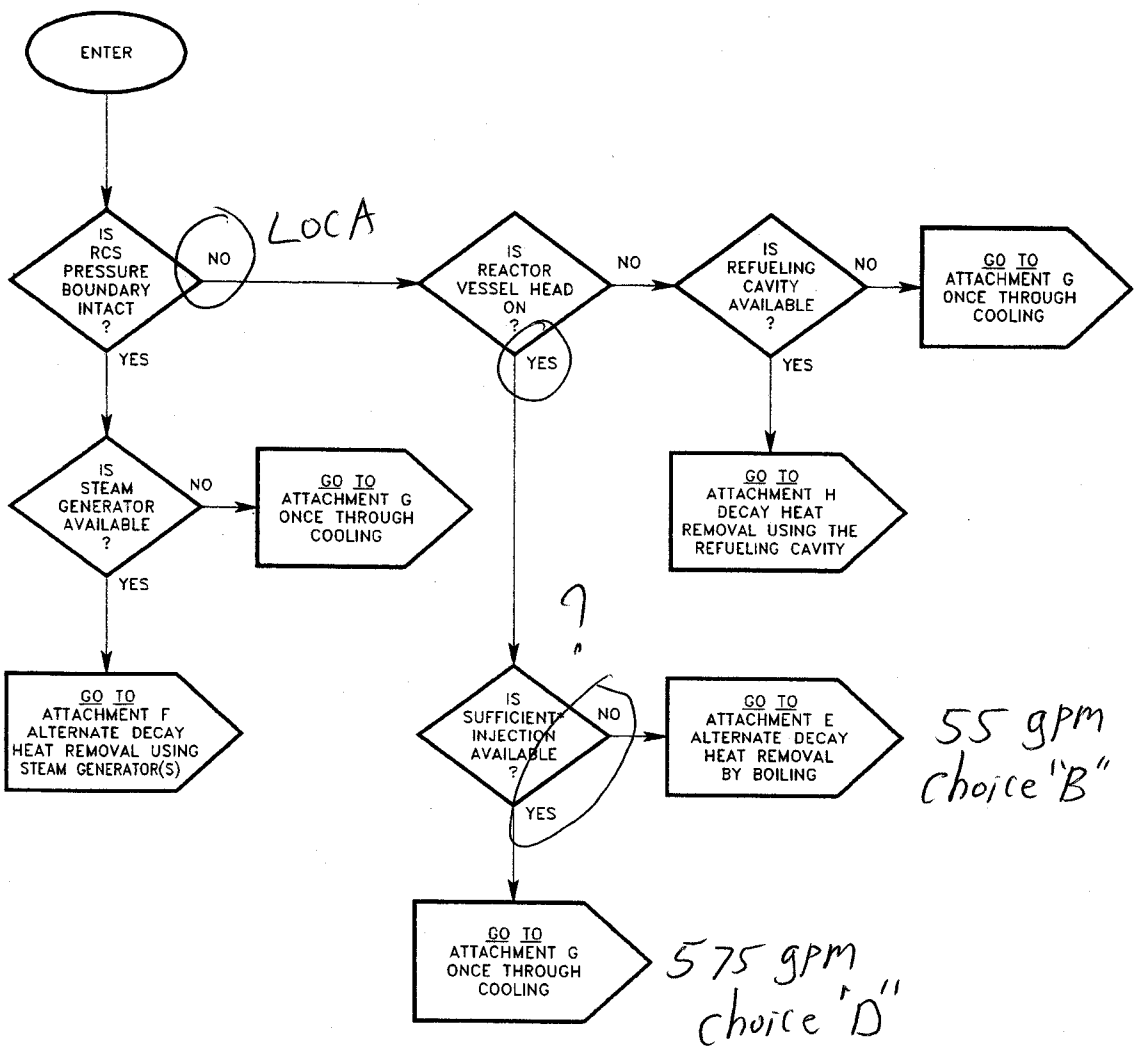
NRC Commnent - reference does not clearly support the answer..discuss

AOP-19 states that a minimum of 55 gpm is required to remove decay heat 24 hours after shutdown. The CVCS STM states that the capacity of the charging pumps is 40 gpm per pump, Therefore, at least two charging pumps are required.

Attachment D

Alternate Decay Heat Removal Method Determination

Determine the method of Alternate Decay Heat Removal from the Flow Chart.



* Appropriate flow required to remove heat by injection, **based on** 100% full power operation for greater than 30 days.

Time after shutdown (days)	Required (gpm)
1	575
5	385
10	310
30	230

End of Attachment D

Attachment G

Once-Through-Cooling

INSTRUCTIONS	CONTINGENCY ACTIONS
1. Verify the RCS injection flow capability is greater than or equal to that required PER Attachment D, Alternate Decay Heat Removal Method Determination.	1.1 **IF** the RCS injection flow capability is inadequate, **THEN** GO TO Attachment E, Alternate Decay Heat Removal By Boiling.

NOTE

Steps 2 and 3 need not be performed if completed previously.

2. Sound the Emergency Alarm for 30 seconds.

3. Announce and repeat the following using the Plant communications system:

   "Attention all personnel. Attention all personnel. All personnel evacuate Containment".

4. Ensure **BOTH** of the PORV Block Valves are open:

   - HCV-150
   - HCV-151

5. Open both of the PORVs.

Attachment E

Alternate Decay Heat Removal by Boiling

INSTRUCTIONS CONTINGENCY ACTIONS

4. **IF** the RCS Pressure Boundary is intact,
THEN open both of the PORVs.

5. Commence injection to the RCS at greater than 55 gpm PER **one** of the following attachments:

- Attachment K, RCS Makeup from the BAST
- Attachment L, RCS Makeup from the SIRWT
- Attachment M, RCS Makeup using HPSI Pump
- Attachment I, RCS Makeup using LPSI Pump
- Attachment J, RCS Makeup using CS Pump

6. Throttle RCS injection to restore RCS level.

7. Continue efforts to restore SDC.

Question Number 56

System/Mode 000067 **Stem**

Plant Fire on Site

KA No 2.1.32 **Description** Ability to explain and apply all system limits and precautions.

Question

The plant is operating at 80% power when a fire breaks out in the turbine building in the vicinity of the main Generator. Attempts to extinguish the fire are unsuccessful. What actions should be taken by the CRS?

A. Initiate an AOP-05 shutdown, Direct isolation of hydrogen to the generator and supplying CO2 to the generator.

B. Initiate an AOP-05 shutdown, Direct isolation of hydrogen to the generator and venting the generator to the turbine building roof.

C. Enter AOP-06, Direct tripping of the Reactor, isolation of hydrogen to the generator and supplying CO2 to the generator.

D. Enter AOP-06, Direct tripping of the Reactor, isolation of hydrogen to the generator and venting the generator to the turbine building roof.

Answer D or C **CFR Section** 41.10 / 43.2 / 45.12

Higher Level ☑ **RO** ☐ 3.4 **SRO** ☑ 3.8

LP Number 0717-06 **LP Objective** 01.03

Describe the major recovery actions of this AOP.

Question Source New

Reference AOP-06 pages 13-15

Attachment None

Comments

NRC Comment - not SRO Only, from memory OK?

Reworded to diagnose AOP-06 entry and direct RO and plant operator actions (5-25-01)

Section I - Fire Emergency

INSTRUCTIONS

CONTINGENCY ACTIONS

b. Close G-07, "HYDROGEN GAS LINE PRESS REG GRE-2 OUTLET VALVE".

c. Ensure G-05, "HYDROGEN GAS LINE PRESS REG GRE-2 BYPASS VALVE", is closed.

d. Open G-02, "HYDROGEN GAS TO VENT HDR ISOL VALVE".

e. Open G-03, "GENERATOR ST-2 VENT HEADER ISOLATION VALVE", to begin venting the Hydrogen gas.

21. Initiate an emergency purge of the Generator by performing the following steps:

a. Place valve G-01, "CARBON DIOXIDE SELECTOR VALVE FROM MANIFOLD OR TO VENT", in the vertical position (Turbine Building Basement).

b. Connect Carbon Dioxide bottles to the CO_2 manifold (Chlorine Injection Room).

****

CAUTION

CO_2 pressure in excess of Seal Oil pressure may cause damage to Generator Seals.

****

Section I - Fire Emergency

INSTRUCTIONS	CONTINGENCY ACTIONS
c. Initiate flow to generator by throttling open valve G-15, "TURBINE GENERATOR ST-2 CARBON DIOXIDE GAS MANIFOLD ISOLATION VALVE" (Chlorine Injection Room).	

22. Continue purging until 25 bottles of carbon dioxide have been used (Chlorine Injection Room).

A CO_2 purge of the Generator eliminates the possibility of a Hydrogen explosion in the Turbine Building.

---

23. **IF** the fire has been extinguished, **THEN** GO TO Section 5.0, Exit Conditions.

Steps 1 to 15 provide immediate response to any indication of a fire. Determination of the validity of any report or alarm and warning plant personnel is of immediate importance. Assistance from the Blair Fire Department may be required, based on the size and location of the fire [R4]. Subsequently, guidance is provided to direct the appropriate operations necessary to maintain the plant in a safe condition.

End of Section 4.0

Question Number 92

System/Mode 035000 Steam Generator System

Stem Knowledge of S/GS design feature(s) and/or interlock(s) which provide for the following:

KA No K4.02

Description S/G level indication

Question

As Control Room Operator you are controlling S/G Level using LIC 903Y/906Y, in MANUAL Mode, via the Feedwater Bypass Valves HCV-1105/1106. The setpoint knob was originally set for 65% as a level setpoint. On monitoring S/G Level you notice a "large" positive deviation indicated on the deviation meter.

CHOOSE the statement below that best describes your actions regarding LIC-903Y/906Y.□

A. Turn the setpoint knob to a higher setpoint which will bring the level back to 65%

B. Turn the setpoint knob to a lower setpoint which will bring the level back to 65%

C. Move the MANUAL control in small increments to the right [open valve] and restore the deviation to zero in small steps

D. Move the MANUAL control in small increments to the left [close valve] and restore the deviation to zero in small steps

Answer D or C

CFR Section 41.7

Higher Level ☐

RO ☑ 3.2

SRO ☐ 3.5

LP Number 0711-11

LP Objective 02.04

EXPLAIN "tracking" as it applies to the Feedwater Control System.

Question Source Bank 0711-11 2.4 003

Reference &C STM pages 34-35

Attachment None

Comments

NRC Comment - A,B not responsive to the question

Add "positive deviation" to the stem. Change distractors C&D 6/4/01

recirculation flow of 2500 gpm. An auxiliary contact on the feed pump motor circuit breaker will close the recirculation valve when the associated feed pump is stopped. Flow transmitters provide feed pump suction flow indication locally and on panel CB-10.

2.19 High Pressure Feedwater Heaters FW-16A and B

The high pressure feedwater heaters, FW-16A and B, provide the final stage of feedwater heating. They condense and cool extraction steam from the high pressure turbine while conserving heat in the system by preheating the feedwater, thus increasing plant efficiency. The heaters return condensed drainage to the condensate system.

The high pressure feedwater heaters are located on the 1023 foot level northeast corner of the turbine building. They are shell and U-tube heat exchangers with feedwater flowing through the tubes and extraction steam on the shell side. The shell side is baffled and provides a cooling area for the condensed steam and moisture drainage. The heaters are rigidly mounted on the tube sheet and to the floors of the turbine building. The remaining supports are welded on the shell of the heaters with rollers on the floor. The roller support arrangement allows for thermal expansion of the heaters.

The shell side of FW-16A(B) is supplied by 2nd stage high pressure turbine extraction steam. Each heater is supplied with relief valves on the shell side (500 psig) and tube side (1665 psig) of the heater. The shell side relief protects the shell side from overpressurization on a loss of feedwater flow. At full power, FW-16A(B) raises the feedwater temperature approximately 40°F. The inlet and outlet feedwater temperatures are indicated on the computer. Local temperature and pressure indicators are also provided.

The heater shell side vent, drain and level control is similar to the low pressure heaters. FW-16A(B) drains to FW-15A(B) and is the top heater in the cascade arrangement. The high level drainage path is to the main condenser. FW-16A(B) has an additional level controller that shuts extraction steam non-return valve LCV-959A(B) and opens bypass valve FCV-960 on high level.

2.20 Feedwater Regulating Bypass Valves HCV-1105, -1106

The feedwater regulating bypass valves, HCV-1105 and 1106, control steam generator water levels during startup, shutdown, and very low power operations. The valves are located in Room 81, at the 1036 foot level.

The bypass valves are four inch, double seated, pneumatically operated globe valves. They are built with two outlet flow paths, directing the outlet flow in opposite directions, to minimize the thrust loads on the valve operator. The valves fail shut upon loss of control air.

The valves can be controlled either manually or automatically. HCV-1105 and 1106 are controlled by level indicating controllers LIC-903Y and 906Y, respectively. Both controllers are located on panel CB-10, with valve position indication provided at the controller. When the valves are operated in the manual mode, the output signal from the controller to the valve via the electro-pneumatic converter is adjustable by the control lever on the front of the controller. Valve position can be controlled from full open to full close.

When operating in the automatic mode, the controllers receive and process steam generator level signals from transmitters LT-903Y and 906Y. The actual steam generator level is compared to preset level. An output signal from the controller positions the valve to correct any deviation. A deviation indicator is provided on the controller.

HCV-1105 and HCV-1106 close automatically upon actuation of a Steam Generator Isolation Signal (SGIS). The SGIS is actuated upon receipt of a Containment High Pressure Signal (CPHS) or a Steam Generator Low Pressure Signal (SGLS). For further information refer to the Engineered Safeguards Controls System Training Manual.

Electrical circuits have been modified to allow continued operation of HCV-1105 and -1106 during a loss of instrument air and SGIS. A key-operated three position "NORMAL-OVERRIDE-OPEN" switch has been added on panel CB-10 for each valve to allow this operation. Key insertion and removal will only be possible when the switch is in the "NORMAL" position. Moving the switch out of the "NORMAL" position will cause an alarm "HC-1105 (-1106) OFF NORMAL" on CB-10, annunciator A-21. In "NORMAL" the valve functions normally. In "OVERRIDE" the SGIS is overridden and HCV-1105 (-1106) is positioned by HIC-1105 (-1106). The "OPEN" position allows operation of the valve(s) if instrument air is lost. The accumulators for each valve are sized for a minimum of three (open/close) cycles over an eight hour period.

2.21 Feedwater Regulating Valves FCV-1101, -1102

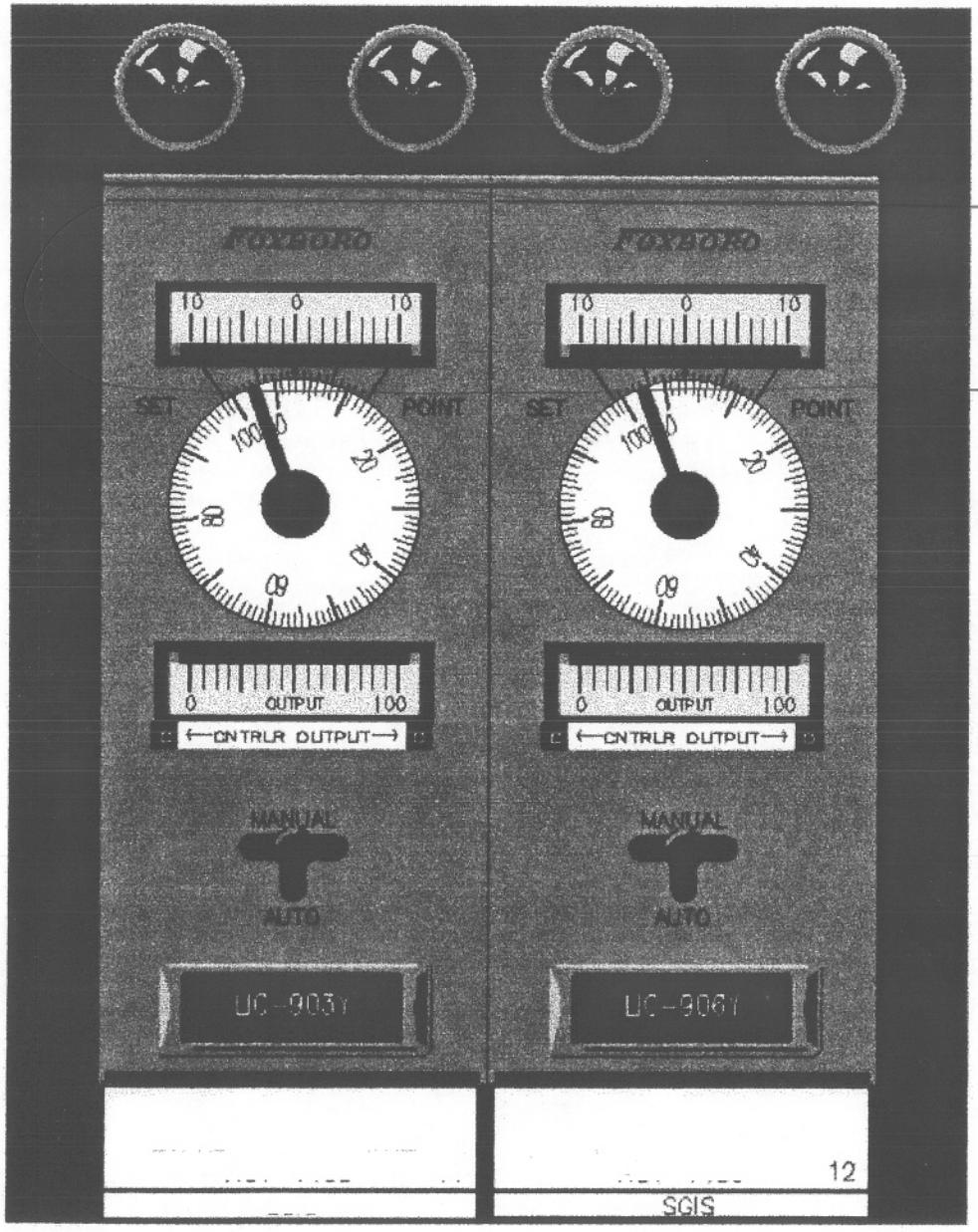
The feedwater regulating valves, FCV-1101 and 1102, function to maintain programmed steam generator level from 15 to 100 percent reactor power. The valves are located in Room 81 on the 1036 foot level.

FCV-1101 and 1102 are eight inch pneumatically operated globe valves. The valves are controlled from panel CB-10. Upon loss of air or electrical power, the valves fail as is. The control air system has a pressure switch in the line to sense control air pressure. This pressure switch opens contacts in the circuit to the solenoid valves on low control air pressure (75 ± 5 psig). This shuts the solenoid valves, securing control air. The actuation of this pressure switch also extinguishes an amber light on CB-10 at the valve controller, indicating that control air has been lost to the feedwater regulating valves. In addition, per MR-FC-88-036, annunciator A9 on CB-10 activates indication loss of solenoid power to the actuators. A switch below the amber light is used to reset the circuit and reenergize the solenoids when air pressure is regained.

The valves can be controlled either manually or automatically. The automatic mode consists of a three element control system (feed flow, steam flow, and level). The system functions to maintain the feedwater flow rate into the steam generator equal to the steam flow rate out of the steam generator, while keeping the steam generator water level at a programmed level. The system is adjusted to be level dominant.

The controls for the two steam generators function in the same manner. The controls associated with maintaining level in steam generator RC-2A are discussed.

STM Drawing



Digital Photo

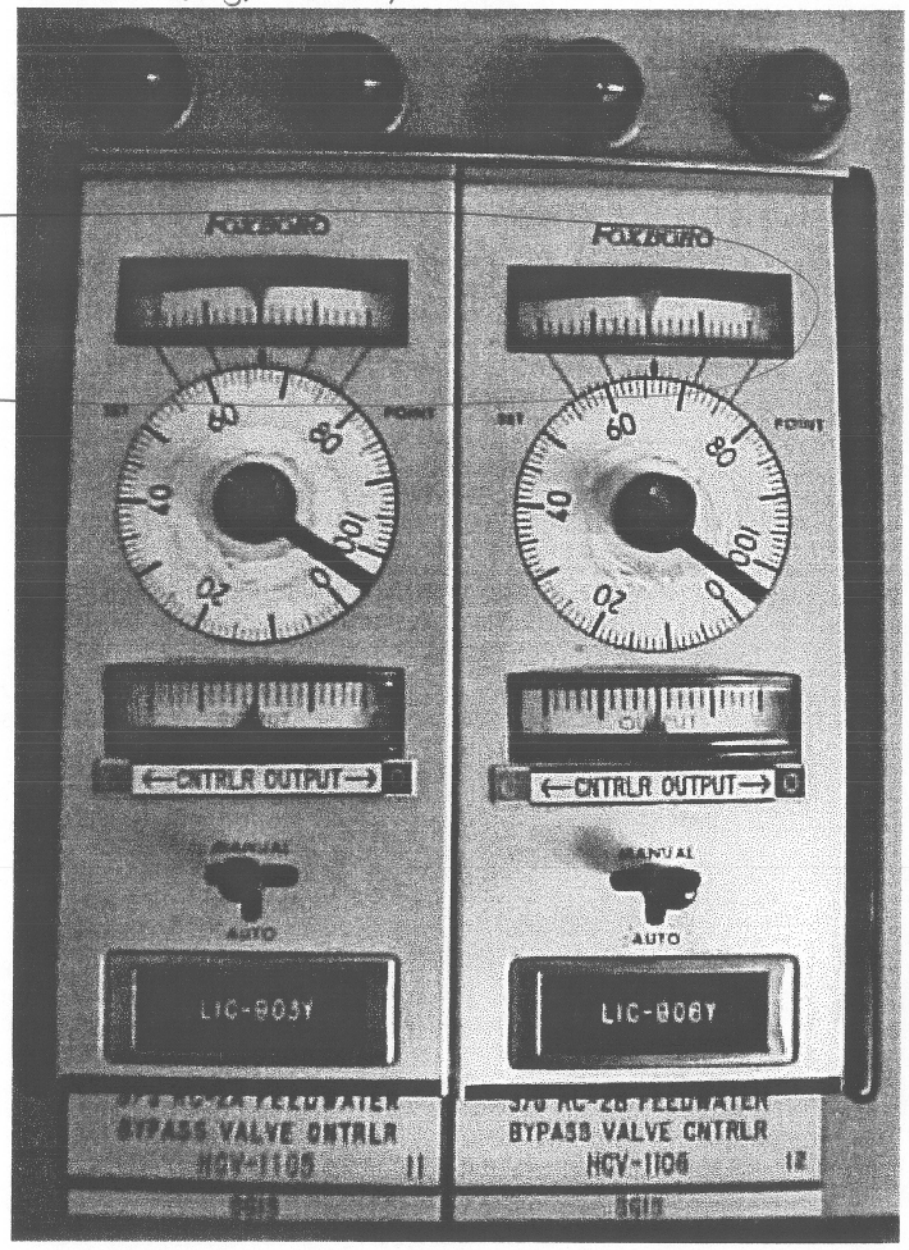


Figure 3-13b shows the face of a typical controller. The major features of an electronic or pneumatic controller are shown; depending on the manufacturer, controllers will have slightly different configurations of pushbuttons, meters and switches. The setpoint/measured variable indicator (vertical scale) displays the measured variable, the value of the error signal and the setpoint. The tape scale typically reads out in percent of full scale, but may be graduated in process units (inches of level, lb_m /hr of flow, psig, etc.). The scale is circular and rotates to display the current values. The hairline on the scale is fixed and indicates the current setpoint value. The error indicating pointer moves to display the value of the measured variable and the deviation of the measured variable from setpoint. If the pointer deflects above the hairline, an error above setpoint is indicated; if it deflects downward, an error below the setpoint is indicated. When the setpoint thumbwheel is rotated to change the setpoint, the tape scale will move to display the value of the setpoint at the hairline.

The horizontal meter is the output meter. It is typically a fixed meter, reading controller output in percent of full scale. The pointer moves to indicate the magnitude and direction of the output signal from the controller, via either automatic or manual control. Two pushbuttons are shown, which place the controller in either manual or automatic. In some controllers, automatic-manual selection is accomplished with one switch. Some controllers have lights to indicate automatic or manual operation, as shown in this figure. When the controller is in manual operation, the operator has control of the final element. This is accomplished by manual pushbuttons (labelled OPEN and CLOSE).

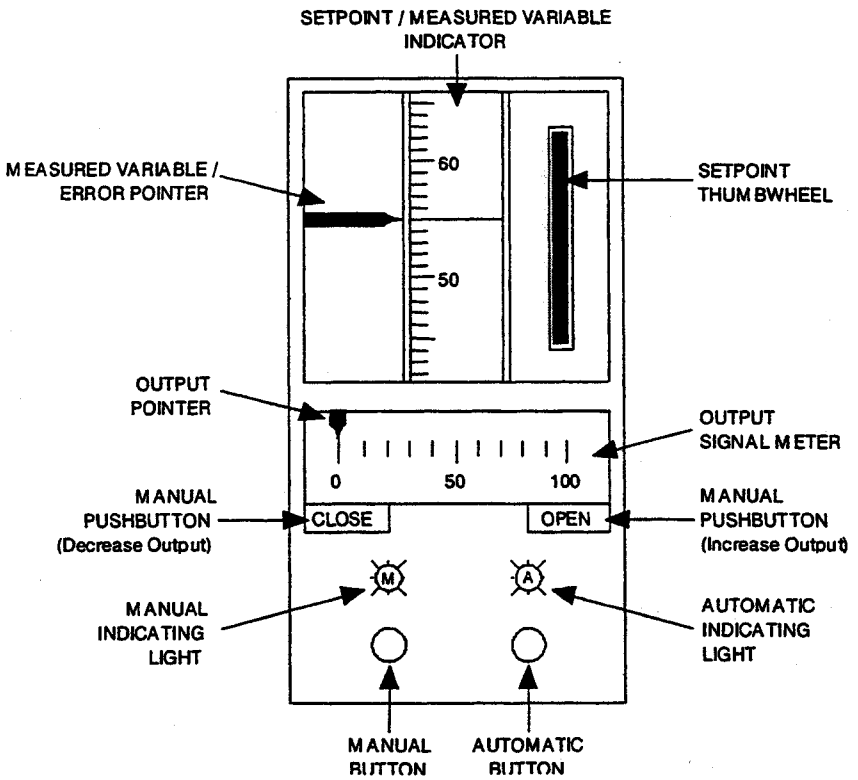


Figure 3-13b Controller

© 1993 GENERAL PHYSICS CORPORATION

At time t_2, the measured variable decreases by 50°F, or 25%, of the measured variable span. The 25% controller input decrease causes a 50% controller output increase. This results in a controller output increase from 3 psi to 9 psi, and the control valve goes from fully shut to 50% open.

The purpose of this system is to provide hot water at a setpoint of 150°F. The system must be capable of handling demand disturbances that can result in the outlet temperature increasing or decreasing from the setpoint. For that reason, the controller is set up such that the system functions as shown in Figure 18.

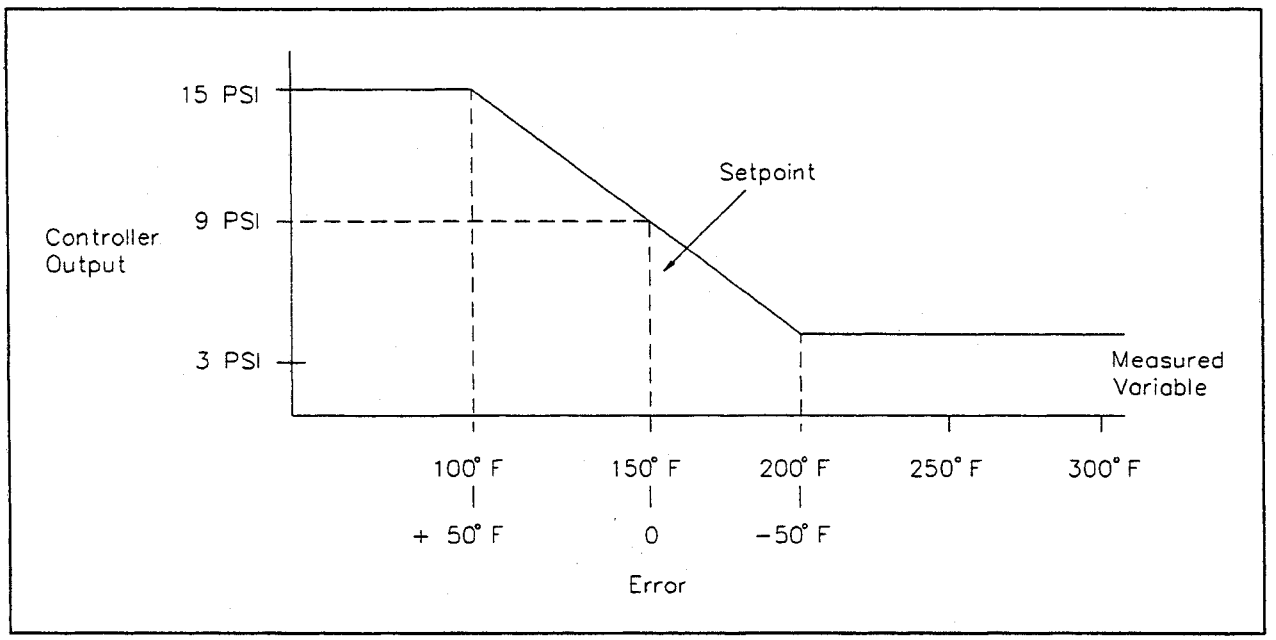


Figure 18 Controller Characteristic Curve

If the measured variable drops below the setpoint, a positive error is developed, and the control valve opens further. If the measured variable goes above the setpoint, a negative error is developed, and the control valve throttles down (opening is reduced). The 50% proportional band causes full stroke of the valve between a +50°F error and a -50°F error.

When the error equals zero, the controller provides a 50%, or 9 psi, signal to the control valve. As the error goes above and below this point, the controller produces an output that is proportional to the magnitude of the error, determined by the value of the proportional band. The control valve is then capable of being positioned to compensate for the demand disturbances that can cause the process to deviate from the setpoint in either direction.

Question Number 112

System/Mode 071000 **Stem** Ability to manually operate and/or monitor in the control room:

Waste Gas Disposal System

KA No A4.30 **Description** Water drainage from the WGOS decay tanks

Question

The "Moisture Separator WD-28A HI/LO Level" alarm was received on AI-100. The EONA noted that the level in the sight glass was high and that valves LC-533A and LC-533B were both open. What action should be taken?

A. Trip the waste gas compressor

B. Open WD-216 to drain the moisture separator

C. Isolate Demineralized water to the moisture separator

D. Isolate the gas analyzer from the system

Answer C or A **CFR Section** 41.7 / 45.5 to 45.8

Higher Level ☑ **RO** ☑ 2.9* **SRO** ☑ 2.6*

LP Number 0711-31 **LP Objective** 01.02

EXPLAIN the operation of controls located in the Control Room associated with the Waste Disposal (Gas) System.

Question Source New

Reference ARP-AI100/A50

Attachment None

Comments

NRC Comment - required from memory

Operator should be able to deduce that drain valve is open due to high level and demin water makeup valve has failed open.

Panel: **AI-100**	Annunciator: **A50**	Window: **A-3**

WASTE GAS COMPRESSOR A MOISTURE SEPARATOR HIGH OR LOW LEVEL

SAFETY RELATED

MOISTURE SEPARATOR WD-28A HI OR LOW LEVEL

Tech Spec References: None

Initiating Device LC-533A Setpoint >13 inches
Initiating Device LC-533B Setpoint <7 inches Power AI-41A

OPERATOR ACTIONS

1. Check Waste Gas Compressor WD-28A Moisture Separator Level.

2. IF Level is less than 7 inches, THEN ensure LCV-533B, Demineralized Water Makeup Valve is open.

   2.1 IF DW is not being supplied, THEN check the DW alignment to the moisture separator.

   2.2 IF unable to makeup to the moisture separator, THEN place WD-28B in service.

   2.3 IF LCV-533B is not open, THEN notify Maintenance of LCV-533B malfunction.

3. IF Level is greater than 13 inches, THEN ensure LCV-533A, Moisture Separator Drain Valve is open.

   3.1 IF LCV-533A is not open, THEN drain tank to the normal level using WD-216, Manual Drain Valve.

(continued)

PROBABLE CAUSES

- Failure of moisture separator makeup of drain valve
- Demineralized Water Makeup isolated to the Waste Gas Compressor

REFERENCES

136B3086 Sh 3 06336
IC-CP-01-0533
11405-E-36 12271
11405-M-98 Sh 1 10452
EM-533/534 15453

Panel: **AI-100**	Annunciator: **A50**	Window: **A-3**

WASTE GAS COMPRESSOR A MOISTURE SEPARATOR OR LOW LEVEL

Page 2 of 2

SAFETY RELATED

OPERATOR ACTIONS (continued)

3.2 Verify DW is not being supplied to the moisture separator.

3.2.1 IF DW is being supplied to the moisture separator, THEN isolate Demineralized Water from the moisture separator.

3.3 IF LCV-533A is not open, THEN notify Maintenance of valve malfunction.

R
Reference Use

Attachment 3 - Waste Gas Transfer from the Vent Header to a Waste Gas Decay Tank

PROCEDURE (continued) (√) INITIAL

3 b. Open WD-949, Vent Header L/G Outlet Valve. _____

c. IF liquid is visible in LG-608,
THEN open WD-747, Vent Header L/G Drain Valve. _____

d. WHEN the Vent Header is drained,
THEN close the following Vent Header L/G Isolation Valves:

- WD-747 ___
- WD-949 ___
- WD-948 ___ _____

CAUTION

To prevent pump rotor failure, a Waste Gas Compressor must not be operated until seal water is aligned and proper Moisture Separator Tank level is established.

4. Ensure the selected Waste Gas Compressor is operable and primed by performing the following steps (Room 16):

a. Ensure the Seal Water Isolation Valve to the Waste Gas Compressor Skid is open:

- WD-28A, DW-156 ___
- WD-28B, DW-157 ___ _____

b. Verify Moisture Separator Tank level, relative to the pump casing, is above the casing bottom and below the pump rotor centerline (C_L):

- WD-28A, Visible below C_L ___
- WD-28B, Visible below C_L ___ _____

TM N010.0010

TECHNICAL MANUAL

FOR

NASH WASTE GAS COMPRESSOR

lar schedule. Separator should be blown down every 24 hours. Open water make-up and separator drain simultaneously. Let water drain until it runs clear.

C. Motors and controls have a definite limit allowed for start-stop cycles per hour. Excessive cycling will damage or destroy them. Use start-stop control only for those periods when compressor cycles will not exceed maximum starts. The number of allowable motor cycles per hour must be determined by motor supplier. The table below is a rough guide to be used judiciously.

Suggested Starts and Stops

Motor H.P.	*Maximum Starts Per Hour*
15 H.P.	10
25 H.P.	10

D. Monthly checks should be made on the strainer screens, gauge glass. Note pressure loss across cooler and discharge air filter. Intentionally raise separator water level to verify that alarm switch functions. Inspect check valves monthly. Valves should be clean and function freely. Overhaul or replace when wear is detected. Wear will show first on hinge pins, pivots and springs, clapper nuts.

E. Never run compressor without water — even when checking motor rotation. Normal water prime is 1/3 to 1/2 a casing. Never start pump when filled above casing centerline. This can lead to rotor blade failure.

F. Bearing Lubrication — All bearings are mounted in dust proof housings and require little attention other than lubrication. The MD type compressors require lubrication on the motor bearings only. A good grade ball bearing grease, free from acid or alkali, should be used on the motor. For lubrication instructions refer to the motor manufacturer's instruction sheet attached to the motor. It is extremely important to avoid over greasing. The compressor requires no lubrication.

The type AL compressor requires grease lubrication of the pedestal ball bearings. Two grease fittings (641 & 641A) are provided for this purpose. Do not over-grease as this will cause the bearings to run hot and possibly cause trouble. The same grease used on the motor may be used on the pedestal bearings. The bearings should be greased approximately once every three months, and thoroughly cleaned and regreased once every four or five years.

Use good medium grade grease equivalent to Regal Starfak #2, or with following general specifications:

Composed of a high grade soap and refined filter mineral oil, free of all fillers. Consistency #2 grease ASTM, penetration 265-295 at 77° F., with minimum 2 per cent ash. Corrosion — bright copper plate shall show no discoloration submerged in grease for 24 hours at normal room temperature. Moisture not to exceed maximum 1 per cent. Dropping point — minimum 250° F.

G. Stuffing Box — The stuffing box should be packed with seven rings of graphite impregnated asbestos packing. The correct packing should be preformed into a ring which is 1½" inside diameter and 2.137" outside diameter. The packing must be 5/16" square.

During compressor operation the stuffing box gland should be adjusted to permit a slight outward leakage of water. The water will act as a lubricant and prevent excessive wear of the shaft sleeve. If the stuffing box gland is pulled up too tightly the stuffing box will run hot, use excessive power and score the shaft sleeve.

The packing should be replaced from time to time as a good maintenance procedure. This will reduce shaft sleeve wear and prevent uncontrolled leakage.

DRAINING

Remove all drain plugs from compressor casing and separator, if seal water or sealing liquid is likely to freeze. All drain openings may be independently valved and piped to waste when it is desirable to drain the compressor casing frequently. For long periods of shutdown, drain compressor and pour in some light oil. Turn shaft over a few revolutions to lubricate the interior and prevent sticking.

Remove the stuffing box packing and flush out the stuffing box with rust inhibitor, then repack with new packing.

Grease lubricated ball bearings should be repacked with new grease. Old type oil lubricated bearings should be drained of old oil and relubricated with new clean oil.

It is recommended that the compressor be turned over by hand occasionally to insure that the bearings are well coated with grease (or oil).

TROUBLE SHOOTING

Ref. Fig. II, Page No. 7

Basically, the system arrangements are simple. When a system malfunctions it is generally due to the controls or accessories. When trouble shooting, a process of elimination should be used before making changes or disassembling the pump. The following are possible causes of malfunction.

A. Failure to get discharge pressure when discharge of pump is throttled.
   1. Restricted air inlet.
   2. Air unloader or bypass valves hung open.
   3. Check valves in water lines hung open or closed.
   4. Restrictions in water piping or cooler.
   5. Blockage in line between compressor and separator.
   6. Low seal water pressure on once through seal.

B. Pump Surging (Pump will build up to high pressure and fall back approximately 20 p.s.i.g.)
   1. Restricted water flow.
   2. Wrong water level in separator.

C. Pump Stalling — The pump will generally stall if it exceeds the maximum operating pressure. This will be recognized by a high pitched screeching noise. The "C" series systems are equipped to detect a pump running stalled (optional on 80 pound units). The lobe pressure switch will detect this and unload the pump. When the internal lobe pressure drops (approximately 60 p.s.i.g.) the pump will start compressing.

   Causes of pump going into a stall:
   1. Malfunction of automatic valves or check valves.
   2. Excess seal water flow.
   3. Pump discharging over maximum pressure.
   4. Throttling of suction.