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NIAGARA MOHAWK POWER CORPORATION

NINE MILE POINT NUCLEAR STATION

UNIT II OPERATIONS

02-LOT-001-288-2-02 Revision 6

TITLE: CONTROL ROOM ENVIRONMENTAL CONTROL SYSTEM (CRE)

	SIGNATURE	DATE
PREPARED BY	B.S. Bridges	11-10-90
TRAINING SUPPORT SUPERVISOR	F.A. Peeling for J. LeClair	12-10-90
TRAINING AREA SUPERVISOR	J. Kaminski	12-10-90
PLANT SUPERVISOR/ USER GROUP SUPERVISOR	Stephen for D. Terry	12/12/90

Summary of Pages

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TRAINING DEPARTMENT RECORDS ADMINISTRATION ONLY:

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RECORDS:

2390
5/3/380

I. TRAINING DESCRIPTION

A. Title of Lesson: Control Room Environmental Control System (CRE)

B. Lesson Description: This lesson contains information pertaining to the Control Room Environmental Control System. The scope of the training is defined by the learning objectives and in general covers the knowledge required of a Licensed Control Room Operator.

C. Estimate of the Duration of the Lesson: 2.0 Hours

D. Method of Evaluation, Grade Format, and Standard of Evaluation: Written exam passing grade of 80% or greater.

E. Method and Setting of Instruction: This lecture should be conducted in the classroom.

F. Prerequisites:

1. Instructor:
   a. Certified in accordance with NTP-16.
2. Trainee:
   a. Initial License Candidate - In accordance with the eligibility requirements of NTP-10.
   b. Licensed Operator Requal - In accordance with the requirements of NTP-11.

G. References:

1. Technical Specifications:
   a. 3/4.7.3, Control Room Outdoor Air Special Filter Train
   b. 3/4.3.7.1, Radiation Monitoring Instrumentation
   c. Technical Specification Interpretations 25, 61, and 71
2. Procedures:
   a. N2-OP-53A, Control Building Ventilation System
   b. N2-OP-53E, Standby Switchgear/Battery Room Ventilation System
3. NMP-2 USAR
   Design Bases Volume 20, Chapter 9

II. REQUIREMENTS

A. AP-9, Administration of Training

B. NTP-10, Training of Licensed Operator Candidates

C. NTP-11, Licensed Operator Requalification Training

D. NTP-12, Unlicensed Operator Training

III. TRAINING MATERIALS

A. Instructor Materials:

1. Transparency Package
2. Overhead Projector
3. Whiteboard and Markers
4. Lesson Plan - O2-LOT-001-288-2-02
5. Operations Technology (HVC, HVK)
6. N2-OP-53A, Control Building Ventilation System
7. N2-OP-53E, Standby Switchgear/Battery Room ventilation System

B. Trainee Materials:

1. Operations Technology (HVC, HVK)
2. N2-OP-53A, Control Room Building Ventilation System
3. N2-OP-53E, Standby Switchgear/Battery Room Ventilation System
4. Pens, pencils, paper, course evaluation sheets as required

IV. EXAM AND MASTER ANSWER KEYS

A. Exams will be generated and administered as necessary.

B. Exams and Master Answer Keys will be permanent file in the Records Room.

V. LEARNING OBJECTIVES

A. Terminal Objectives:

Upon completion of training, the trainee will have gained the knowledge to:

TO-1.0	Operate the Control Room special filter trains.	(2880020101)	6
TO-2.0	Operate the air conditioning chiller units from the Control Room.	(2880050101)	
TO-3.0	Monitor the Control Building ventilation system.	(2880070101)	
TO-4.0	Perform the actions required for a high radiation or a LOCA signal for the Control Room ventilation system	(2889050401)	
TO-5.0	Operate the smoke removal portion of the ventilation system	(2889060101)	
TO-6.0	Auto start a ventilation chilled water unit.	(2889070101)	
TO-7.0	Perform the Control Room special filter train operability test N2-OSP-HVC-M001.	(2889100201)	
TO-8.0	Perform the Control Room special filter train functional test, N2-OSP-HVC-R001.	(2889130201)	
TO-9.0	Startup the Control Building ventilation system.	(2889220101)	
TO-10.0	Operate the Control Building ventilation system with one chiller.	(2889290101)	6
TO-11.0	Respond to an abnormal level in the chilled water expansion tank.	(2889300101)	
TO-12.0	Shutdown the Control Building ventilation system.	(2889400101)	

B. Enabling Objectives:

EO-1.0 Explain the purpose and function of the Control Room Environmental Control (CRE) system.

EO-2.0 Describe the purpose and function of the major components of the CRE System listed below. 6

a. Control Room Envelope
b. Special Filter Trains
c. Radiation Elements 18A-D
d. CRE Chillers

EO-3.0 Given a specific set of plant conditions, determine how the Control Room Environment Control system responds. |6

EO-4.0 State the setpoint and purpose of the following interlocks.

a. Special filter Train Auto Starts and Trips

b. Auto closure of MOVs 1A and 1B

EO-5.0 Describe the interrelationship of the following systems with the CRE System.

a. Plant Electrical Distribution

b. Instrument Air (IAs)

c. Make Up Water System (MWS)

d. Service Water System (SWP)

e. Radiation Monitoring (DRMS)

EO-6.0 Explain the basis for the precautions and limitations listed in N2-OP-53A, Control Building Ventilation System.

EO-7.0 Regarding the Control Room Environmental Control system, determine and use the correct procedure to identify the actions and/or locate information related to the following:

a. Startup

b. Shutdown

c. Normal Operations

d. Off Normal Operations

e. Annunciator Responses

EO-8.0 Given NMP2 Technical Specifications and a set of plant conditions, determine the appropriate bases, limiting conditions for operation, limiting safety system setting, and/or action statement(s) as applicable.

EO-9.0 Regarding the Control Room Environmental Control system, 1) locate the correct drawing and 2) use drawings to perform the following: |6

a. Identify electrical and mechanical components

b. trace the flowpath of fluids or electricity

c. Identify interlocks and setpoints

d. Describe system operation

e. Locate information about specific components

f. Identify system interrelations

LESSON CONTENT	DELIVERY NOTES	OBJECTIVES/ NOTES
I. INTRODUCTION		
Student Learning Objectives	Show overhead of and review objectives with candidates.	
A. Design Considerations	Handout TR.	
1. Purpose	Handout course critique sheets.	EO-1.0
The purpose of the Control Room Environmental Control System is to maintain the quality of the Control Room environment to ensure that the plant operators can remain in the Control Room to safely operate the plant under normal conditions and maintain the plant in a safe condition under all accident conditions.	Inform candidates method of evaluation, written exam, >80% to pass.	
B. General Description		
1. Main Control Room Envelope		
a. The main Control Room envelope or pressure boundary consists of all the rooms in the main Control Room and the Relay Room of the Control Building.	Show TP of Figure 1 Discuss boundaries of the envelope	
b. The main Control Room envelope is separated from the rest of the plant by air tight doors and contains all instrumentation and controls necessary to safe shutdown of the plant.		
c. The Control Room envelope contains all supplies and facilities needed by a team of six (6) people for 30 days.		

2. Control Building Air Conditioning System

   a. The Control Room air conditioning system (HVC) supplies conditioned outside air to the Control Room envelope.

   b. On high airborne radioactivity level or a LOCA signal, the air conditioning system will automatically divert the supply air through the special filter trains. The special filter trains consist of an electric heater to control humidity, a prefilter, a high efficiency air particulate (HEPA) filter, an active charcoal filter for removal of radioactive iodine, and a second HEPA filter and a booster fan.

   c. Smoke detectors and a separate smoke removal system and provided for Control Room envelope.

Ask candidates when they would expect an airborne radioactivity problem.

- Temperature inversions
- Fallout
- CNMT failure with major plant failures

II. DETAILED DESCRIPTION

A. Main Control Room Envelope

1. Envelope

a. The main Control Room envelope or pressure boundary contains all controls and instrumentation necessary for a safe shutdown of the plant and is limited to areas requiring operator access during and after a DBA.

b. The construction of the main Control Room envelope ensures that the Control Room can continue to operate during a safe shutdown earthquake, a tornado, or the design flood.

c. The reinforced concrete walls of the envelope provide the Control Room operators with radiation shielding.

Describe the sections of the Control Building included in the Control Room envelope.

EO-2a

B. Control Room Envelope HVAC Supply and Exhaust

1. Control Room air is recirculated through the Control Room HVAC System for filtering and cooling.

a. Outside air for system makeup is drawn in through a missile protected air inlet with tornado dampers and a bird screen.

Show overhead of Control Building vent and describe how the system performs its function including:

1. Flow path(s)
2. Major Components
3. Normal Operation

b. The purpose of mixing the outside air with the inside air is to preclude the buildup of airborne radioactivity within the Control Room.

c. Air flows through the normal supply duct work and bypasses the special filter trains through bypass valves.

d. Radiation levels are monitored by radiation monitors.

e. On high radiation level or a LOCA signal the bypass valves close and air is directed through the special filter trains.

f. Booster fans (FN2A/B) are used to compensate for the pressure drop across the filter train and exhaust the air to the normal supply duct.

2. Two exhaust fans (FN1 and FN7) continuously discharge a small amount of the Control Room envelope air from the kitchen and toilet.

C. Special Filter Trains

1. The special filter trains operate automatically upon receiving either a LOCA signal or a high radiation condition in the Control Room ventilation.
2. They are designed to remove any airborne radioactivity to ensure Control Room personnel do not exceed the design radiation criteria of the CFR.
3. They are each 100% capacity, each have the following components:
   a. Electrical Heaters
      1) Heaters are used to reduce the humidity of the incoming air to increase the efficiency of the down stream filters and charcoal bed.
   b. Pre-Filters
      1) Pre-filters are used to remove the larger particulate materials to lengthen the HEPA filters service lives.
   c. HEPA Filter
      1) HEPA filter used to remove particulate materials.

Show TP of Filter trains to discuss their components and indicate direction of air flow through them.

EO-2b

Ask candidates if they know the location of each filter train.

ANS: Train A is on CB 288'
Train B is on CB 306'

d. Charcoal Filter Bed

1) Treated with potassium iodide (KI) to remove any radioactive iodines that maybe present in the air stream.

2) Removes radioactive iodines by exchange.

e. HEPA filter

1) Second HEPA filter used to remove any charcoal fines that may entrain in the air stream.

f. Booster Fan (FN2A & 2B)

1) Used to make up for the pressure drop across the filter train.

D. Control Room Air Conditioning Units

1. The Control Room Envelope areas at Elevation 306 ft. are supplied with air by two redundant, 100 percent capacity air conditioning units (ACU1A/B). The air conditioning units take air from the ventilation chases through a filter unit (FLT1A/B).

EO-2.0 | 6

a. The filter unit consists of a prefilter, a charcoal filter, and a main dry unit filter. Manual dampers allow the charcoal filter to be bypassed (normal operation) or placed on the line to remove any odors in the air. The air then exits the filter unit and enters the air conditioning unit where the air is cooled by cooling coils supplied by the Control Building Chilled Water System.

b. A fan in the air conditioning unit discharges the cooled air through an air operated damper (AOD6A/B) to the common ductwork to the air distribution ducts.

2. Local heating is provided by unit heaters in the air conditioning Equipment Room and the Divisions 2 and 3 cable chase, and by baseboard heating in the corridors and the Training Room. All other areas are heated by electrical duct mounted heaters.

3. Return air from all areas of the Control Room envelope at Elevation 306 feet, except the kitchen and toilet, is routed to the ventilation chases.

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4. Supply capacity exceeds the exhaust capacity to ensure a positive pressure is maintained in the Control Room envelope.

Ask students what the positive pressure maintained is.

Answer: 1/8" H_2O pressure

E. Relay Room Air Conditioning Units

1. the Control Room Envelope areas at Elevation 288 feet, 6 inches, are supplied with air by two redundant, 100 percent capacity air conditioning units (ACU2A/B) with two additional air conditioning unit (ACU4A/B) provided for the Computer Room.

EO-2.0

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a. The air conditioning units (ACU2A/B) draw air from the ventilation chases. The unit consists of dry media filter, cooling coils supplied by the Control Building Chilled Water System, and a fan. The fan discharges through an air operated damper (AOD12A/B) to the Relay Room common air supply header. The air is then distributed to the envelope areas at Elevation 288 feet, 6 inches.

Continue using TP of Figure 2 to explain flowpaths.

b. The Computer Room air conditioning units recirculate the Computer Room air and receive makeup air from the two fans (FN17/FN18) which supply air from the outside makeup air ductwork.

c. Each of the Control Room air conditioning units contains internal filters, cooling coils supplied by the Control Building Chilled Water System, and a fan.

d. The return ventilation flow is routed by ductwork to the ventilation chases. Supply capacity is greater than return capacity to maintain positive pressure.

e. The air conditioning Equipment Room and the division 2 and 3 cable chase area are heated by local unit heaters. All other ares are heated by duct mounted electrical heating coils.

EO-2.0 | 6

F. Fire Dampers and Smoke Removal

Show TP of Smoke Removal Dampers and fan, explain flowpaths.

1. The ductwork and natural ventilation paths between Control Room areas are equipped with fire dampers to enable a fire to be isolated.

2. A separate system ties into the return ductwork with air operated dampers to provide smoke removal.

   a. A smoke removal fan discharges through air operated dampers to an exhaust outlet.

   b. This system must be aligned by the operator.

G. Control Building Chilled Water System

1. The Control Building chilled water system consists of two independent, redundant closed loops. Each loop consists of a chilled water pump, a chiller compressor, an expansion tank, and the cooling coils of the four ACU's serviced.

Show overhead of Control Building chilled water system layout and discuss flowpath and function of the system with trainees. EO-2.0 | 6

2. Chilled water circulating pump pumps water from the loop discharge collection header to the Control Building chiller where the water is cooled by refrigerant.

3. Chiller Compressors (2HVK*CHL1A/B)

a. The Chilled Water System chillers consist of a hermetic motor-compressor and a single shell comprising the condenser, cooler, and flow control chamber. | 6

b. In operation, water to be chilled flows through the cooler, where Refrigerant-11, boiling at a low pressure and temperature, removes heat from the water. The chilled water is then piped to the ACUs where it flows through the coils removing heat from the air. The warmed water is then returned to the loop discharge collection header and then pumped by the chilled water pump back to the Control Building chiller shell. EO-2d

c. The chiller refrigerant removes heat from the Chilled Water System and transfers the heat to the Service Water System.

4. The supply header downstream of the chiller distributes the water to the following loads:
   a. Cooling coils in the Relay Room A/C Unit
   b. Cooling coils in the Computer Room A/C Unit
   c. Cooling coils in the Control Room A/C Unit.
5. The Control Room and the Relay Room A/C cooling coils utilize temperature control valves to control the cooling flow.
6. Computer room A/C cooling coils do not have a temperature control valve, however, they do have a solenoid isolation valve to provide component isolation.
7. Loop expansion tank provides a volume for makeup water supplied from the makeup water system.

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LESSON CONTENT	DELIVERY NOTES	OBJECTIVES/ NOTES

III. INSTRUMENTATION AND CONTROL

A. Instrumentation

1. Level - The chilled water expansion tank level (measured in inches) in each loop is monitored and provides:
   a. Local indication
   b. Automatic closure signal to the Computer Room supply valves on low level.

Describe instrumentation available to the the operator and discuss as necessary. Procedures and P&ID's may be used to identify particular instruments if a trainee exercise is desired at this point.

EO-3.0

2. Radioactivity (uc/cc) - Measured by four elements in the makeup air supply line high radiation on detectors RE-18 A/C (B/D) will result in closing MOV1A(1B) and automatically starting the special filter train fans.

(i.e., Identify the instrument which measures the difference in pressure between Control Room and Atmospheric pressure.)

EO-2c

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3. Pressure
   a. Differential pressures across the system filters and filter units provide local indication of a clogged filter.
   b. The pressure in the chiller compressor condenser is monitored and used to promptly secure the compressor if abnormal conditions occur.

c. Differential pressure gauges in the Control Room and Relay Room supply indication of the difference between atmospheric and envelope pressure.

4. Flow - System flows are measured and are used to start the redundant standby component in the event of low flow through an operating unit.

5. Temperature - Temperature in the various spaces are monitored and used to control system heaters and air conditioners. The Control Room and Relay Room A/C units temperature control valves use an auctioneered (highest) signal of room temperature and room humidity to maintain optimum room conditions.

6. Smoke detectors are provided in the system supply and return lines to aid in the prompt detection of fires.

B. Controls

1. Major system components use a 4 position (PULL TO LOCK-STOP-NORMAL AFTER-START) control switch. The switch spring returns to NORMAL AFTER from STOP or START with mechanical target flags to indicate the previous positions (red-START, green-STOP).

Describe the typical "Major Component" control switch for this system. ESK's for the switch may be used to illustrate its operation.

C. System Interlocks

1. Special Filter Train Booster Fan

a. Starts - when the following conditions are met.

1) Fan control switch in NORMAL AFTER with booster fan flow low and:

a) Control Bldg. air supply radiation is high OR (Rad Level 5.92 E-6 uc/cc)

b) LOCA signal (L_2 or DW press.).

b. Trips

1) Filter train charcoal absorber temperature high. (250°F)

2) Fan flow low. (900 CFM)

2. Supply Valves Automatic Closure

a. Control Room supply air high radiation OR

b. LOCA signal (L_2 or DW press.)

3. Fan Outlet Dampers

Outlet Dampers for Control Room air conditioning units and Relay Room air conditioning units auto open when unit is started and auto close when unit trips or stops.

Discuss these interlocks with the trainees and use supporting electrical and/or logic drawings for emphasis.

EO-3.0
EO-4.0
EO-9.0

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Discuss electrical print ESK-HVC03 Sheets 1 & 2. Ask candidates if they can determine which fan will start first.

EO-9.0

IV. SYSTEM OPERATION

A. Normal Operations

1. During normal operation, outside air is drawn in to supply makeup air to the ventilation system.
2. A single Control Room air conditioning unit, Relay Room air conditioning unit, and Computer Room air conditioning unit are in service with the second air conditioning unit of each pair of standby.
3. All of the A or B components will be operating together with the single chiller loop (A or B) required for component cooling in operation.
4. The Computer Room booster fans are in operation and the kitchen and toilet exhaust fans are running.

Show overhead of Figure 1 and discuss flowpath and normal operation of the system as necessary with the class.

V. SYSTEM INTERRELATIONS

A. Plant Electrical System

The plant electrical system provides electrical power to operate components required to maintain the Control Room envelope and provides power for the Control Room indications and controls.

B. Instrument Air system (IAS)

The instrument air system provides air for Control Room envelope instrumentation and operation of system air operated dampers.

Discuss plant system interrelations for this system including systems required for support and systems served by CRE.

EO-5a-e

C. Makeup Water System (MWS)

The makeup water system provides makeup water to the Control Building chilled water loops.

D. Service Water System (SWP)

The service water system normally cools the Control Building chilled water chillers and can be lined up by the operator to provide cooling water to the Control Building envelope air conditioning units on a loss of Control Building chilled water.

VI. DETAILED SYSTEM REFERENCE REVIEW

Review each of the following referenced documents with the class.

A. Technical Specifications
   1. 3/4.7.3, Control Room Outdoor Air Special Filter Train
   2. 3/4.3.7.1, Radiation Monitoring Instrumentation
   3. Tech. Spec. Interpretations - 25, 61, and 71

B. Procedures
   1. N2-OP-53A Control Building Ventilation System
   2. N2-OP-53E Standby Switchgear/Battery Room Ventilation
   3. Applicable Surveillance Procedures

•Discuss how T.S. Interp. #25 fits with Spec 3.7.3 — EO-6.0, EO-7.0

•Discuss uniqueness of T.S. Interp #71 — EO-8.0

EO-9.0

Discuss procedures as necessary with the class and emphasize: |6

1. Precautions and limitations bases.
2. Any "Cautions" or "Notes" which need clarification or emphasis. |6
3. Immediate actions which may be required by procedures. |

VII. RELATED PLANT EVENTS

A. Refer to Addendum "A" and review related events with the class, (if applicable).

Obtain and review related industry events from OEA group for review with the class.

VIII. SYSTEM HISTORY

A. Refer to Addendum "B" and review related modifications with the class, (if applicable).

•Obtain and review related plant modification packages from the modification coordinator at Unit 2 for review with trainees.

IX. WRAP-UP

A. Review how the system accomplishes its purposes.

1. The Control Room environmental control system maintains radiation levels within specifications by diverting the air conditioning system supply air through a special filter train.
   a. Filters are used to remove air particulate.
   b. A charcoal filter is used to hold up the noble gases.
2. Control Room areas may be purged of smoke or stale air by securing the operating air conditioning units and lining up the air operated dampers of smoke removal fan FN3 suction and exhaust lines and starting the smoke removal fan.

•Discuss Temp Mod on the Smoke Removal portion of this system that blocks a damper open.

B. Review of Student Learning Objectives

Instructor to ask selected questions from the Learning Objectives to check student comprehension.