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DESCRIPTION OF FACILITY RADIATION AND CONTAMINATION ALARM SYSTEMS
INSTALLED IN THE CHEMICAL TECHNOLOGY ALPHA LABORATORY, BLDG. 3508

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1. ABSTRACT

Facility radiation and contamination alarm systems were installed in the Chemical Technology Alpha Laboratory, Building 3508, to continuously and automatically monitor neutron radiation (by three neutron rate-burst detectors) and air contamination (by five constant alpha air monitors) in the entire facility. These instruments and other components in the network provide health physics monitoring information, sound local alarms when abnormal conditions occur, and indicate the abnormal conditions on a central panel board.

Operating personnel are first given warning when a "high level" is detected by a constant alpha air monitor. The neutron detectors operate "rate" or "burst" alarms when the alarm levels are exceeded.

The building evacuation system operates automatically when two or more constant alpha air monitors detect a "high level" of air contamination or when two or more neutron monitors detect a neutron burst or a "high-rate" level.

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CONTENTS

	Page
1. Abstract	1
2. Introduction	4
3. Description	4
3.1 System	4
3.2 Components	7
3.2.1 Panel Board	7
3.2.2 Constant Alpha Air Monitors	7
3.2.3 Neutron Rate and Burst Detector	10
3.2.4 Indicator Module	11
3.2.5 Coincidence Module	12
3.2.6 Buzzer Module	13
3.2.7 Evacuation Alarm Devices	13
3.2.8 Power Supplies	14
3.3 Drawings	16
4. Checkout and Operating Procedures for Facility Radiation and Contamination Alarm System	16

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2. INTRODUCTION

The Chemical Technology Alpha Laboratory (Building 3508) is one of several facilities at Oak Ridge National Laboratory being equipped with networks of radiation and air monitoring instruments connected to a central monitoring panel within the building and to the Laboratory Emergency Control Center.^{1,2} Facility neutron radiation and contamination systems were installed to continuously and automatically determine the radiation condition of the entire facility and to report this information to a central control panel within the building. Should the radiation level or the air activity in several isolated portions of the building exceed present values, an audible alarm in the building will be actuated, warning lights outside the building will flash, and an alarm signal will be transmitted to the Emergency Control Center, Building 2500.

3. DESCRIPTION

3.1 System

The neutron radiation level is monitored by three neutron rate and burst detectors located throughout the building (Table 1). Air is monitored for alpha-emitting particles by five constant alpha air monitors located throughout the building.

Most of the required contamination monitoring instrumentation had been installed as personnel protection instrumentation with local audible and visible alarms. These instruments were connected to the facility contamination alarm system without altering their local health physics functions by using auxiliary contacts within the instrument or by adding auxiliary alarm devices to the equipment. Each instrument is connected to an individual indicator module on the monitoring panel in the operating area. By means of two colored lamps, which normally give a dim light, an indicator module indicates the condition of the air monitor to which it is connected; that is, a white lamp burns at full intensity if the instrument becomes inoperative, and a red lamp burns at full intensity if the "high alarm level" is reached (Table 2). Any change in the intensity of any lamp in the indicator module is accompanied by a buzzer signal.

The neutron detectors cause an amber lamp to burn at full intensity if the dose rate exceeds 23 mrem/hr, and a red lamp to burn at full intensity if the neutron burst level alarm is tripped (Table 3). This instrument is designed to alarm at a neutron burst level that would be observed if

¹D. J. Knowles et al., Instrumentation and Controls Div. Ann. Progr. Rept. Sept. 1, 1963, ORNL-3578, pp. 37-40.

²D. J. Knowles et al., Instrumentation and Controls Div. Ann. Progr. Rept. Sept. 1, 1964, ORNL-3782, pp. 65-68.

a criticality occurred at a distance of 200 ft. For these instruments there is no indication when an instrument becomes inoperative. Any change in the intensity of any lamp, that is, from dim to bright, is announced by a buzzer module.

The high-level alarm outputs of the indicator module for the constant alpha air monitors are connected so that the evacuation alarms operate when any two constant alpha air monitors are in the "high level" alarm condition. The alarm outputs of the neutron burst-rate detectors are connected so that evacuation alarms sound whenever two or more instruments are in either a burst or high-rate alarm condition. No inoperative alarm signal is available on the neutron monitor.

Table 1. Radiation Contamination and Neutron Monitors
Installed in Building 3508

Location	Monitor No.
<hr/>	
1. Facility Alpha Contamination Alarm Monitors ^a	
Laboratory 1	A1
Laboratory 2	A2
Laboratory 3	not installed
Laboratory 4	A4
Laboratory 5	A5
North Hall Center	A6
2. Facility Neutron Radiation Monitors ^b	
North Hall East	N1
North Hall West	N2
Change Room	N3
<hr/>	

^aORNL Model Q-2340 Constant Alpha Air Monitors. Coincidence of any two high-level alarms signals automatic evacuation.

^bAll monitors are ORNL model Q-2562 Neutron Burst-Rate Detectors. Coincidence of either alarm from any two instruments signals automatic evacuation.

Table 2. Alarm Indications on the Central Control Panel
for Air Monitors

Instrument Condition	Lamp Intensities	
	Red	White
Normal Operation	Dim	Dim
High Level ^a	Bright	Dim
Instrument Inoperative	Dim	Bright
Instrument Removed ^b	Bright	Bright

^aHigh level for an alpha air monitor is 800 counts/minute.

^bLamp intensities remain until a maintenance connection is made, giving an "inoperative" indication.

Table 3. Alarm Indications on the Central Control Panel
for Neutron Detectors

Instrument Condition	Lamp Intensities	
	Red	Amber
Normal Operation	Dim	Dim
Burst Level ^a	Bright	Dim
Rate Level ^b	Dim	Bright
Burst and Rate Level	Bright	Bright
Instrument Removed ^c	Bright	Bright

^aBurst level is fixed in the instrument to that level whose current magnitude and rate of rise would be attained if a criticality should occur at a distance of 200 feet from the instrument.

^bRate level alarm is 23 mrem/hr.

^cLamp intensities exist until a maintenance connection is made giving a "normal" indication.

3.2 Components

3.2.1 Panel Board

The central panel board (Fig. 1) in the office area contains the following equipment: two 12-module racks, one central control chassis, and the dc supply for the facility neutron radiation and contamination alarm system. Three modules used to monitor the condition of the off-gas system are located in the lower rack. An abnormal vacuum condition is indicated by a buzzer and a bright light on one of these modules. Since these units are not a part of the contamination and neutron alarm system, they operate neither the evacuation alarms nor the alarm signal to the Emergency Control Center. The facility radiation and contamination alarm module racks contain one indicating module for each instrument, coincidence modules for each instrument group, a buzzer module, and a manual evacuation module.

The racks and modules are made of anodized aluminum. The modules have anodized Metalphoto front panels. A Metalphoto text strip is provided at the top of each rack for instrument identification. The central control chassis contains manual switches, timers, relays, and monitoring equipment which are parts of the system but not located in modules.

3.2.2 Constant Alpha Air Monitors

The alpha air monitors installed in the building are ORNL model Q-2340 instruments (Fig. 2).

This instrument consists of an aspirating system, a paper-tape filter, a scintillation detector, a linear count-rate meter, a recorder, and visible and audible alarms. Air is drawn through the filter at 3 cfm (controlled manually) by a Roots blower. A sample of dust particles in the air is collected on the paper-tape filter. The sample tape is automatically advanced once every 24 hours and after a caution level alarm. The tape may be advanced manually at any time by the operator. The detector, which counts the sample as it is being collected, is a silver-activated zinc sulfide scintillator having an effective detector diameter of 1-7/8 in. The detector window (nominal thickness of 1 mg/cm²) is light-tight.

The count-rate meter is a linear duty-cycle type, utilizing a single range and having a high-voltage supply as an integral part. The normal range is 0 to 1000 counts/min, but ranges of 0 to 250, 0 to 2500, 0 to 5000, and 0 to 10,000 counts/min at full scale may be obtained by relocating two jumper wires under the chassis. The input voltage sensitivity of the rate meter is 200 mv. The overall accuracy of the rate meter, including the effect of long-term drift, is within 5%. The corona-regulated high-voltage supply is nominally 900 v with ± 150 -v adjustment. The maximum load current is 20 μ a.

The rate meter has adjustable high-level and caution alarms and puts out a 1-ma full-scale signal to drive an integrally mounted Rustrak recorder.

The caution alarm is adjustable over the range of approximately 2 to 58% of full scale, and the high-level alarm is adjustable from the caution-alarm set point to full scale. The caution alarm is an electronic circuit employing a dual triode and plate relay with potentiometer adjustment. The relay is energized below the trip point and is de-energized by current transfer from one triode to the other by diode coupling the cathode circuits. Hysteresis is approximately 4% of full scale. The high-level trip is accomplished by the high contact on a contact-making meter. The associated high-level relay is de-energized below the set point. Upon reaching the set point, the meter contacts and relay are locked in; these can be released only by the depression of the reset pushbutton. There is a low-level pointer on the panel meter, but it has no contacts and is to be used only as a visual indicator. The pointer should be set at the level corresponding to the caution-alarm set point.

The instrument has an alarm panel with four lights, a bell, and a buzzer. When the caution set point is reached, an amber lamp is lighted and the buzzer is energized for 15 sec. The filter tape will advance after a 10-min delay. There is no switch to silence the buzzer. When the high-level trip point is reached, a red lamp is lighted and the bell rings. The bell can be silenced by a toggle switch, and when this is done, an amber neon indicator is lighted.

Filter-tape breakage is also indicated. When a tape breaks, a red neon indicator is energized and the caution circuit is energized through a flasher. The amber neon bulb burns continuously, and the caution light and the buzzer come on intermittently. If a tape breaks and, at the same time, the caution alarm sounds, the tape-break neon light, the caution light, and the buzzer will be on continuously. A test pushbutton permits checking the alarm panel by simultaneously simulating tape break and high-level alarm signals.

An auxiliary alarm chassis, mounted on the inside rear of the instrument, contains a meter relay which when it reads zero (no output) lights the instrument "inoperative" alarm on the central panel module.

The constant alpha air monitors and their associated alarms operate as follows:

1. An accessory meter relay connected to the 0- to 1-ma output of the count-rate meter will cause the white "inoperative" light on the central panel to burn brightly whenever the meter pointer drops to zero, indicating no signal from the instrument. After power is restored and a 60-sec delay, this alarm clears itself. During the 60-sec delay, local caution and high-level alarms do not sound since they are locked out.

2. At the caution alarm level of 500 counts/min an electronic alarm circuit will turn on a yellow lamp on the front of the air monitor and cause a buzzer in the instrument to sound for 15 sec. At the end of 10 min, the filter tape is automatically advanced. Caution-level alarms are reset automatically when the filter is changed.

Fig. 1. Central Panel Board for Radiation and Contamination Alarm Systems.

Fig. 2. Constant Alpha Air Monitor, ORNL Model Q-2340.

3. At the high alarm level (800 counts/min) the panel meter relay on the instrument causes the red lamp on the instrument and the red "Hi Level" lamp on the central panel to burn brightly. The bell on the constant alpha air monitor sounds. These alarms are reset by advancing the filter tape and by pressing the manual reset button on the monitor.

3.2.3 Neutron Rate and Burst Detector³

The neutron monitor, ORNL model Q-2562 (Fig. 3), is a transistorized, ac-powered instrument for the continuous measurement of dose rate from fast and thermal neutrons and for the immediate warning of the occurrence of a critical incident. A polyethylene moderator which surrounds the BF_3 detector thermalizes the fast neutrons. The polyethylene is covered with a 0.025-in.-thick cadmium sheet which affords a lower cut-off limit to the thermal neutrons. The compression of the neutron energies results in an RBE (relative biological effectiveness) factor for the detector which is approximately the same as for the original admixture of fast and thermal neutrons.

The monitor has a single range of 0 to 25 mrem/hr (milliroentgens equivalent man per hour), which is indicated by a calibrated panel meter.

³F. M. Glass, E. D. Gupton, and E. E. Waugh, Instrumentation and Controls Div. Ann. Progr. Rept. Sept. 1, 1962, ORNL-3378, pp. 32-33.

Fig. 3. Neutron Monitor, ORNL Model Q-2562.

A high-level alarm with manual reset can be adjusted to alarm at any value within 0-24 mrem/hr. The output from the monitor can be fed to a strip chart recorder to record the dose rate. A burst alarm operates independently of the dose-rate circuitry, which would be paralyzed by a fast excursion in neutron level before it could indicate an alarm condition. The response of the burst detector is sufficiently fast to provide an alarm output when neutron bursts of only 20- μ sec duration originate from critical incidents up to 200 ft from the detector. There is no indication of burst alarm at the instrument.

When the burst alarm is tripped, a red lamp burns brightly on the indicator module at the central alarm panel; when the dose-rate alarm level is exceeded, an amber lamp burns brightly on the indicator module at the central alarm panel.

3.2.4 Indicator Module

The indicator module, ORNL model Q-2563-1 (Fig. 4), consists of three independent transistorized channels, each operating an indicator lamp and providing a dc-voltage shift signal for alarm or control purposes and a voltage pulse signal for operating the buzzer module. Although the module shown in Fig. 4 has three lamps and a pushbutton on the front panel, the modules in Bldg. 3508 were modified by removing one of the lamps from the front panel: the caution lamp was removed from modules used with air monitors; and the inoperative lamp was removed from modules used with

Fig. 4. Indicator Module, ORNL Model Q-2563-1.

neutron burst-rate detectors, and the face plate was replaced with one bearing the legends "burst" and "dose." Each module is 35.8 mm wide, 120 mm high, and 125.8 mm deep. All connections are made on printed strip connections at the rear edge of the plug-in module.

When the instrument connected to an indicator module is operating normally, all lamps on that module are dim (Table 2). When the module receives a signal that the instrument is operating abnormally or that the high-level alarm values have been exceeded, the lamps burn at full intensity: white for inoperative instrument, amber for a neutron "dose" level alarm, and red for neutron high rate or "burst" alarm. Also, a signal generated by the module causes the buzzer to sound. The white lamp indication will remain until the condition causing the alarm is cleared, at which time the lamp will return to the dim condition. The red and amber lights will remain bright until they are manually reset by a pushbutton on the indicator module. If the indicator module is reset when the alarm or abnormal condition still exists, the lamps will momentarily become dim when the reset button is depressed, and then will become bright and the buzzer will sound again when the reset button is released.

All model Q-2563 indicator modules have identical circuits and can be interchanged or replaced without alteration. Some of the units have been modified as previously described by omitting parts or changing panels. These units are designated by use of different suffix numbers or suffix letters.

3.2.5 Coincidence Module

The coincidence module, ORNL model Q-2563-2 (Fig. 5), consists of one transistorized circuit which accepts a dc shift alarm signal from as many as six indicator modules. The circuit can be adjusted by internal jumper connections to operate a relay for alarm or control purposes on any combination of one to six input signals. Each module is 35.8 mm wide, 120 mm high, and 125.8 mm deep. All connections are made on printed strip connections at the rear edge of the plug-in module.

The constant alpha air monitors and neutron burst-rate detectors are connected in the coincidence groups listed in Table 1. Whenever the coincidence requirements listed in Table 1 are satisfied for a group of instruments, the associated coincidence module will actuate the building warning and evacuation equipment and will transmit a signal to the Emergency Control Center, Building 2500. A red lamp on the affected coincidence module will indicate which set of instruments has detected an abnormal condition.

When the indicator modules showing an abnormal condition are reset manually, the coincidence module will also be reset.

All coincidence modules are identical and can be interchanged or replaced without alteration, except for the internal jumper connection which determines the number of coincidental input signals required for an output signal. The containment module is identical to the coincidence module except for labeling on the module face.

Fig. 5. Coincidence Module, ORNL Model Q-2563-2.

3.2.6 Buzzer Module

The buzzer module, ORNL model Q-2563-4 (Fig. 6), consists of a transistorized trigger circuit that operates a silicon controlled rectifier to actuate a buzzer when a voltage shift pulse is received from an indicator module. The buzzer module is the same size as all other modules and is interchangeable with other buzzer modules.

The buzzer module gives audible notice that an indicator module has received any one of three input signals. The buzzer module, which serves all indicator modules, is reset by a pushbutton at the front of the module.

After being reset, the buzzer will sound again whenever an input signal is received by one of the indicator modules. For example, a change from a normal condition to a "caution alarm level" at some location will start the buzzer. After it is reset, a change to "high alarm level" or to "inoperative instrument" will start the buzzer again.

3.2.7 Evacuation Alarm Devices

Evacuation Horn.--When a coincidence module has been energized by signals from air monitors or neutron monitors according to Table 1, a horn is actuated to notify the building occupants to leave the building. The horn, a "Clarion Whistle" by Westinghouse Air Brake Company, operates on a gas supply of 90 psi. The supply is obtained through a control box

which contains a pressure regulating valve, pressure switches which monitor tank and regulated pressures, and a solenoid valve that is opened by an electrical signal from the coincidence module. Two standard high pressure gas bottles filled with oil-pumped nitrogen to a pressure of approximately 1800 psi are connected to a manifold through isolating valves to the control box. Normally, the valves are set so that one tank is supplying the system, and the second tank is valved off as a standby supply. The valve arrangement permits replacement of an exhausted tank with a filled tank without disturbing the operational status of the horn alarm assembly. The horn is operated by a voltage applied momentarily to the solenoid valve in the control box; the valve will remain open until it is closed manually by pressing the mushroom head of the valve stem inward. The horn will sound for about 4 min on one filled gas bottle.

The normal gas pressures for proper operation of the horn are not less than 1000 psig tank pressure and 80 to 120 psig line pressure to the solenoid valve. Abnormal pressures are indicated by a red lamp (labeled "horn trouble") on the central control panel board. The dim lamp indicates normal pressures, and a bright lamp indicates abnormal pressures. Inspection of the gages will indicate whether the tank pressure or the line pressure is abnormal.

Beacon Lights.--Four Federal Sign and Signal Corp., model 27S, 110-v beacons with magenta colored lens are installed on the corners of the building to warn personnel outside that the building has been evacuated. These beacons are actuated by a signal from a coincidence module, and they are automatically stopped when the coincidence module has returned to a normal condition.

Control Switches.--A key-operated switch, labeled "normal-disable," (Fig. 7) on the central control panel board may be used to disconnect the air horn and beacons during maintenance or abnormal operation periods. Since the Emergency Control Center receives an alarm signal when the switch is moved to the "disable" position, the Emergency Control Center should be notified before the switch is set at this position.

A large red pushbutton on the central control panel, labeled "manual evacuation," actuates the air horn and beacons and transmits an alarm signal to the Emergency Control Center (if the Center has not already received an alarm) regardless of the position of the "normal-disable" switch. If the manual evacuation pushbutton has been used, it must be reset by pressing the "reset" pushbutton on the module to restore the system to the normal conditions.

3.2.8 Power Supplies

The main power for the system is 120-v, 60 cycle, and is supplied from the emergency power bus in Building 3508 to the 24-v dc power supply and the monitoring instruments.

Fig. 6. Buzzer Module, ORNL Model Q-2563-4.

Fig. 7. Manual-Evacuate Module, ORNL Model Q-2563-16.

The 24-v dc power supply is a saturating core, voltage stabilized type. A green "power on" lamp on the control chassis and a neon lamp on the power supply panel will be brightly lighted to indicate that the power supply is operating.

3.3 Drawings

The facility radiation and contamination alarm systems in Building 3508 are described in the following ORNL Instrumentation and Controls Division drawings:

1.	Q-2374-1 through -6:	Instrumentation location and wiring diagrams.
✓ 2.	Q-2563-1, -2, -4, and -16:	Plug-in modules.
✓ 3.	Q-2563-25 Series:	Horn control box.
CAPE-348 4.	Q-1154B-1 through -14:	Monitron
CAPE 1157 5.	Q-2562-1 through -9:	Neutron monitor with optional burst detector.
CAPE 808 6.	Q-2340-1 through -15:	Constant alpha air monitor.

The following drawings can be obtained from the General Engineering and Construction Division:

✓ 1.	E-20544-ED-001:	Electrical plan and details.
✓ 2.	E-20544-ED-002:	Electrical details.

4. CHECKOUT AND OPERATING PROCEDURES FOR FACILITY RADIATION AND CONTAMINATION ALARM SYSTEM

Although the central alarm panel board serves as an aid in operating the facilities in the building, its primary purpose is to provide automatic radiation and contamination alarms required by safety and radiation control regulations. An "inoperative instrument" alarm and a radiation alarm from each of the fixed-installation monitoring instruments in the facility are indicated on the central alarm panel. High-level alarm signals from these instruments actuate the evacuation alarm when the alarm limit is reached on two or more air monitors or two or more neutron burst detectors as listed in Table 1.

To utilize the indications efficiently, the instruments should be reset, the alarm signals should be cleared, and burned out lamps, horn pressure alarms, and other abnormalities should be corrected promptly.

An alarm signal can be cleared by performing the following steps:

1. Press the reset button on the buzzer module. This permits the audible alarm to be sounded again if another alarm is actuated before the first alarm can be cleared..
2. Check conditions at the instrument, and reset the instrument if required (air monitor filter change or air monitor high-level alarm). The air monitor "caution" and "instrument inoperative" alarms are self-resetting when the radiation level is decreased or the trouble causing the alarm is corrected. The neutron monitors must be manually reset if the alarm has operated.
3. Reset the module on the central alarm panel by pressing the button at the bottom of the module.

Whenever the local evacuation alarm is sounded in the facility, an alarm signal is indicated and sounded in the Laboratory Emergency Control Center, Building 2500.

A key-operated "normal-disable" switch located on the central alarm panel may be used to prevent the system from causing unnecessary evacuation of the building or from sending false signals to the Emergency Control Center during maintenance or abnormal operating conditions. Since an alarm indication will show at the Emergency Control Center when the key-operated switch is in the "disable" position, the Emergency Control Center must be notified (call extension 3-6646) before the switch is operated.

A procedure for checking the instruments and their indicators for proper operation and a sheet for recording the test results are given on the following pages.

FACILITY RADIATION AND CONTAMINATION SYSTEM
CHECK-OUT PROCEDURE

DATE _____

BUILDING 3508

TEST	PURPOSE AND PROCEDURE	CORRECT OPERATION
1. Preliminary	Prepare to test system.	
a. Disable evacuation portion of system	1. Contact Emergency Control Center (phone 3-6646) and notify dispatcher of coming alarm. 2. Obtain clearance from the building supervisor and have test announced on public address system. 3. Turn key switch to "disable" and close valves on H_2 tanks for horns.	Disconnects evacuation whistles and beacon lights. Gives evacuation alarm signal at Emergency Control Center.
b. Check panel lamps	Examine all panel lamps.	All lamps are dim.
2. Facility Alpha Contamination System	Test all monitors individually (see checkout sheets for locations).	
a. "Inoperative" alarm	1. Unplug instrument. 2. Plug in instrument.	Buzzer sounds and white lamp glows brightly. Buzzer can be reset, but lamp cannot be reset. After 1-min delay, white lamp will reset.
b. "Caution" alarm	1. Increase alpha count rate with source to 600 counts/min. 2. Remove source until the count rate is less than 600 counts/min.	Buzzer in instrument sounds for 15 sec. Tape will advance in 10 min if source is not removed. No central panel indication is provided.
c. "High-Level" alarm	1. Increase count rate with source to 800 counts/min. 2. Remove source.	Buzzer sounds and red lamp glows brightly. Buzzer can be reset, but lamp cannot be reset. Red lamp can be reset.
3. Facility Neutron Monitoring System	Remove polyethylene moderator and install test neutron source.	Instrument should read upscale.
a. Dose alarm	Turn switch on test source to dose test position and press pushbutton several times.	Meter pointer moves upscale as pushbutton is pressed successively. No alarm should be indicated.
b. Burst alarm	Turn switch to burst test 1 position and press pushbutton. Turn switch to burst test 2 position and press pushbutton.	If alarm sounds, replace radiation sensing probe or replace instrument. Burst alarm operates.
c. Return instrument to normal	Remove test source, replace moderator can and reset instrument to normal condition.	
4. Evacuation System	Check all features of evacuation system for correct operation.	A coincidence of two high-level alarms from Facility Contamination System or Radiation System should operate the evacuation horn, magenta lights outside building should flash, and Bldg. 2500 should receive correct alarm signal. Key-switch lockout of horn and lights and gas tank pressure switch should operate correctly.
a. Check for control output from coincidence alarm.	1. Turn key switch to "disable" after contacting Emergency Control Center. 2. Check evacuation modules for radiation and contamination alarm systems. a. Increase radiation at one air monitor to high-alarm level. b. Increase radiation at second air monitor in same system to high-alarm level. c. Remove radiation sources. d. Different pairs of instruments should be used each time this test is made. e. Repeat procedure with pairs of neutron rate-burst detectors in the facility radiation system.	Check the Emergency Control Center. A radiation and contamination alarm should be received there. A coincidence of two high level alarms from the Facility Contamination System or Radiation System should operate the appropriate evacuation module. Red lamps on appropriate module should be bright. Red and amber lamps on this module become bright and buzzer sounds. Reset buzzer. Do not reset lights. Red and amber lamps become bright on second module and buzzer sounds. Red lamp on evacuation module becomes bright. Reset buzzer. Alarm lamps and buzzer may be reset. Evacuation alarm should reset automatically when either alarm is cleared. Same results as above except neutron evacuation module is tested.

TEST	PURPOSE AND PROCEDURE	CORRECT OPERATION
b. Check evacuation alarm equipment.	<ol style="list-style-type: none"> 1. Close valves on all horn N_2 tanks (if not previously done in Part 1). 2. Plug horn trouble test boxes at horn control box. 3. Move key switch from "disable" to "normal" 4. Set two coincident "high-level" alarms on the Facility Contamination System. 5. Reduce radiation levels to normal and reset alarm modules. 6. Reset horn solenoid valves manually; open tank valves until low-pressure alarms on test box clear. 7. Test high-pressure alarm by raising pressure regulator setting in horn box to more than 110 psi. 8. Close tank valves. Set two coincidence alarms on Facility Radiation System. 9. Reduce radiation levels to normal and reset alarm modules. 10. Reset horn solenoid valves manually, open tank valves, and readjust regulators to 90 psi output pressure. 11. If building has manual evacuation button, close valves on tanks and push button. 12. Reset manual evacuation module and repeat Step 6. 	<p>Alarm lights at Emergency Control Center clear.</p> <p>Buzzer, channel alarms, and coincidence alarm noted on central panel. Horns sound a short blast, alarm should indicate at Emergency Control Center, and flashing lights outside building should start. Horn trouble lights at central panel become bright. Low-line pressure and low-tank pressure lights show on test box.</p> <p>All modules clear, Emergency Control Center alarms clear, and flashing beacons stop.</p> <p>Horn trouble alarms clear.</p> <p>Horn trouble light should be on. High-pressure alarm is indicated by test box.</p> <p>Buzzer, channel alarms, and coincidence alarm noted on central panel. Horns sound a short blast, alarm should indicate at Emergency Control Center and flashing lights outside building should start. Horn trouble lights at central panel become bright. Low pressure alarm lights on test box are lighted.</p> <p>All modules clear, Emergency Control Center alarms clear, and flashing beacons stop.</p> <p>Gas cylinder pressure gages should show 1800 psi on tank side of regulator and between 80 and 100 psi on horn side. Neither high-pressure nor low pressure alarms should show on test box. Horn trouble light becomes dim. All alarms in all locations should be clear.</p> <p>Same as Step 4, except no buzzer, no channel alarms, and only a radiation (red) light appear at the central panel and at the Emergency Control Center.</p> <p>End of test.</p>
c. Conclude test	Return all controls and instruments to normal condition.	<p><u>Check List</u></p> <ol style="list-style-type: none"> 1. No alarm lights on central panel of Emergency Control Center. 2. One gas tank at each horn with valve open, regulators adjusted. 3. Key switch in "normal" position. 4. Notify Emergency Control Center and building personnel of end of test period.

FACILITY RADIATION AND CONTAMINATION ALARM SYSTEM CHECK SHEET

MONTHLY ☐
 QUARTERLY ☐
 ANNUAL ☐

BLDG: 3508
 CHECKED BY: _____
 DATE: _____

CONTAMINATION		INOP.	RADIATION	NEUTRON			REMARKS
MONITOR	LOCATION	AC OFF	METER	CAUTION	HIGH BURST	DOSE	
CAAM 1	Lab. 1						
CAAM 2	Lab. 2						
CAAM 3	Lab. 3						
CAAM 4	Lab. 4						
CAAM 5	Lab. 5						
CAAM 6	North Hall Center						
RADIATION							
N 1	North Hall East						
N 2	North Hall West						
N 3	South Hall						

EVACUATION SYSTEM

MONITOR	LOCATION	EVAC.	REMARKS
CONTAMINATION			
CAAM 1	Lab. 1		
CAAM 2	Lab. 2		
CAAM 3	Lab. 3		
CAAM 4	Lab. 4		
CAAM 5	Lab. 5		
CAAM 6	North Hall Center		
Coincidence modules checked using station _____ with all other modules.			
NEUTRON RADIATION			
N 1	North Hall East		
N 2	North Hall West		
N 3	South Hall		
Coincidence modules checked using station _____ with all other modules.			

* Manual evacuation checked ☐

		ALARM LIGHTS		CYL. PRESS (PSIG.)	
BEACON*	LOCATION	ON	ROTATING	LOW CYL.	HIGH CYL.
1	Bldg. Corner NW				
2	Bldg. Corner NE				
3	Bldg. Corner SW				
4	Bldg. Corner SE				

ALARMS AT BLDG. 2500—KEY SWITCH DISABLED: Neutron _____ Contamination _____ Buzzer _____.

* Quarterly and annual checks only.

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