USEC-01, APPLICATION FOR UNITED STATES NUCLEAR REGULATORY COMMISSION CERTIFICATION PADUCAH GASEOUS DIFFUSION PLANT REMOVAL/INSERTION INSTRUCTIONS REVISION 35 JANUARY 8, 1999

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Appendix A

Applicable Codes, Standards, and Regulatory Guidance

This Appendix lists the various industry codes, standards, and regulatory guidance documents which have been referenced in certification correspondence. The extent to which PGDP satisfies each code, standard, and guidance document is identified below, subject to the completion of applicable actions required by the Compliance Plan.

1.0 American National Standards Institute (ANSI)

1.1 ANSI N14.1, Uranium Hexafluoride - Packaging for Transport, 1990 Edition

PGDP satisfies the requirements of this standard, except for those portions superseded by Federal Regulations, with the following clarifications:

New cylinders and associated valves - Entire standard

Cylinders and valves already owned and operated by PGDP that were not purchased to meet this edition of the standard - Satisfy only Sections 4, 5, 6.2.2 - 6.3.5, 7, and 8 of the standard. Cylinders purchased prior to 1990 were manufactured to meet the version of the ANSI standard or specification in effect at the time of the placement of the purchase order.

Section 5.2.1 - For U.S. Department of Transportation 7A Type A packaging, satisfy U.S. Department of Energy (DOE) evaluation document DOE/RL-96-57, Revision 0, Volume 1, which supersedes DOE/00053-H1.

Tinning of cylinder valve and plug threads: ANSI N14.1 - 1990 requires the use of ASTM B32 50A, a 50/50 tin/lead solder alloy described in the 1976 and previous editions of the ASTM standard. Cylinder valve and plug threads are tinned with solder alloys meeting the requirements of ASTM B32. Tinning is performed with nominal 50% tin alloy or with a mixture of alloys with nominal tin content from 40% to 50%, with a lower limit of 46% tin in the mix.

See SAR Sections 3.7.1 and 4.3.1.5 and the basis statements for TSR Sections 2.1.4.8, 2.2.4.6, and 2.3.4.16.

1.2 ANSI/ANS 2.8, Determining Design Basis Flooding at Power Reactor Sites, 1981 Edition

The extent to which PGDP satisfies the requirements of this standard will be determined as part of the SAR Upgrade activity.

For references to this standard, see SAR Section 2.4.3.

1.3 ANSI/ANS 3.1, Selection, Qualification, and Training of Personnel for Nuclear Power Plants, 1987 Edition

PGDP satisfies only the following section of this standard:

Section 4.3.3 - The qualifications of the Radiation Protection Manager identified in SAR Section 6.1 satisfy the requirements of this section of the standard.

1.4 ANSI/ANS 3.2, Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants, 1994 Edition

The extent to which PGDP satisfies the requirements of this standard is outlined in SAR Section 6.11.1 and Appendix B to SAR Section 6.11.

1.5 ANSI/ANS 8.1, Nuclear Criticality Safety in Operations With Fissionable Materials Outside Reactors, 1983 Edition

PGDP satisfies the requirements of this standard.

For references to this standard, see SAR Sections 5.2.2.1, 5.2.2.3, 5.2.3.2, 5.2.4.1, and Table 6.9-1.

1.6 ANSI/ANS 8.3, Criticality Accident Alarm System, 1986 Edition

The recommendations of this standard were used as guidance only for the design of the CAAS. PGDP satisfies the requirements of this standard with the following exceptions:

Section 4.4.2 - An alarm signal with a complex sound wave or modulation is not provided.

Section 4.5.3 - Emergency power supplies for AQ and NS alarm systems are not provided. A battery backup serves as the backup power supply for the cluster and local nitrogen horn.

Section 5.3 - The CAAS is not designed to withstand seismic stresses.

For references to this standard, see SAR Section 3.12.6, Section 2.5.1 of Appendix A to Chapter 4, and the basis statements for TSR Sections 2.1.4.5, 2.2.4.3, 2.3.4.7, 2.4.4.2 and 2.6.4.1.

1.7 ANSI/ANS 8.7 (N16.5), Guide for Nuclear Criticality Safety in the Storage of Fissile Material, 1975 Edition

PGDP satisfies the requirements of this standard with the following exceptions/clarifications:

Section 4.2.6 - Fire protection systems are installed throughout the process buildings where flammable liquids are used in operating equipment. Individual cell housings do not contain fire protection systems.

2.5 INSTRUMENTATION AND CONTROL SYSTEMS/FEATURES

2.5.1 Criticality Accident Alarm System

The Criticality Accident Alarm System (CAAS) is used for warning plant personnel of a criticality incident. The system is designed to detect gamma radiation and provide a distinctive, audible signal that will alert personnel to evacuate the areas that are potentially affected.

A block diagram of the overall system configuration is depicted in Fig. 2.5-1. In addition to the devices described in the figure, one other type of detector is associated with the system. This detector is identified as the argon gammagraph detector. This detector and its logic was not changed or affected by the changes for the HAUP and will not be discussed. For more information on these devices and their functions, refer to Sect. 3.12.7 of the PGDP SAR.

The CAAS was significantly affected by the HAUP due to the additional areas requiring criticality alarm coverage. The entire system will be described and reviewed for acceptability.

2.5.1.1 Principal Design Basis and Criteria

The primary input (i.e., principal design criteria) for the CAAS is ANSI/ANS 8.3. The following design criteria support the present bases for CAAS at PGDP.

2.5.1.1.1 Text Deleted

2.5.1.1.2 ANSI/ANS 8.3

1. Gamma radiation detectors shall be capable of detecting a criticality that produces an absorbed dose in free air of 20 rads of combined neutron and gamma radiation at an unshielded distance of 2 m from the fissionable material within 60 seconds. Areas where this requirement is not met must have adequate justification for not providing alarm coverage. It should be noted that this requirement is not applicable to areas containing material less than 1 wt % ^{235}U.

2. The system shall automatically initiate an evacuation alarm signal within one half second of the alarm setpoint being exceeded. The building evacuation alarm system shall be capable of being manually activated from a central remote location.

3. Text Deleted

4. The system shall remain in an alarm condition after initiation regardless of radiation levels returning to normal until a manual reset of the alarm has been accomplished. Reset capability shall be limited in access to preclude inadvertent reset and shall be located outside the area to be evacuated.

5. The local evacuation alarm system shall be able to perform its function without the aid of off-site alternating current (ac) electrical power or the plant air system.

6. The system shall be designed to preclude inadvertent initiation signals to the extent practical to provide system credibility.

7. The system shall be designed to provide an indication of system malfunctions for alerting personnel of maintenance requirements.

8. A means shall be provided to test the response and performance of the system (excluding the sounding of the alarm) without causing an evacuation alarm. In addition, the portions of the system not affected by the test shall still remain functional.

9. The system shall provide sufficient information to the Central Control Facility (CCF) to allow implementation of site emergency response procedures for criticality accidents; this information shall be provided independent of off-site ac power for a minimum of 4 hours.

10. The alarm signal shall be for immediate evacuation purposes only and of sufficient volume and coverage to be heard in all areas that are to be evacuated.

11. The CAAS shall remain operable in the event of seismic shock equivalent to the site-specific design basis earthquake or the equivalent value specified by the Uniform Building Code.

Each of these criteria will be addressed in Sect. 2.5.1.3 by illustrating how the system meets the requirements.

2.5.1.2 System Description

The CAAS is primarily divided into three categories for description. These three areas are the local alarm system, building alarm system, and the Building C-300 CCF alarms and controls. The local alarm system includes the individual cluster unit detectors that provide detection capability for the entire system.

The cluster unit detection system actuates both visual and audible alarms in the affected area(s). The personnel alarms that would be activated consist of:

- a local horn (continuous high pitched blast) actuated by plant air or by nitrogen or an electronic horn,
- building horns (air or electric),
- red rotating or strobe beacons located on the outside of buildings, and
- an audible and visible alarm on the Building C-300 CAAS control panel.

The local and building horns produce a loud, distinctive sound and are used as an emergency signal for immediate evacuation of all personnel from the building or area.

Due to the significant number of changes in this system, the local and building alarm system will be described first. Once the basic concept has been established, each building or area will be discussed in detail to provide information on the specific configuration and how the system is arranged.

2.5.1.2.1 Local alarm system

The local alarm system consists of three major devices: the cluster unit, the local junction/horn control box, and the alarm horn. The cluster unit sends the required input to the building alarm system and to the CCF. The individual local alarm units are located throughout the plant as indicated on Fig. 2.5-2. C-710 and C-720 do not have a specific local horn.

from the detector circuit to the building alarm system could cause spurious operation of the system. However, past operational history has shown this portion of the system to be reliable in preventing spurious alarms within the system. Therefore, based upon the detection logic and past operational experience, the system configuration meets the applicable criterion.

Section 2.5.1.2.1 previously described the self-testing capability of the individual detector channel by the function of the LED light source within the assemblies. This meets the requirements for indication of system malfunctions for the detector channels (Criterion 7). In addition to this capability, the power supply circuits are monitored with appropriate alarm indication within C-300 as well as the local horn control boxes as described previously. In addition to the self-monitoring of the system, periodic testing of the system is also performed as described in Sect. 5 to verify proper system operability.

Test circuits and switches are located throughout the system to allow for system verification as described in Sect. 5. In addition, local alarms will remain operational as long as the individual alarm is not being tested. These local alarms will still send input to the building alarms during these conditions unless the building alarms have been disabled before the test. The individual detector channels have their own test circuit along with the cluster logic module. The building alarm system can be tested by the HORN CONTROL SWITCH as previously described. Therefore, the system meets the testability requirement specified in Criterion 8.

As described in Sect. 2.5.2, all of the alarms and fault conditions are displayed in C-300. Section 2.5.2 gives a detailed evaluation of this requirement (Criterion 9) for the CAAS.

Criterion 10 is one of the most difficult portions of the system to verify by analysis. ANSI/ANS 8.3-1986, Sect. 4.4.1, requires that the alarm signal shall be for immediate evacuation purposes only and of sufficient volume and coverage to be heard in all areas that are to be evacuated. Those areas that do not have sufficient volume to be audible are being addressed under the PGDP Compliance Plan.

The following acceptance criteria were developed using approved industry standards and are used by PGDP to verify compliance with ANSI/ANS 8.3, 1986 CAAS audibility requirements:

1) Ensure the broadband CAAS alarm signal is at least 10 dB above the maximum expected broadband background noise. If this criterion cannot be met, go to step 2.
2) Ensure the 1/3 octave 500 Hz CAAS alarm signal is at least 13 dB above the maximum expected 1/3 octave 500 Hz effective masked threshold. If this criterion cannot be met, go to step 3.
3) Expose a minimum of ten people, representing a cross section of the plant population's age and hearing capability, to the alarm signal and ensure each of the test subjects can hear the alarm signal. This test is repeated five times and the results are satisfactory if each of the test subjects hear the signal each time they are exposed.

If any of the above criteria are met, the CAAS meets the CAAS audibility requirement of ANSI/ANS 8.3, 1986.

PIP report number PIP:45-89-0043, *Improve Maintenance and Monitoring of Radiation Alarm System*[11], documented that the present system could not be proven to meet Criterion 11. This section requires that the system remain operable in the event of a seismic shock equivalent to the site specific design basis earthquake or the equivalent value specified by the Uniform Building Code. The CAAS does not meet seismic qualifications. Specific exceptions to ANSI/ANS 8.3 criteria are listed in SAR Section 1.6.

2.5.1.4 CAAS Safety Class Equipment and Instrumentation

The CAAS is designated a safety system. The core of the CAAS is the radiation detection cluster unit, the alarm horn control box, and the local alarm horn which are installed throughout PGDP where fissionable material is handled and a non-trivial risk of a criticality exists. These devices must function in order to initiate a prompt evacuation of personnel from the area of detection in the event of an inadvertent criticality.

The following are the components of the CAAS which are identified as safety system components:

- building CAAS horns and lights (lights are not safety system components in C-710 and associated facilities)

- gamma criticality monitors (cluster):

  - three detectors,
  - one common control panel;

- alarm horn control box (where applicable):

  - one nitrogen regulator (where applicable),
  - two pressure switches (where applicable),
  - one air to nitrogen control valve (where applicable),

- alarm cabinet (relay matrix):

  - control relays (W, Y, and Z relays),

- local alarm horns.

2.5.2 Central Control Facility Provisions and Features

2.5.2.1 System Description

At the radiation alarm system console, the operator can identify cluster units in an "ALARM" or "TROUBLE" state, silence alarms, test and turn on building horns, and disable alarms.

The radiation alarm system console is located in C-300 (CCF). Portions of the radiation alarm system console front panel are shown in Fig. 2.5-15. Portion "A" of Fig. 2.5-15 is a plot plan that depicts the alarm indicators and controls associated with each cluster unit. Figure 2.5-16 shows a grouping of indicator lights and control switches, all of which are common to the radiation alarm system console. The functions of the components shown in Fig. 2.5-15, portions "A, " "B," and "C," are discussed below.

A group of indicators and switches provide indications and controls for one cluster unit. This cluster unit plot plan is shown in portion "A" of Fig. 2.5-15.

1. 10-mR Alarm Light

   The red 10-mR light comes on, along with the console horn, when a criticality alarm signal is received from the related cluster unit. After the alarm condition is over, this light is reset by pushing the CL RESET (cluster reset) switch, which turns off the 10-mR light and resets the logic in the cluster unit (see Sect. 2.5.1).

2. Memory Light

   This light is part of the MEMORY/CL RESET combination as shown in Fig. 2.5-15, portion "A." When a criticality event signal is received, the red 10-mR and blue MEMORY lights come on and the red 2-R light comes on if conditions so warrant. Reset of the 10-mR light is discussed in Item 1; however, after the criticality event is over and no alarm signal is being received from the cluster unit, the MEMORY light will remain ON until the console operator actuates the MEMORY RESET switch located in the common indicators and controls section (see Fig. 2.5-15, portion "B").

3. CL (Cluster) Reset Switch

   The CL RESET switch is pushed to reset the logic in the cluster unit and turn off the 10-mR light at the radiation alarm system console when a criticality event is over.