Regulatory File Cy.

Consumers Power Company

General Offices: 212 West Michigan Avenue, Jackson, Michigan 49201 • Area Code 517 788-0550

May 11, 1972

Mr. E. J. Bloch, Director
Directorate of Licensing
United States Atomic Energy Commission
Washington, DC 20545

Re: Docket No 50-155
License No DPR-6

Dear Mr. Bloch:

This is written to apprise you of the failure of liquid poison system explosive valve CV-4121 to shear off the integral cap during a test firing operation on March 28, 1972 during the refueling outage which currently is in progress.

Due to the failure of CV-4121, the liquid poison system was classified as inoperable. Extensive investigation has been conducted into this problem and is summarized below.

This explosive valve, manufactured by the Conox Corporation, is of a simple design and function. The valve consists of a primer chamber, trigger unit, valve body and integral inlet cap and fitting. To open the normally closed valve, a current energizes the bridge wires imbedded in each of two explosive primers. These may be of either the low temperature or high temperature type depending on the environmental temperature they are subjected to. Ignition of the primers creates a shock wave, which is directed at the ram located in the trigger unit, and forces the ram forward at high velocity to shear off the integral cap of the inlet fitting. The ram also holds the sheared off portion of the Cono-O-Cap securely away from the in-line fluid passage in the valve body recess, allowing full flow through the valve.

Following the initial failure of CV-4121, the trigger unit was machined off the high-temperature primer unit to verify that both primer charges had detonated. The explosive force had tightened the threaded fitting such that the units could not be separated using wrenches. Separation revealed that both primer sections had detonated and that one primer had "backfired" completely through the electrical connector housing along the path of the wiring potting compound feed through as evidenced by a rough hole about 1/8 inch in diameter.

A second unit of the same type and storage history was fired and also resulted in failure to shear the inlet end cap even though a backfire did not occur.

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The Reliability Manager for the valve manufacturer, Conax Corporation, was contacted. He informed us that some time ago problems were discovered in connection with the use of "high temperature" primers. One of the problems was failure to autodetonate (one primer ignites the other primer). The manufacturer claimed that it is essential that the two electrical circuits be arranged to be energized at the same precise instant (within fraction of a millisecond).

Based on this information, a third test using a high-temperature primer was made. This test proved that energization of one primer section failed to autodetonate the second primer section. It also failed to shear the inlet end cap. A fourth test firing of a unit believed to be a high-temperature unit, was arranged such that the electric circuits would fire both primer sections simultaneously (a requirement which is not fulfilled by our two-circuit switch contact and relay contact arrangement). It, too, resulted in a failure to "shear."

The electric circuit was returned to normal. The "low" temperature primer unit was test fired using a unit that had been installed in a valve since 1969. This test firing was successful.

In a special bench test on April 29, one new low-temperature primer and spare trigger unit was installed in a valve body and fired successfully. The test was conducted with only one primer receiving the signal to fire. This was done to insure that if only one primer were to receive a firing signal, the explosive force was of the magnitude necessary to shear off the integral cap. This primer chamber was one unit out of 16 new low-temperature replacement kits P/N 1621-046-02 (replacement kit P/N 1532-021-01). Seven of these replacement kits were installed April 26, 1972 making the poison system operational.

The primer units used at our facility prior to March 28, 1972 have part numbers specified as follows:

High Temperature = P/N 1621-046-03 Primer Charge Is Designated CC-64

Low Temperature = P/N 1621-046-02 Primer Charge Is Designated CC-12-1

The procurement specification of Conax Corporation describes a destructive and nondestructive acceptance testing program for our squib valves. Although the destructive tests do not include actual shearing of the integral inlet cap, the energy output is monitored and checked against a standard before the primer can be accepted. Thus, we are assured the energy output is sufficient to shear the integral cap.

In order to further insure primer capability, we are also upgrading our testing program to include the shearing of an integral cap in addition to monitoring the minimum current necessary to fire the primer. The primer and trigger assembly will be removed from system operation and tested in a valve block on the bench. This will be done annually during the refueling outage with a different unit fired each year.

In an effort to determine the reason for substituting the high-temperature units for the low-temperature units, the original purchase orders, specifications and mail correspondence were reviewed. Following the initial test firing of the explosive valves in the liquid poison system (with all low-temperature units installed) for the Acceptance Test in July of 1962, 14 high-temperature primers were sent from Conax to the Big Rock Plant. This apparently evolved from concern about the possible high ambient temperatures that might be experienced by the primers prior to their firing. The low-temperature unit has an operating range of -60°F to +160°F and an infinite shelf life at environmental temperatures of 120°F or less. No documentation was found listing these operating ambient and/or storage temperatures that were of apparent concern. Evidently, the primers were changed to the high-temperature type because of conditions that might have existed but were never established.

These test failures were experienced because the high-temperature primers did not have enough explosive force to shear off the integral cap. The low-temperature primers, however, proved in a test that it will shear the integral cap and will shear it with only one of the two primers firing. Conax Corporation data confirm these findings. The high-temperature primers were evidently substituted because they can withstand higher temperatures for longer periods of time without affecting their firing capability. However, the low-temperature primers, if subjected to an environmental temperature of 120°F for approximately 13 years, still have the capability of firing properly. An environmental temperature of 132°F corresponds to a one-year storage life. Temperatures in the area where these valves are installed are felt to about 125°F during the hottest days of the summer. A test will be conducted during the next run to determine the ambient environmental temperatures of the poison system in an operating condition and during the summer months. This will determine the effective storage life of the primers. Based on the results of these tests, appropriate action will be taken to insure that primers that approach the time temperature effective storage life limit do not remain installed in the poison system.

The Big Rock Point Plant Hazards Summary Report describes the explosive squib valves as valves with an infinite storage life below 170°F and, hence, the identification of the high-temperature primer unit as being the unit described for initial plant use. A

facility change has been submitted to allow the use of low-temperature primers in place of high-temperature primers.

Based on our review and the upgraded purchasing and acceptance requirements, we have concluded the liquid poison system is now a capable and reliable system and meets all criteria of initial plant design, the Final Hazards Summary Report and the Technical Specifications. The testing programs implemented will ensure continued adherence to these criteria.

Yours very truly,

Ralph B. Sewell
Nuclear Licensing
Administrator

RBS/dmb

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DESCRIPTION:
Ltr reporting incident on March 28, 1972, concerning the failure of liquid poison system explosive valve CV-4121 to shear off....

ENCLOSURES:

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ACKNOWLEDGED

PLANT NAME: Big Rock

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