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September 9, 1980

1-090-08

Director of Nuclear Reactor Regulation
ATTN: Mr. T. M. Novak, Chief
Operating Reactors
Division of Licensing
U. S. Nuclear Regulatory Comm.
Washington, D. C. 20555

Subject: Arkansas Nuclear One - Unit 1
Docket No. 50-313
License No. DPR-51
Waste Gas System
(File: 3920)

Gentlemen:

Your letter of June 23, 1980, requested information on the Waste Gas System at ANO-1. This was in response to your concern about the present status of the system based upon a review of the Appendix I Technical Specifications for ANO-1. As stated previously by AP&L, this system does operate to process waste gas per its intended function but has design problems that allow air in-leakage to the system. Positive action has been taken to correct this problem. We presently plan to finalize the identified modifications in early 1981, dependent on equipment and manpower availability. Attached are responses to your questions.

Very truly yours,

Donald A. Rueter
for David C. Trimble
Manager, Licensing

DCT:MAS:skm

Attachment

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1. Per previous telephone conversations, it was the NRC staff's understanding that Arkansas Power and Light Company (AP&L) was about to complete a thorough evaluation of the ANO-1 waste gas system. Provide the details of the findings of this evaluation, the proposed changes or modifications which are planned, the schedules for implementation of the changes and the expected operating results of the changes.

RESPONSE:

A detailed evaluation of the ANO-1 Waste Gas System (WGS) was recently completed. In this evaluation the following was conducted: a complete walk down of the WGS, including the Gas Collection Header (GCH); discussion with plant operating personnel; evaluation of the system operation; a review of the material of construction; and a review of the routing of all equipment vents and drains to the system was made. This evaluation was conducted by the Arkansas Power & Light Company's Generation Engineering Department and an outside consultant. The results of these independent evaluations were in excellent agreement indicating the validity of the results.

The most significant problem area discovered during the evaluation of the WGS was the accumulation of water at various points in the system, including the Waste Gas Surge Tank (T-17), the Waste Gas Filter (F-16), and at low points in the piping. This accumulation of water interfered with proper gas flow through the system and caused corrosion damage to some components in the WGS. This corrosion damage did not significantly affect the integrity of the system.

Several actions are scheduled or have been completed to correct this accumulation of water. Initially, parts of the system were relocated, including F-16, to eliminate low points in which water may accumulate.

As a second phase in eliminating the water, the source was examined. It was determined that there were two major sources of water input to the WGS. The first was the condensation of water vapor in the system. The second was excessive carryover of the seal water from the Vacuum Degasifier Vacuum Pumps (C-10, A & B). The major cause of this was due to an undersized Moisture Separator (T-76) and improper piping layout from C-10, A & B to T-76.

The problem of excessive carryover is being addressed by completely redesigning the piping associated with C-10, A & B and replacing T-76 with a properly sized unit. It is believed that the larger moisture separator will reduce the amount of water vapor condensing in the remainder of the system.

Several changes have also been made to reduce other sources of moisture input to the WGS. These changes primarily involve the Reactor Building Vent Header (RBVH). The Core Flood Tank (T-2, A & B) vents were removed from the RBVH and are now vented directly to the Containment Building. This eliminates a high volume source of saturated nitrogen which contains little or no activity and does not need to be processed by the WGS. The remainder of the equipment vented to the RBVH includes items such as reactor coolant system vents, letdown cooler vents, etc. which are low volume but contain significant quantities of liquid. The reactor building vent header will be rerouted to the Quench Tank (T-42) to remove the liquid prior to leaving containment. A float type trap will also be added to remove any moisture which may condense downstream of T-42.

To aid in monitoring any accumulation of water that may occur in the system, level indication is being added to T-17. The level indication on the Vacuum Degasifier (T-14) is also being upgraded to provide better control of the Vacuum Pumps (C-10, A & B)

Examination of past gas analysis records indicated some air in-leakage into the system. To preclude this possibility in the future, it has been decided to modify the system to operate with a slight nitrogen overpressure (approximately 3" of water). This will improve the system leak integrity from the current negative pressure operation.

Currently, many of the valves in the system are diaphragm valves which have caused maintenance problems in the past. These valves are scheduled to be replaced to provide reduced maintenance and greater system reliability and integrity.

The engineering on all the above items is expected to be complete by November 1, 1980, with installation of most items to be completed during the next refueling outage, dependent on equipment and manpower availability.

The expected results of the above modifications are easier operation, greater reliability of system components, reduced maintenance, reduced radiation exposure, smaller volumes of gas to process and reduced air in-leakage. Actual benefits will be evaluated after installation of all items is completed.

2. Provide an operational description of the hydrogenated portion of the waste gas system (i.e., the surge tank/decay tank train) and the performance history of the waste gas system, specifically addressing the following:

   a. oxygen and hydrogen levels - design versus actual,

   b. waste gas holdup times - design versus actual,

   c. system availability,

   d. problem areas, and

   e. modification history.

RESPONSE:

The ANO-1 Waste Gas System is designed such that gases which may contain air are separated from gases associated with primary system water, which contains hydrogen. The system was, however, designed with the possibility of a waste decay tank rupture in mind. The maximum curie content allowed by Technical Specifications is well below the curie level considered in the Safety Analysis Report (Chapter 14). Considering that the Safety Analysis showed the acceptability of a Waste Gas Decay Tank rupture, the acceptability is increased due to the lower concentration allowed by Technical Specifications, in conjunction with the low probability of Decay Tank rupture discussed above.

Because of the design consideration described above, no oxygen and/or hydrogen limits are given in the FSAR. Again, because of the design consideration, hydrogen and oxygen are not required to be sampled. A grab sample was taken from the decay tanks last month. The tank with the highest concentration contained 6.06% hydrogen and 11.7% oxygen.

As stated in the FSAR, the decay tanks are designed to provide a 30-day holdup time for decay. A review of waste gas release permits for 1976, 1977, 1978 and the last half of 1979 was conducted. The average holdup time was 25 days. It should be pointed out that not all waste gas requires a 30-day holdup time.

The WGS is available to compress and store gas on a batch basis. Currently, the system must be operated manually, with an operator monitoring the system to insure proper operation.

The current WGS requires a large amount of maintenance. Many of the valves which are presently used were not designed to be used with gas. Piping layout did not consider condensation and water removal systems were undersized resulting in excessive water carryover to other parts of the system. Part of the system is currently being operated at a negative pressure while it was intended to operate under pressure.

The modification history of the WGS primarily involves maintenance items. Part of the system was modified previously to operate at a negative pressure because the nitrogen overpressure control system kept the decay tanks full of nitrogen. The control system will be modified to allow proper operation as the system was designed for positive pressure operation.

3. Per the ANO-1 FSAR, aerated gases are separated from all gases associated with primary system water (which contains hydrogen gas) to prevent the formation of an explosive mixture <u>anywhere</u> in the gaseous waste system. In this regard, provide the following information:

   a. the means available for monitoring (or measuring) the oxygen concentration at specified locations in the system;
   b. monitoring (measuring) frequency;
   c. means available for corrective action, requirements for taking corrective action, and history of any such past action; and
   d. in lieu of oxygen monitoring capabilities to demonstrate that explosive mixtures do not exist <u>anywhere</u> in the system, provide analyses to this effect.

RESPONSE:

The oxygen concentration can be measured by taking grab samples from each of the decay tanks and the surge tank. Any samples taken are usually analyzed with a gas chromatograph. As stated in response to Item 2, the tanks are not sampled routinely for hydrogen and oxygen concentrations.

If a tank was found to have a high concentration of hydrogen and oxygen, it could be diluted with nitrogen, mixed with the contents of the other tanks, or released.

An analysis has been performed by Rockwell International's Atomic International Division (report number AI-73-29 dated May 11, 1973) which shows no detonation wave propogation at 16 volume percent hydrogen in air. Also, a recent issue of the International Journal of Hydrogen Energy (Volume 5, No. 4 published August 13, 1980) contains a paper titled, "Combustion Characteristics of Hydrogen", which shows a detonability limit of 41% air in hydrogen. These two documents show that a hydrogen limit of 16% and an air limit of 41% will preclude any possibility of detonation. Beyond this, a source of ignition would be necessary for an explosion to occur. It is possible for higher oxygen concentrations to be present at vent inlets than is measured elsewhere in the system, however, the lack of ignition sources coupled with rapid mixing due to flow conditions precludes the possibility of flame propogation to a decay tank. Also, the small quantity of gases present in these pipes (generally 1" O.D.) is not enough to cause significant damage if ignition occurred.

4. If oxygen levels in the waste gas system have been, or are suspected of having been, higher than trace levels (say greater than 100 ppm), please provide the following information in order that we may perform our own evaluation of the potential for a hydrogen explosion, specifically addressing the following points:

   a. sources of oxygen in-leakage;
   b. data taken to evaluate this problem;
   c. actions taken to insure that explosive conditions do not exist within the system;
   d. what assurance do you have that explosive conditions do not exist at the local points of air in-leakage, particularly at the degasifier/waste gas system interface;
   e. what corrective actions have been taken, to date, to minimize oxygen in-leakage into the system; and
   f. what corrective actions are planned in this regard, provide a schedule for their implementation.

RESPONSE:

Oxygen in-leakage results primarily from malfunctioning drains, faulty venting filters, leaky valves, and leaking equipment connections.

As stated in response to Item 1, an engineering evaluation of the WGS was recently completed. This evaluation indicated the possibility of some air in-leakage into the WGS and maintenance work was done to reduce such in-leakage as far as practical with the existing system design. To further reduce the amount of air in-leakage, several design changes will be made. The major change will be operation of the WGS at a slight nitrogen over-pressure. Also, many of the leaking diaphragm valves will be replaced. All of these modifications are currently scheduled for completion in early 1981.

In order to have an explosion, there must be a fuel (hydrogen in this case) and oxygen mixture in proper proportions, plus an ignition source. During system operation, gas is normally flowing through the system such that static conditions do not exist for long periods of time. Considering the infrequency of an ignition source causing a spark and the chances of the spark occuring at the same time and place as a localized pocket of explosive gas in a dynamic system, the chance of a small explosion occuring is extremely small. The chance of this small explosion spreading and causing a major explosion capable of rupturing the system is even more remote. Therefore, we feel that there is adequate assurance that explosive conditions do not exist within the WGS. Again, it should be pointed out that the decay tanks are limited in curie content by Technical Specifications such that an explosion would not cause excessive exposure as outlined in the Safety Analysis Report.