

# LIS ORIGINAL

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IN 86-43

UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
OFFICE OF INSPECTION AND ENFORCEMENT  
WASHINGTON, D.C. 20555

June 10, 1986

IE INFORMATION NOTICE NO. 86-43: PROBLEMS WITH SILVER ZEOLITE SAMPLING  
OF AIRBORNE RADIOIODINE

Addressees:

All nuclear power reactor facilities holding an operating license (OL) or a construction permit (CP).

Purpose:

This information notice is provided to alert licensees of the potential hazards associated with sampling for radioiodines with silver zeolite (AgZ) in the presence of hydrogen (H<sub>2</sub>) and oxygen (O<sub>2</sub>). It is expected that recipients will review the information for applicability to their radiation monitoring and survey program and consider actions, if appropriate, to preclude similar problems at their facility. However, suggestions contained in this notice do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

During a recent surveillance test, the LaCrosse Boiling Water Reactor (BWR) experienced a hydrogen ignition while sampling the plant offgas system. The high H<sub>2</sub> concentration in the offgas system was caused by a faulty H<sub>2</sub>-O<sub>2</sub> recombiner. An excerpt from the NRC regional followup inspection report in Attachment 1 gives a detailed account of the event.

The licensee believes that the ignition source during this event was the AgZ cartridge used in the offgas sampling rig. The cartridge contained dehydrated (less than 1% water content) AgZ. The heat of hydration released when the AgZ absorbed moisture from the sample stream may have added enough heat to allow catalytic recombination of H<sub>2</sub> and O<sub>2</sub>. Catalysis also releases heat that would have rapidly increased the temperature of the AgZ to the H<sub>2</sub> ignition point.

Discussion:

Silver zeolite cartridges are used for sampling radioiodines in radioactive gas mixtures. The AgZ chemically traps the iodines while letting the noble gasses (which would interfere with subsequent radioanalysis) pass through. The LaCrosse event highlights the following two properties of AgZ that are apparently not well understood by the industry.

Copies to: Withers, Yundt, Lentsch, Orser, Steele, E. Burton, E. Jordan, A. Holm,  
LIS; C. A. Olmstead, S. Hoag, S. Sautter, TNP:GOV REL F:NRC CHRONO,  
TNP:GOV REL F:NRC IE Information Notice 86-43

PGE Action - M. H. Malmros (Due 8/12/86)  
NSRD Action - M. H. Malmros

1. Hydration State

The noble gas retention efficiency of AgZ is a function of its water content (hydration). Dehydrating AgZ activates its surface, freeing-up sites for noble gas adsorption. Data presented in NUREG/CR-3445 (March, 1985), "A Comparison of Iodine, Krypton, and Xenon Retention Efficiencies for Various Silver Loaded Adsorption Media," show that the retention efficiency for bound noble gas (gas not residing in the void fraction of AgZ) of dehydrated AgZ is an order of magnitude higher than AgZ hydrated to 9% by weight. Because AgZ is used to minimize noble gas retention and interference, the use of dehydrated AgZ is self-defeating.

The heat of hydration can also effect AgZ's iodine retention. Heat released, if dehydrated AgZ is used to sample humid air, increases its temperature. This elevated temperature can reduce the retention efficiency for iodine.

For the above reasons, when sampling for airborne radioiodine in the presence of noble gases, use of dehydrated or activated AgZ is not appropriate.

2. Catalytic Properties

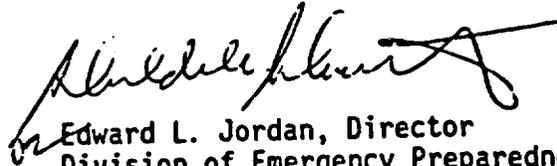
Silver zeolite will act as a catalyst to recombine  $H_2$  and  $O_2$  into  $H_2O$  (water). One manufacturer's study, run with 2%  $H_2$  in moderately dry (10% humidity) air, indicated a threshold temperature at 150°F before the catalytic reaction becomes significant. Although the dependence of this threshold temperature on such parameters as moisture content and  $H_2$  concentration are not known, it is assumed that higher  $H_2$  concentration will lower the threshold temperature. This catalytic property of AgZ makes its use in sampling from explosive or potentially explosive atmospheres (such as BWR offgas or waste gas storage tanks) unadvisable.

Note that for sampling the offsite environment or other onsite areas where there is no possibility of having a significant  $H_2$  concentration, the catalytic properties of AgZ are of no concern.

In addition to returning the offgas recombiner to an operable state, the licensee is considering the following actions:

- using only charcoal cartridges for sampling the offgas radionuclides
- using a portable  $H_2$  analyses and checking for  $H_2$  concentration before sampling the offgas
- using only partially hydrated (or noncatalyzing cartridges) for post-accident sampling of stack effluents
- not using AgZ for post-accident containment sampling unless  $H_2$  concentration is less than 4 percent

No specific action or written response is required by this information notice. If you have any questions about this matter, please contact the Regional Administrator of the appropriate regional office or this office.



Edward L. Jordan, Director  
Division of Emergency Preparedness  
and Engineering Response  
Office of Inspection and Enforcement

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(301) 492-9524

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Attachments:

1. Hydrogen Ignition in an Offgas Sampling Rig
2. List of Recently Issued IE Information Notices

HYDROGEN IGNITION IN AN OFFGAS SAMPLING RIG  
(Excerpted from Referenced Inspection Report, Edited Version)

On March 6, 1986, a senior health physics technician at the LaCrosse Boiling Water Reactor set up a portable sampling system to sample particulate and radioiodine activity in the operational offgas line both upstream and downstream of the on-line offgas system final high-efficiency particulate air (HEPA) filter and charcoal adsorber bank. The sampling was being conducted to test the collection efficiency of the HEPA filter and charcoal adsorber using a differential radionuclide concentration method.

The sampling equipment consisted of new tygon tubing, a flow meter, an aluminum filter paper holder containing an acetate filter paper, and a dual cartridge holder containing two plastic cartridges containing silver zeolite (AgZ). The AgZ had been dehydrated by the manufacturer to less than 5 percent moisture. Past sampling of the offgas line was performed using two standard 2-inch charcoal cartridges instead of AgZ cartridges. AgZ cartridges were substituted because they adsorb less noble gaseous activity than charcoal cartridges and, therefore, reduce sample analysis interferences.

Two minutes after starting the sampling equipment (flow rate of 0.6 cfm), the technician noted that water droplets had formed on the inside of the tygon tubing downstream of the filter holders. One minute later, the technician heard a loud bang and saw a bluish flash inside the sample tubing. The technician then turned off the sampling pump, isolated the sampling lines, and inspected the sampling equipment. The tygon tubing was a burnt brown color; the inside of the flow meter was covered with a brown-colored oil film; the cartridge holder was hot, difficult to open, and had a burned odor when opened; plastic parts of the zeolite filters and holder displayed some melting and were fused; the plastic retaining screens in the zeolite holders were no longer intact; and the HEPA filter had disintegrated.

The licensee believes that an ignition began in the sample holder and that sufficient  $H_2$  must have been present in the sample lines to sustain an ignition. Sufficient  $H_2$  could be present if the offgas system catalytic recombiner, located upstream of the filters being tested, were not operating optimally. There is no  $H_2$  monitor downstream of the catalytic recombiner. The licensee's Radiation Protection Engineer discussed the potential of  $H_2$  and  $O_2$  recombination catalysis by AgZ at ambient temperatures with two outside suppliers. It was determined that dehydrated AgZ will absorb moisture from the sample stream until it reaches hydration. During this hydration, which creates a slightly exothermic reaction, the AgZ granules will heat up. During this heating, additional  $H_2$  and  $O_2$  alignment with the AgZ molecules may occur, and some controlled catalytic recombination also may occur, which may further increase the AgZ granules' temperature. At about  $150^\circ F$ , the AgZ will reach its threshold temperature for  $H_2$  and  $O_2$  catalytic recombination. At this threshold temperature, the AgZ may cause a rapid recombination (ignition) of  $H_2$  and  $O_2$  if the  $H_2$  concentration is above 4 percent. This may rapidly generate temperatures inside the AgZ in excess of  $1065^\circ F$ .

The offgas system continued to operate after the ignition. There were fluctuations in effluent noble gas, particulate, and halogens for several hours after the ignition; however, no alert setpoint was reached. The licensee noted an increase in the temperature of the offgas storage tanks and the catalytic recombiner (monitored parameters). The system slowly returned to near normal except that an identifiable increase in halogen and particulate effluent remained. These remaining increases indicate a possible degradation of the final HEPA filter and charcoal adsorber. The licensee plans to inspect the filter bank for damage and replace the HEPA and charcoal as necessary during this outage.

Reference:

LaCrosse Boiling Water Reactor Inspection Report No. 50-409/86003 (DRSS), March 28, 1986.

LIST OF RECENTLY ISSUED  
IE INFORMATION NOTICES

Information Notice No.	Subject	Date of Issue	Issued to
86-42	Improper Maintenance Of Radiation Monitoring Systems	6/9/86	All power reactor facilities holding an OL or CP
86-41	Evaluation Of Questionable Exposure Readings Of Licensee Personnel Dosimeters	6/9/86	All byproduct material licensees
86-32 Sup. 1	Request For Collection Of Licensee Radioactivity Measurements Attributed To The Chernobyl Nuclear Plant Accident	6/6/86	All power reactor facilities holding an OL or CP
86-40	Degraded Ability To Isolate The Reactor Coolant System From Low-Pressure Coolant Systems in BWRs	6/5/86	All power reactor facilities holding an OL or CP
86-39	Failures Of RHR Pump Motors And Pump Internals	5/20/86	All power reactor facilities holding an OL or CP
86-38	Deficient Operator Actions Following Dual Function Valve Failures	5/20/86	All power reactor facilities holding an OL or CP
86-37	Degradation Of Station Batteries	5/16/86	All power reactor facilities holding an OL or CP
86-36	Change In NRC Practice Regarding Issuance Of Confirming Letters To Principal Contractors	5/16/86	All power reactor facilities holding an OL or CP
86-35	Fire In Compressible Material At Dresden Unit 3	5/15/86	All power reactor facilities holding an OL or CP

OL = Operating License  
CP = Construction Permit