LICENSEE EVENT REPORT (LER)

FACILITY NAME	DOCKET NUMBER	PAGE
ZION NUCLEAR POWER STATION UNITS 1 and 2	0 5 0 0 0 2 9 5	1 OF 0 4

TITLE: Air Filters Containing Aluminum Inadvertently Installed in Containment, Caused By Faulty Parts Selection Process, Resulting In Exceeding The Design Basis.

EVENT DATE			LER NUMBER			REPORT DATE			OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQ.	REVISION	MONTH	DAY	YEAR	FACILITY NAMES	DOCKET NUMBER(S)
0 3	2 1	9 7	9 7	- 0 0 8	- 0 0	0 4	2 1	9 7	ZION UNIT 2	0 5 0 0 0 3 0 4

OPERATING MODE		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (CHECK ONE OR MORE OF THE FOLLOWING)					
	5	20.402(b)		20.405(e)		50.73(a)(2)(iv)	73.71(b)
POWER LEVEL	0 0 0	20.405(a)(1)(i)		50.36(c)(1)		50.73(a)(2)(v)	73.71(c)
		20.405(a)(1)(ii)		50.36(c)(2)		50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)
		20.405(a)(1)(iii)		50.73(a)(2)(i)		50.73(a)(2)(viii)(A)	
		20.405(a)(1)(iv)	X	50.73(a)(2)(ii)		50.73(a)(2)(viii)(B)	
		20.405(a)(1)(v)		50.73(a)(2)(iii)		50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER

NAME	TELEPHONE NUMBER
Neil Brennan, extension 2380	8 4 7 7 4 6 - 2 0 8 4

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	
				N							

SUPPLEMENTAL REPORT EXPECTED		EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
YES, (If yes, complete EXPECTED SUBMISSION DATE)	X NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines).

On March 21, 1997, while investigating applicability of a vendor notification letter, Station Maintenance Engineering discovered High Efficiency Particulate Air (HEPA) filters containing aluminum were installed in unit 1 and 2 reactor containment buildings. The surface area of aluminum installed as a result of these HEPA filters exceeded the 915 square foot limit established by the Updated Final Safety Analysis (UFSAR). This condition can cause excessive Hydrogen gas concentrations during the Design Basis Loss of Coolant Accident (LOCA) as a result of the reaction between the aluminum and the sodium hydroxide solution in the containment spray fluid. The originally installed HEPA filters were certified by the manufacturer on 16-OCT-73 to comply with the non-aluminum requirement of the design specification. The original filters were in place in the Containment Charcoal Filter Units (CCFU), two in unit 1 and two in unit 2, until replaced as corrective work to address decreasing filter efficiencies. The plant's four CCFU HEPA filters were replaced in the period between April, 1992 and January, 1994. This event was caused by failure to verify the parts were correct. Public safety was not adversely affected during this period. The assessment of safety consequences shows the lower flammability limit for hydrogen would not have been reached within 30 days of the LOCA, and venting the containment to alleviate excess hydrogen would not have been necessary. Therefore, 10CFR100 limits would not have been impacted due to this event. Corrective actions for this event are removing or replacing the aluminum containing HEPA filters, strengthening standards and control of part specification practices in work package preparation, and training appropriate personnel.
(NUREG 1022 CODE E)

TEXT Energy Industry Identification System (EIIS) codes are identified in the text as [XX]

A. PLANT CONDITIONS PRIOR TO EVENT

Unit 1 MODE 5 - Cold Shutdown Rx Power 0% RCS [AB]Temperature/Pressure 86DegF/33PSIA
Unit 2 MODE 5 - Cold Shutdown Rx Power 0% RCS [AB]Temperature/Pressure 74DegF/51PSIA

B. DESCRIPTION OF EVENT

On March 21, 1997, while investigating applicability of a vendor notification letter, Station Maintenance Engineering discovered High Efficiency Particulate Air (HEPA) filters containing aluminum were installed in unit 1 and 2 reactor containment buildings. The design specification (Sargent & Lundy {S&L} X 2284) for HEPA filters in the Containment Charcoal Filter Units (CCFU) [VA] requires non-aluminum containing filter units. The CCFUs are non-safety related and their purpose is to reduce radioactive particulate and iodine in the containment shortly after unit shutdown thereby reducing delay time to start outage work. There two CCFUs per unit, consisting of floor mounted housing units each containing dampers, a fan and pre-filter, HEPA filter and charcoal filter banks. The CCFUs are not used after a Loss of Coolant Accident (LOCA). Originally installed HEPA filters were certified by the manufacturer on 16-OCT-73 to comply with the S&L design specification. The original filters were in place in the CCFU until replaced as follows: Installation of the aluminum containing HEPA filters in the 1A CCFU was completed on 11-APR-92, in the 1B CCFU on 30-APR-94, in the 2A CCFU on 23-DEC-93 and in the 2B CCFU on 4-JAN-94. In all cases, the filters were changed as corrective work to address decreasing filter efficiencies. During preparation of work packages for replacement of the subject filters, Work Analysts used informal guidance from the System Engineer which contained the incorrect part recommendations. Station procedures had not specified the process for determining parts. The informal guidance provided by engineering was not verified to be accurate against controlled documentation. Consequently, the incorrect parts were specified by the work packages drawn from stores, and installed in the plant.

C. CAUSE OF EVENT

The event was caused by failure to verify the parts were correct. The parts selection process for filter replacement did not require the work order preparer (work analyst) to use replacement part specifications determined from controlled documents. Although the work order preparer is not available for interview, current work analyst practices indicate that informal references are used by work analysts to identify parts for air filter replacements.

D. SAFETY ANALYSIS

This event is being reported pursuant to 10CFR50.73(a)(2)(ii)(B): 10CFR50.73(a)(2)(ii)"Any event or condition that resulted in the condition of the nuclear power plant, including its principal safety barriers, being seriously degraded, or that resulted in the nuclear power plant being: (B) In a condition that was outside the design basis of the plant." Following a LOCA, hydrogen gas may accumulate within containment [NH] as a result of:

1 Metal-water reaction involving the zirconium fuel cladding [AC] and the reactor coolant [AB].
2 Radiolytic decomposition of the post-accident emergency cooling [BP] [BQ] solutions.
3 Corrosion of metals (aluminum) by solutions used for emergency cooling or containment spray [BE].

Aluminum use inside containment is restricted due to the reaction with the sodium hydroxide (NaOH) spray additive, which is used for post-accident fission product or corrosion control. The rapid chemical reaction occurs between the alkaline spray solution and aluminum resulting in copious quantities of hydrogen, which could present a combustion or explosion hazard if allowed to accumulate.

D. SAFETY ANALYSIS (continued)

Calculation 22S-B-018M-038 was prepared to provide results expected for the case of post LOCA hydrogen generation with additional aluminum due to the subject High Efficiency Particulate Air (HEPA) filters being installed. (The HEPA filters contained media separators made of aluminum, and will be removed entirely prior to unit start up.) The methodology used in the calculation removed conservatism explicitly defined by the Updated Final Safety Analysis (UFSAR), Standard Review Plan (SRP) 6.2.5: "Combustible Gas Control in Containment", and Regulatory Guide 1.7 (R/2) "Control of Combustible Gas Concentrations in Containment Following a Loss of Coolant Accident," and does not use the hydrogen recombiner. This methodology is intended to provide expected results and is not intended to replace the design basis analysis found in the UFSAR. The following is a summary of calculation 22S-B-018M-038 results:

Hydrogen Generation Due to Zirconium Water Reaction

The quantity of zirconium which reacts with the core cooling solution will depend on the functioning of the Emergency Core Cooling System (ECCS) [BP] [BQ]. Per the UFSAR section 15.6.5.6.2.1, system analysis has shown that core cooling initialization is sufficiently rapid to limit the zirc-water reaction to a maximum 0.1%. The UFSAR analysis assumed 5% of the fuel cladding reacts and is immediately released to containment atmosphere. This calculation uses the 0.1% value.

Hydrogen Generation Due to Corrosion of Metals (Aluminum and Zinc):

Corrosion of Aluminum

The hydrogen production rate from corrosion of metals within containment depends on such factors as coolant chemistry, the coolant pH, the metal and coolant temperatures, and the surface area exposed to the attack by the coolant. Calculation 22S-B-018M-038 determined the corrosion due to the high pH (10.5) for the first 50 minutes following the LOCA and a lower pH for the remaining time. It is unlikely that the entire surface area of the HEPA filter aluminum separators would be exposed to NaOH spray. Although the Containment Charcoal Filter Unit (CCFU) dampers fail open the CCFUs are not used post-LOCA and the separators are protected by prefilters on one side and charcoal filters on the other side. For conservative purposes, the calculations assume all the aluminum is exposed regardless the aluminum source in containment paint, corrosion of all the aluminum in the paint is included in this analysis and is assumed to be immediate. Galvanized carbon steel is not considered an important source of hydrogen per the UFSAR and is not included in the analysis nor is it included in UFSAR Table 15.6-37.

Corrosion of Zinc in Containment Coatings

Hydrogen generation resulting from the zinc-based containment coating is not considered in Safety Guide 7, therefore the UFSAR does not include this corrosion in the results given in Table 15.6-37. This calculation is intended to provide expected results of hydrogen due to the HEPA aluminum, therefore the zinc contribution was included and assumed to be released in the first day (similar to the aluminum in the paint). The UFSAR states that hydrogen production from zinc is 7,250 SCF. Although a thicker topcoat was identified in UFSAR Change 97-001, and it is expected that this topcoat would result in less hydrogen generation, the hydrogen production was not reduced in this calculation.

Hydrogen Generation Due to Radiolysis in the Core

There are two radiolytic environments which exist in containment at LOCA conditions. The first results from the core cooling solution flow through the core exposed to gamma radiation. The energy absorption results in solution radiolysis and the production of molecular hydrogen and oxygen. This radiolysis has been studied extensively by Westinghouse (W) and Oak Ridge National Laboratory (ORNL). The (W) and ORNL results show only 7.4% (maximum) gamma energy will be absorbed by the cooling solution. The UFSAR assumed 10%. (W) and ORNL results show hydrogen yields much lower than the maximum 0.44 molecules per 100 ev. The UFSAR uses 0.5 molecules per 100 ev and assumes no back reaction to reform water. Back reaction to water could reduce the hydrogen value to near zero. This calculation analysis assumes 0.44 molecules per 100 ev.

D. SAFETY ANALYSIS (continued)

Hydrogen Generation Due to Radiolysis in the Sump

Another important source of hydrogen arises from water contained in the reactor sump being subjected to radiolytic decomposition by dissolved fission products (similar to the core). The UFSAR assumed 50% of the core halogens are released to the sump solution. In addition, sump depth and temperature and resulting back reaction were not considered. The UFSAR used 0.5 molecules per 100 ev. The expected yield is 0.1 molecules per 100 ev. Therefore radiolysis in the sump for this calculation is reduced by the ratio (0.1/0.5 = 0.2).

Hydrogen Recombiner Removal [VA] Rate

The hydrogen recombiner is capable of processing a post-LOCA containment atmosphere with a hydrogen concentration of 0.5 to 5 percent hydrogen by volume. The recombiner process gas flow capability is 50 to 70 SCFM, removing all but 0.1% hydrogen, if measured in the effluent. Therefore the recombiner removal rate with 3.05% hydrogen is 50(.0305-.001) = 1.475 SCFM and with 4.04% hydrogen is 50(.0404-.001) = 1.97 SCFM.

Conclusion

The results of the calculation show that the hydrogen recombiner removal rate on the 30th day post-LOCA would have been able to keep up with the hydrogen generation rate and therefore maintain the hydrogen concentration below the flammable limit of 4.1%. Consequently, venting the containment to alleviate excess hydrogen would not have been required, and offsite exposures would have been unaffected by this event (below 10CFR100 limits). Therefore, the safety significance of the event is minimal.

E. CORRECTIVE ACTIONS

1. HEPA filters containing aluminum will be removed or replaced with non-aluminum containing HEPA filters before the respective unit increases MODE of Operation.
2. We will review work performed since 1994, when we completed an inventory of aluminum in the reactor containment buildings, to verify non-modification related parts were properly specified for containment prior to unit start-up.
3. The Station will specify a formal method to ensure parts for preventive and corrective maintenance replacement are in accordance with controlled documents.
4. For the period until the formal method is implemented, Engineering and Work Analyst personnel have been directed to ensure parts specified for preventive and corrective maintenance are in accordance with controlled documents.
5. Appropriate personnel will be trained on the formal parts identification process.

F. PREVIOUS EVENTS SEARCH AND ANALYSIS

No previous events were identified.

G. COMPONENT FAILURE DATA

This event did not involve component failure.