

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555

July 18, 1994

NRC INFORMATION NOTICE 94-53: HYDROGEN GAS BURN INSIDE PRESSURIZER DURING WELDING

Addressees

All holders of operating licenses or construction permits for nuclear power reactors.

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to alert addressees to the potential for the ignition of hydrogen gas mixtures during welding operations while the reactor coolant system is depressurized. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this information notice are not NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances

On February 3, 1994, a control room operator at Surry Power Station, Unit 1, observed pressure spikes on the pressurizer level instruments. At the same time, a loud rumbling sound was heard in the containment. The containment vent radiation alarm was received, and as a precaution, the containment was evacuated.

At the time of the event, the pressurizer was drained and vented to both the pressurizer relief tank and the containment atmosphere through a filtered covering over the piping where the safety valves had been removed. The reactor vessel head had just been detensioned. There was fuel in the reactor vessel. A modification to eliminate the pressurizer loop seals was in progress.

The pressure fluctuations inside the pressurizer caused the expulsion of radioactive gases from the pressurizer into the containment causing alarms on both the containment radiation monitor and the ventilation radiation monitor where the ongoing filtered containment purge was directed. Licensee personnel calculated the release rate through the monitored ventilation purge path to be approximately 30 percent of the technical specification limits. One worker received an estimated internal exposure of 70 μ Sv [7 mrems] and a total dose of 160 μ Sv [16 mrems].

The licensee investigation showed that the screens for excluding foreign material that were taped over the pressurizer side of the piping where the

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three safety valves were removed were discolored and appeared burned. The licensee concluded that a hydrogen gas burn had occurred inside the pressurizer. Welding activities associated with the pressurizer loop seal modification had ignited the hydrogen gas that had come out of solution and accumulated inside the pressurizer and associated piping. There were no personnel inquiries.

Additional details pertaining to this event can be found in Licensee Event Report 50-280/94-001 dated March 4, 1994, and NRC Inspection Report 50-280/94-002 dated March 7, 1994.

Discussion

During refueling operations, the reactor coolant system was depressurized and the pressurizer level was drained while a nitrogen blanket was provided via the pressurizer relief tank. Before the coolant system was depressurized, the system was degassed and the hydrogen concentration was reduced to less than 5 cc/kg in accordance with recommendations from Westinghouse, the nuclear steam system supplier.

The source of the hydrogen gas inside the pressurizer was investigated by the licensee's root cause team. The team concluded that pockets of trapped gas either in the reactor coolant system or in the pressurizer relief tank had moved as a result of the effects of changing containment pressure on the pressurizer. The pressure changes had acted through the removed safety valve openings. Because the licensee had maintained the containment at a slight negative pressure during most of the refueling shutdown, opening and closing of the equipment hatch caused changes in the containment pressure.

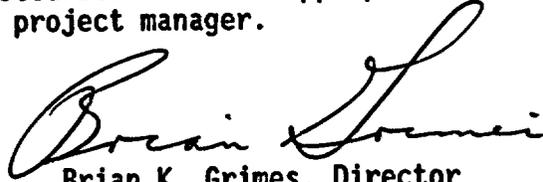
The licensee investigation showed that a similar event had occurred at the Wolf Creek Nuclear Plant in October 1987.

The licensee imposed additional controls for welding on the primary system. These require that samples be taken and analyzed before initiating an arc to determine if explosive gasses are present. The licensee also evaluated pressurizer stresses associated with the rapid hydrogen burn and completed a piping support inspection and internal inspection of the pressurizer. The evaluation showed that no unacceptable stresses had resulted, and no damage was noted during the inspections.

Related Generic Communications

In Information Notice 82-28, "Hydrogen Explosion While Grinding in the Vicinity of Drained and Open Reactor Coolant System," the NRC described a hydrogen gas explosion that took place when maintenance personnel at Arkansas Nuclear One, Unit 1, were grinding a recently cut high-pressure injection pipe. The cut was approximately 46 centimeters [18 inches] from the nozzle connecting the injection pipe to the reactor coolant system piping.

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact one of the technical contacts listed below or the appropriate Office of Nuclear Reactor Regulation (NRR) project manager.



Brian K. Grimes, Director
Division of Operating Reactor Support
Office of Nuclear Reactor Regulation

Technical contacts: Morris Branch, RII
(804) 357-2101

Mark A. Caruso, NRR
(301) 504-3235

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List of Recently Issued NRC Information Notices

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LIST OF RECENTLY ISSUED
NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
94-52	Inadvertent Containment Spray and Reactor Vessel Draindown at Millstone Unit 1	07/15/94	All holders of OLs or CPs for nuclear power reactors.
94-51	Inappropriate Greasing of Double Shielded Motor Bearings	07/15/94	All holders of OLs or CPs for nuclear power reactors.
94-50	Failure of General Electric Contactors to Pull in at the Required Voltage	07/14/94	All holders of OLs or CPs for nuclear power reactors.
94-49	Failure of Torque Switch Roll Pins	07/06/94	All holders of OLs or CPs for nuclear power reactors.
94-48	Snubber Lubricant Degradation in High-Temperature Environments	06/30/94	All holders of OLs or CPs for nuclear power reactors.
94-13, Supp. 1	Unanticipated and Unintended Movement of Fuel Assemblies and other Components due to Improper Operation of Refueling Equipment	06/28/94	All holders of OLs or CPs for nuclear power reactors.
94-47	Accuracy of Information Provided to NRC during the Licensing Process	06/21/94	All U.S. Nuclear Regulatory Commission Material Licensees.
94-46	NonConservative Reactor Coolant System Leakage Calculation	06/20/94	All holders of OLs or CPs for nuclear power reactors.
94-45	Potential Common-Mode Failure Mechanism for Large Vertical Pumps	06/17/94	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License
CP = Construction Permit

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Original signed by
 Brian K. Grimes

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 List of Recently Issued NRC Information Notices

*see JRJohnson memorandum to BKGrimes dated April 4, 1994
 and previous concurrence sheets

OFFICE	*RPB2/REG-II	*C:RPB2/REG-II	*DRP/REG-II	*D:DRS/REG-II
NAME	GABelisle	MVSinkule	JPJaudon	AFGibson
DATE	3/21/94	3/22/94	3/29/94	3/31/94
OFFICE	*D:DRP/REG-II	*OGCB/NRR	*Tech Editor	*SRXB/NRR
NAME	JRJohnson	RJKiessel	MMejac	MACaruso
DATE	4/ 4/94	5/5/94	5/9/94	5/16/94
OFFICE	*C:SRXB/NRR	*D:DSSA/NRR	*AC:OGCB\NRR	D:DORS/NRR
NAME	TECollins	MJVirgilio	RLDennig	BKGrimes
DATE	5/18/94	6/11/94	6/15/94	7/8/94

Document Name: 94-53.IN

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OFFICE	*C:SRXB/NRR	*D:DSSA/NRR	*AC:OGCB\NRR	D:DORS/NRR
NAME	TECollins	MJVirgilio	RLDennig	BKGrimes
DATE	5/18/94	6/11/94	6/15/94	6/ /84

Document Name: NRCIN.451

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This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact one of the technical contacts listed below or the appropriate Office of Nuclear Reactor Regulation (NRR) project manager.

Brian K. Grimes, Director
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DATE	3/21/94	3/22/94	3/29/94	3/31/94
OFFICE	*D:DRP/REG-II	*OGCB/NRR	*Tech Editor	SRXB/NRR
NAME	JRJohnson	RJKiessel	MMejac	MACaruso
DATE	4/ 4/94	5/5/94	5/9/94	5/16/94 <i>MR</i>
OFFICE	C:SRXB/NRR	D:DSSA/NRR <i>see</i>	PRPB/NRR	C:PRPB/NRR
NAME	TECollins <i>AC</i>	<i>see</i> MJVirgilio	JDBuchanan	LCuningham
DATE	5/16/94 <i>fn</i>	6/5/11/94	5/ /94	5/ /94
OFFICE	D:DRSS/NRR	C:OGCB/NRR	D:DORS/NRR	
NAME	FJCongel	Wagner R. Denny	BKGrimes	
DATE	5/ /94	6/5/15/94	5/ /84	

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Attachments:

1. List of Recently Issued NRC Information Notices

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OFFICE	*RPB2/REG-II	*C:RPB2/REG-II	*DRP/REG-II	*D:DRS/REG-II
NAME	GABelisle	MVSinkule	JPJaudon	AFGibson
DATE	3/21/94	3/22/93	3/29/94	3/31/94
OFFICE	*D:DRP/REG-II	OGCB/NRR	Tech Editor	SRXB/NRR
NAME	JRJohnson	RJKiessel <i>RJK</i>	<i>M. Neje</i>	MACaruso
DATE	4/ 4/94	5/5/94	5/9/94	5/ /94
OFFICE	C:SRXB/NRR	D:DSSA/NRR	PRPB/NRR	C:PRPB/NRR
NAME	TECollins	MJVirgilio	JDBuchanan	LCunningham
DATE	5/ /94	5/ /94	5/ /94	5/ /94
OFFICE	D:DRSS/NRR	C:OGCB\NRR	D:DORS/NRR	
NAME	FJCongel	AJKugler	BKGrimes	
DATE	5/ /94	5/ /94	5/ /84	

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cc w/encl cont'd:
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RII:DRP
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 03/2/94

RII:DRP
 AGibson
 03/3/94