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UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION AND
OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS
WASHINGTON, D.C. 20555-0001

January 4, 1995

NRC INFORMATION NOTICE 95-01: DOT SAFETY ADVISORY: HIGH PRESSURE ALUMINUM SEAMLESS AND ALUMINUM COMPOSITE HOOP-WRAPPED CYLINDERS

Addressees

All U.S. Nuclear Regulatory Commission licensees.

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to alert addressees to a safety concern for workers identified in the safety advisory (see Attachment 1) recently issued by the Research and Special Programs Administration of the U.S. Department of Transportation (DOT). The DOT notice advises users of certain high pressure cylinders made of aluminum alloy 6351-T6 to follow precautionary measures to prevent or mitigate cylinder ruptures. 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 July 26, 1994, the Research and Special Programs Administration of DOT issued a safety advisory, "High Pressure Aluminum Seamless and Aluminum Composite Hoop-Wrapped Cylinders," in the *Federal Register* (Volume 59, No. 142, pages 38028-38030). The advisory contains a description of two catastrophic cylinder failures. The first occurred at a chemical plant in Texas, where a self-contained breathing apparatus aluminum alloy air cylinder ruptured while being filled to its rated pressure of 15.4 MPa [2216 psig]. The second failure was the rupture of a self-contained underwater breathing apparatus cylinder also made of the same type alloy that also occurred while the cylinder was being filled. The rupture caused serious injury to the attending technician. In both events, a piece of the cylinder neck separated and was blown away with great force. Ruptures like these are unexpected for aluminum alloy 6351-T6, since current metallurgical findings and modeling predict only leaking at pressures below 27.7 MPa [4000 psig]. The DOT investigation of these failures is continuing.

The DOT advisory applies to seamless aluminum cylinders marked "DOT 3AL," manufactured under one of the following exemption or special permit numbers: 6498, 7042, 8107, 8364, or 8422; composite cylinders affected are marked with one of the following exemption numbers: 7235, 8023, or 8115.

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PDR I+E Notice 95-001- 950104
updated on 1/5/95

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Discussion

These two events are the first known ruptures of aluminum alloy 6351-T6 in the seamless (non-composite) cylinder neck and shoulder area at pressures below 27.7 MPa [4000 psig]. Previous problems with the same alloy in composite cylinders (hoop-wrapped aluminum cylinders) have been described in various National Institute for Occupational Safety and Health, DOT, and NRC generic communications, which all dealt with ruptures or cracking of cylinders rated at 31.1 MPa [4500 psig] or cracking (leaking) of cylinders with a service rating of 15.4 MPa [2216 psig].

DOT cautions users to take reasonable precautions as described in its advisory when using or handling affected cylinders, and to call the manufacturer or distributor if they have any questions about that particular unit. Anyone aware of the rupture of any DOT 3AL cylinder made of aluminum alloy 6351-T6 can call the technical contacts at DOT, as DOT is collecting information and insight on this matter, and is planning to consider additional advisories.

Licensees may wish to share this information with other potential users, such as local fire departments.

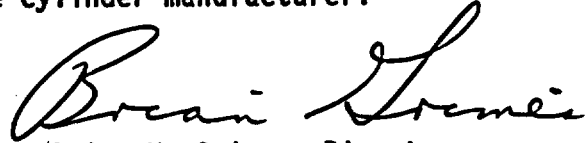
Related Generic Communications

- NRC Information Notice 83-68, "Respirator User Warning: Defective Self-Contained Breathing Apparatus Air Cylinders"
- NRC Information Notice 84-34, "Respirator User Warning: Defective Self-Contained Breathing Apparatus Air Cylinders"
- NRC Information Notice 85-48, "Respirator User Notice: Defective Self-Contained Breathing Apparatus Air Cylinders"
- NRC Information Notice 86-24, "Respirator User Notice: Increased Inspection Frequency for Certain Self-Contained Breathing Apparatus Air Cylinders"

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 NRC technical contacts listed below, the DOT contacts mentioned in the subject DOT safety advisory, or the cylinder manufacturer.



Robert F. Burnett, Director
Division of Fuel Cycle Safety
and Safeguards
Office of Nuclear Material Safety
and Safeguards



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

Technical contacts: Jim Wigginton, NRR
(301) 504-1059

Jerry Roth, NMSS
(301) 415-7257

Attachments:

1. DOT Safety Advisory, "High Pressure Aluminum Seamless and Aluminum Composite Hoop-Wrapped Cylinders"
2. List of Recently Issued NMSS Information Notices
3. List of Recently Issued NRC Information Notices

Attachments filed in Jacket

Safety Advisory: High Pressure Aluminum Seamless and Aluminum Composite Hoop-Wrapped Cylinders

AGENCY: Research and Special Programs Administration (RSPA), DOT.
ACTION: Safety advisory notice.

SUMMARY: RSPA is aware of ruptures involving two DOT-3AL cylinders made of aluminum alloy 6351-T6. Cylinder ruptures pose a risk of death, serious personal injury, and property damage. The purpose of this notice is to advise owners of certain cylinders made of aluminum alloy 6351-T6 to follow the precautionary measures outlined in this notice. RSPA also seeks information on ruptures involving other cylinders made of aluminum alloy 6351-T6.

FOR FURTHER INFORMATION CONTACT: Charles H. Hochman or Gopala K. Vinjamuri, telephone (202) 366-4545, Office of Hazardous Materials Technology, Research and Special Programs Administration, U.S. Department of Transportation, 400 Seventh Street SW, Washington, DC 20590-0001. Office hours are: 8:30 a.m. to 5 p.m., Monday through Friday, except holidays.

SUPPLEMENTARY INFORMATION: RSPA has been notified of the rupture of two DOT-3AL aluminum cylinders made of aluminum alloy 6351-T6. The first cylinder rupture occurred in Deer Park, Texas. This cylinder was manufactured in 1977 and was part of a self-contained breathing apparatus (SCBA) unit. It ruptured while being filled to its marked service pressure of 2216 pounds per square inch gauge (psig). The second cylinder rupture occurred in North Miami, Florida. This cylinder was manufactured in 1982 and was part of a self-contained underwater breathing apparatus (SCUBA) unit. It ruptured while being filled to its marked service pressure of 3000 psig. The person filling the SCUBA cylinder sustained serious

injury. In both ruptures, a piece of the cylinder neck separated from the cylinder.

RSPA estimates that approximately seven million cylinders have been manufactured using aluminum alloy 6351-T6. RSPA presently does not know which cylinders among this population have the potential for similar failure. Cylinders made of aluminum alloy 6351-T6 are known to be susceptible to sustained load cracking (SLC) in the neck and shoulder area of the cylinder. Extensive research, testing and analysis have been performed on cylinders made of aluminum alloy 6351-T6 to determine any correlation between SLC and the probability of rupture. Findings indicated that cylinders with a marked service pressure below 4000 psig failing due to SLC would leak and not rupture. Present data are inconclusive as to why the two cylinders noted here ruptured instead of leaked. RSPA is continuing to investigate the incidents.

Aluminum cylinders are widely used in industrial, medical SCUBA and SCBA services. Aluminum alloy 6351-T6 has been used in the manufacture of the following DOT high pressure cylinders:

1. Cylinders (seamless aluminum) marked "DOT 3AL", including those marked with "DOT 3AL" above or near one of the following exemption or special permit numbers:

6498
7042
8107
8364
8422

2. Composite cylinders (aluminum-lined with hoop-wrapped, fiber-reinforced plastic) marked with one of the following exemption numbers:

7235
8023
8115

To RSPA's knowledge, no cylinders have been manufactured under the exemption or special permit numbers listed above, except DOT-E 7235, since 1984. Any cylinder marked with one of these exemption or special permit numbers most likely is made of aluminum alloy 6351-T6. (DOT-E 7235 cylinders are discussed more fully below.) If in doubt, contact the cylinder manufacturer or distributor to identify the material of construction.

The primary domestic manufacturers of DOT-3AL cylinders currently in service are Luxfer USA; Walter Fiddle Co.; Cliff Impact Division of Parker Hannifan Corporation; and Catalina Cylinders, a division of Aluminum Precision Products Inc. Luxfer USA is the only manufacturer of DOT-E 7235 cylinders. Between 1987 and 1989, Luxfer USA discontinued using alloy 6351-T6 and changed to alloy 6061-T6 for DOT-3AL cylinders and DOT-E 7235 cylinder liners. Cylinders manufactured from alloy 6061-T6 are not believed to be susceptible to SLC; therefore, they are not subject to this advisory notice. According to Luxfer USA data, the following types of cylinders stamped as manufactured by Luxfer USA before the dates indicated below likely are made from alloy 6351-T6.

DOT	Service and type cylinder	Part no.	Date mfd.
CO₂			
Spec. 3AL	1.2 and 1.5 lb	C1.2, C1.5	1-89
Do	2.18 lb	C2-18	11-88
Do	10 lb	C10	8-88
Do	5 lb	C5	6-88
Do	15 lb	C15	11-87
Do	20 and 35 lb	C20, C35	4-88
Do	50 lb	C50	2-88
SCBA			
Do	7, 8 and 13 cu. ft	L7, L8, L13	9-87
Do	13.3 cu. ft	L13-30	5-88
Do	15 cu. ft	L15	1-89
Do	26 cu. ft	L26	2-88
Do	45 cu. ft	L45	11-87
SCUBA			
Do	30 and 63 cu. ft	S30, S63	5-88
Do	40 cu. ft	S40	6-88
Do	50 and 92 cu. ft	S50, S92	4-88
Do	72 and 100 cu. ft	S72, S100	8-87
Do	80 cu. ft	S80	1-88
Do	80.8 cu. ft	S80.8	5-87
Medical O₂			
Do	C	M9	1-88

DOT	Service and type cylinder	Part no.	Date mfd.
Do	D and E Industrial	MD, ME	12-87
Do	22 and 150 cu. ft.	N22, N150	6-88
Do	33 cu. ft.	N33	11-88
Do	60 and 122 cu. ft.	N60, N122	12-87
Do	88 cu. ft.	N88	12-88
Do	Service Pressures 2016 and 3000 psig		8-89
E-7235	Service Pressure 4500 psig		See below.

All Walter Kidde DOT-3AL cylinders, of which production ceased in January 1990, are made of alloy 6351-T6. Cliff Impact DOT-3AL cylinders were made from alloy 6351-T6 before July 1990, at which time Cliff Impact changed to alloy 6061-T6. Catalina Cylinders did not produce any DOT-3AL cylinders from alloy 6351-T6; therefore, cylinders manufactured by Catalina are not subject to this notice.

Until determined otherwise, any DOT-3AL or DOT-E 7235 cylinder should be assumed to be made of alloy 6351-T6, if it was:

1. Manufactured by Luxfer USA before the applicable date listed in the chart above;
2. Manufactured by Cliff-Impact before July 1990;
3. Manufactured by any other company in the United States, excluding Catalina, before February 1990; or
4. Manufactured outside the United States.

For aid in determining whether a cylinder is constructed with alloy 6351-T6, contact the cylinder manufacturer or distributor. RSPA will provide further information as it becomes available.

Any person who owns, uses, fills or retests an affected cylinder should take the following precautions:

1. Do not fill the cylinder to greater than the marked service pressure, except during a hydrostatic test.
2. Do not fill a cylinder that is beyond its required retest date.
3. Do not use a SCUBA or SCBA cylinder that is beyond its required retest date.

4. Whenever you remove the cylinder valve, visually inspect the interior of the cylinder neck and shoulder area for cracks. Any evidence of a crack or crack-like defect may require further evaluation. Contact the cylinder retester, distributor or manufacturer for the procedure to be used in performing the visual inspection and for rejection criteria. For guidance on inspecting Luxfer USA cylinders, contact Luxfer USA Limited, Customer Service Department, PO Box 5300, Riverside CA 92517, telephone (909) 684-5110.

RSPA wishes to reiterate two previous advisories it has issued regarding DOT-E 7235 cylinders. On August 15, 1985, RSPA published an exemption-related notice [Notice 85-4, 50 FR 32944] to alert users that any cylinder marked DOT-E 7235, with a service pressure of 4500 psig and not equipped with a neckring was required to be removed from service by October 1, 1985. On March 24, 1993, RSPA published a safety advisory notice [Notice 93-8, 58 FR 15895] after being notified of the rupture of a cylinder authorized under DOT-E 7235 that had not been fitted with a neckring. Cylinders properly fitted with the required neckring are not susceptible to rupture. That notice stated in part:

Persons finding cylinders without the required neckring should immediately take the following precautions.

1. If a cylinder has been filled, its entire contents should be vented in order to relieve internal pressure.
2. The vented cylinders should be segregated from all other cylinders by being placed in a secured area and marked conspicuously with a tag bearing the notation "Do Not Use" or similar warning.
3. Under no circumstances should any of the cylinders in question be sold or otherwise transferred, filled, refilled or used for any purpose.

Once the above procedures have been taken, persons finding cylinders without neckrings should contact the company, or distributor from whom they were purchased, for their disposition.

Any person who is aware of the rupture of any DOT-3AL cylinder or any other cylinder manufactured from aluminum alloy 6351-T6, whether the incident was domestic or foreign, is requested to contact RSPA as soon as possible.

Issued in Washington, DC on July 20, 1994.

Ahm L. Roberts,
Associate Administrator for Hazardous
Materials Safety.
[FR Doc. 94-18192 Filed 7-25-94; 8:45 am]
GALILEO CODE 9910-00-9

LIST OF RECENTLY ISSUED
NMSS INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
94-89	Equipment Failures at Irradiator Facilities	12/28/94	All U.S. Nuclear Regulatory Commission irradiator licensees.
89-25, Rev. 1	Unauthorized Transfer of Ownership or Control of Licensed Activities	12/07/94	All fuel cycle and material licensees.
94-81	Accuracy of Bioassay and Environmental Sampling Results	11/25/94	All U.S. Nuclear Regulatory Commission licensees.
93-60, Supp. 1	Reporting Fuel Cycle and Materials Events to the NRC Operations Center	10/20/94	All 10 CFR Part 70 fuel cycle licensees.
94-74	Facility Management Responsibilities for Purchased or Contracted Services for Radiation Therapy Programs	10/13/94	All U.S. Nuclear Regulatory Commission Medical Licensees.
94-73	Clarification of Criticality Reporting Criteria	10/12/94	All fuel fabrication facilities.
94-70	Issues Associated with Use of Strontium-89 and Other Beta Emitting Radiopharmaceuticals	09/29/94	All U.S. Nuclear Regulatory Commission Medical Licensees.
94-65	Potential Errors in Manual Brachytherapy Dose Calculations Generated Using a Computerized Treatment Planning System	09/12/94	All U.S. Nuclear Regulatory Commission medical licensees.
94-64	Reactivity Insertion Transient and Accident Limits for High Burnup Fuel	08/31/94	All holders of OLs or CPs for nuclear power reactors and all fuel fabrication licensees.

LIST OF RECENTLY ISSUED
 NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
94-90	Transient Resulting in a Reactor Trip and Multiple Safety Injection System Actuations at Salem	12/30/94	All holders of OLs or CPs for nuclear power reactors.
94-89	Equipment Failures at Irradiator Facilities	12/28/94	All U.S. Nuclear Regulatory Commission irradiator licensees.
94-88	Inservice Inspection Deficiencies Result in Severely Degraded Steam Generator Tubes	12/23/94	All holders of OLs or CPs for pressurized water reactors.
94-87	Unanticipated Crack in a Particular Heat of Alloy 600 Used for Westinghouse Mechanical Plugs for Steam Generator Tubes	12/22/94	All holders of OLs or CPs for nuclear power reactors.
94-86	Legal Actions Against Thermal Science, Inc., Manufacturer of Thermo-Lag	12/22/94	All holders of OLs or CPs for nuclear power reactors.
94-85	Problems with the Latching Mechanism in Potter and Brumfield R10-E3286-2 Relays	12/21/94	All holders of OLs or CPs for nuclear power reactors.
94-40, Supp. 1	Failure of a Rod Control Cluster Assembly to Fully Insert Following a Reactor Trip at Braidwood Unit 2	12/15/94	All holders of OLs or CPs for nuclear power reactors.
94-84	Air Entrainment in Terry Turbine Lubricating Oil System	12/02/94	All holders of OLs or CPs for nuclear power reactors.
89-25, Rev. 1	Unauthorized Transfer of Ownership or Control of Licensed Activities	12/07/94	All fuel cycle and material licensees.

OL = Operating License
 CP = Construction Permit

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orig /s/'d by RFBurnett

orig /s/'d by BKGrimes

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 Office of Nuclear Material Safety
 and Safeguards

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DOCUMENT NAME: 95-01.IN
 *SEE PREVIOUS CONCURRENCE

OFFICE	OECB:DOPS	ADM:PUB	TERB:DOTS	SC/TERB:DOTS
NAME	PWen*	MMejac*	JWigginton*	REmch*
DATE	12/06/94	12/06/94	12/06/94	12/06/94

OFFICE	C/TERB:DOTS	IMOB:NMSS	FCOB:NMSS	D/ONDD:DOPS
NAME	CMiller*	KRamsey*	JRoth*	SWeiss*
DATE	12/06/94	12/12/94	12/12/94	12/13/94

OFFICE	SC/OECB:DOPS	OECB:DOPS	C/OECB:DOPS	D/FCSS/NMSS	D/DOPS
NAME	EGoodwin*	RKiessel*	AChaffee*	RBurnett*	BGrimes
DATE	12/13/94	12/13/94	12/15/94	12/12/94	12/29/94

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DOCUMENT NAME: G:\PETER\SCBACYLD.IN
 *SEE PREVIOUS CONCURRENCE

OFFICE	OECB:DOPS	ADM:PUB	TERB:DOTS	SC/TERB:DOTS
NAME	PWen*	MMejac*	JWigginton*	REmch*
DATE	12/06/94	12/06/94	12/06/94	12/06/94

OFFICE	C/TERB:DOTS	IMOB:NMSS	FCOB:NMSS	D/ONDD:DOPS
NAME	CMiller*	KRamsey*	JRoth*	SWeiss
DATE	12/06/94	12/12/94	12/12/94	12/13/94

OFFICE	SC/OECB:DOPS	OECB:DOPS	C/OECB:DOPS	D/FCSS/NMSS	D/DOPS
NAME	EGoodwin S	RKiessel	AChaffee JSB	RBurnett*	BGrimes
DATE	12/13/94	12/13/94	12/15/94	12/12/94	12/29/94

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OFFICE	OECB:DOPS	ADM:PUB	TERB:DOTS	SC/TERB:DOTS	C/TERB:DOTS
NAME	PWen PCW	M. MEJAC	JWigginton	REmch RZC	CMiller Cn
DATE	12/06/94	12/16/94	12/16/94	12/16/94	12/16/94

OFFICE	IMOB:NMSS	FCOB:NMSS	D/ONDD:DOPS	SC/OECB:DOPS
NAME	KRamsey Zmr	JRoth	SWeiss	EGoodwin
DATE	12/12/94	1/12/94	1/1994	1/1994

OFFICE	TA/OECB:DOPS	C/OECB:DOPS	D/FCSS:NMSS	D/DOPS
NAME	RKiesel	AChaffee	RBurnett	BGrimes
DATE	1/1994	1/1994	12/12/94	1/1994

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