February 14, 2000

KNOWN IN-SERVICE FAILURES OF NGV CYLINDERS (Since 1976)
EX POWERTEC LABS/CAN (additions after 2/99 from NGVC)

Date	Place of Failure	No. of Failures	Producer	Cylinder Type	Source of Data	Cause of Failure
2000 Feb 5	Montreal, PQ Canada	1	Faber	Type 1	FuelMaker	Overpressurization caused by failure of FuelMaker CP3 pressure relief system.
1999 Oct 31	Toronto, ON Canada Enbridge/Consumers Gas Dodge B Van	one	Comdyne	Type 3	MGVC, PowerTech	Acid from inside Dodge Van leaking thru access door in van floor causing stress corrosion cracking of cyl.
1999 Feb	Lyons, France	one	?	steel	Ecole des Mines de Douai	rupture due to vehicle tire (vandalism) - no PRD, one fireman killed
1998 Mar	Argentina	one	Kalvanco	Uncoated E-glass fully-wrapped aluminum liner	Enargas	SCC rupture during filling
1998 Feb	Argentina	one	Kalvanco	Uncoated E-glass fully-wrapped aluminum liner	Powertech	SCC leak during filling
1997 Nov	Argentina	one	Kalvanco	Uncoated E-glass fully-wrapped aluminum liner	Kalvanco	SCC rupture during filling
1997 Feb	Winnipeg (New Fl er)	multiple	Lincoln	Hybrid fiber all-composite	Lincoln	Weld leaks caused by low temperature fast filling
1997 June 20	Los Angeles	one	Comdyne	Coated E-glass fully-wrapped aluminum liner	SoCal	UA vehicle (coated UA grey), ruptured 12" in from transition during filling
1997	North America	multiple	EDO	Carbon fiber all-composite	Powertech	leaks caused by plastic liner cracks
1996 Aug	Pennsylvania	one	EDO	Carbon fiber all-composite	CATA (Colton)	Puncture of roof cylinder which struck overpass
1996	North America	multiple	EDO	Carbon fiber all-composite	EDO	leaks caused by liner seals
1996	Argentina	one	Kalvanco	Uncoated E-glass fully-wrapped aluminum liner	Instituto del Gas Argentino	SCC rupture during filling
1996	USA (Los Angeles MTA)	one	EDO	Carbon fiber all-composite	EDO	rupture - likely stress rupture of composite due to impact damage
1996	Canada (private conversion - Surrey)	one	Faber	Steel	Powertech Report	rupture in fire caused by vandalism - PRD located in separate compartment from cylinder
1996	USA (private conversion - Houston)	one	Comdyne	Uncoated E-glass fully-wrapped aluminum liner	Cyltek	rupture sometime after filling - likely SCC of glass composite (under investigation)
1996	USA (Alagasco - Alabama)	one	CNG Cylinder	Uncoated E-glass hoop-wrapped aluminum liner	NGV Systems & Cyltek	rupture of composite damaged cylinder - likely overpressured from slow filling (under investigation)
1996	US.4 (New Flyer Buses - Grand Forks)	multiple	Lincoln	Hybrid fiber all-composite	New Flyer	leaks in plastic liners due to combination of operating practices

1995	USA	multiple	EDO	Carbon fiber all-composite	EDO recall Notice	leaks in plastic liner/end boss connections due to improper installation

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1991	USA (Las Vegas)	multiple	Lincoln	Hybrid fiber all-composite	Lincoln	leaks in plastic liner. several due to flawed fusion welds
1994	Canada (Union Gas)	one	EDO	Carbon fiber all-composite	Powertech Report	leak of plastic liner due to manufacturing defect at neck
1994	USA (Minnegasco & PG&E)	two	Comdyne	Uncoated E-glass fully-wrapped aluminum liner	SWRI Report	rupture due to environmentally assisted cracking of glass fibres
1993	USA (SE Michigan Gas)	one	CNG Cylinder	Uncoated E-glass fully-wrapped aluminum liner	Powertech Report	rupture due to severe mechanical damage of glass fibre (and possible overfill)
1993	Italy	one	Faber	Steel	Faber	ruptured in fire after vehicle collision (no PRD)
1992	Italy	one	Faber	Steel	Faber	ruptured in vehicle fire caused by vandalism (no PRD)
1991	Italy	multiple	Bogap	Steel	Faber & SNAM	ruptures due to poor heat treatment
1989	Argentina	one	Bogap	Steel	Inflex	rupture due to poor heat treatment
?	Argentina	two	Inflex	Steel	Inflex	ruptured in vehicle fire (PRD had been altered)
1989	New Zealand	one	IMZ	Steel	DSIR Report	rupture due to improper heat treatment
1985	Italy	one	Faber	Steel	Faber	rupture due to lamination in sidewall
1976	Italy	one	Faber	Steel	Faber	rupture due to lamination in sidewall