



U.S. Department
of Transportation

**National Highway
Traffic Safety
Administration**

400 Seventh Street, S.W.
Washington, D.C. 20590

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Thank you for choosing crash data from the National Highway Traffic Safety Administration (NHTSA) for your research or other use. The information contained in this motor vehicle crash report is collected, maintained and distributed in accordance with Public Law 89-564. In accordance with this Public Law, NHTSA is required not to release any case information until completion of quality control procedures. These procedures include a review of the case material to extract all names, licenses and registration numbers, non-coded interview material, non-research related researcher comments in the margins, non-factual data, and the production number portion of the vehicle identification number (VIN).

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*** **



AUTO SAFETY HOTLINE
(800) 424-9393
Wash. D.C. Area 366-0123

TRANSPORTATION RESEARCH CENTER

**Indiana University
Bloomington, Indiana 47403-1599**

**REMOTE ALLEGED SAFETY-RELATED
DEFECT REPORT**

**CASE NO. - 94-19
FLEET - PUBLIC TRANSIT VEHICLE
LOCATION
INCIDENT DATE 1994**

Submitted By:

**Senior Staff Associate
1995**

Contract Number:

Prepared for:

**U.S. Department of Transportation
National Highway Traffic Safety Administration
National Center for Statistics and Analysis
Washington, D.C. 20590**

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The crash investigation process is an inexact science which requires that physical evidence such as skid marks, vehicular damage measurements, and occupant contact points be coupled with the investigator's expert knowledge and experience of vehicle dynamics and occupant kinematics in order to determine the pre-crash, crash, and post-crash movements of involved vehicles and occupants.

Because each crash is a unique sequence of events, generalized conclusions cannot be made concerning the crashworthiness performance of the involved vehicle(s) or their safety systems.

1. Report No. TRC/IU Case No. 94-19		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle Remote Alleged Safety-Related Defect Report Public Transit Vehicle Location				5. Report Date 1995	
				6. Performing Organization Code	
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12. Sponsoring Agency Name and Address U.S. Department of Transportation (NRD-32) National Highway Traffic Safety Administration National Center for Statistics and Analysis Washington, D.C. 20590				14. Sponsoring Agency Code	
				15. Supplementary Notes Remote alleged safety-related defect investigation involving a 1993 Transportation Manufacturing Corporation Transit Bus, Model RTS08	
16. Abstract This report covers a remote, alleged, safety-related defect investigation that involved the leakage of compressed natural gas (CNG) from a CNG relief valve on a cylinder of a 1993 model transit bus. The leakage occurred during refueling. Based on copies of correspondence between the valve manufacturer and the public transit firm, which this contractor obtained, this contractor learned that the CNG leakage problem involved two components. First, a manufacturing process failure allowed a 4500 p.s.i. "poppet" (i.e., a pressure relief valve) to be installed on the CNG cylinder instead of a 5400 p.s.i. poppet, and second, the fittings to the body(ies) on the pressure relief valves were over-torqued at some point, either during the installation or the production process. The resulting leakage prompted either the replacement of all poppets, or at a minimum, their testing to insure the correct poppet was in place. According to the information provided to this contractor, this defect resulted in over twenty-seven separate incidents throughout North America, none of which reportedly caused any injuries.					
17. Key Words Motor Vehicle Nontraffic Incident Compressed Natural Gas Alleged Safety-Related Defect Gas Cylinder Leakage			18. Distribution Statement General Public		
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TRC/IU REMOTE ALLEGED SAFETY-RELATED DEFECT REPORT

TRC/IU CASE NO. 94-19

FLEET - PUBLIC TRANSIT VEHICLE LOCATION

SUMMARY

This report concerns a motor vehicle incident involving a compressed natural gas (CNG) powered 1993: , model transit bus, occurring on 1994, at in at a transit bus fleet fuel service island located near a city street. This incident is of special interest because: (1) the transit bus was powered by an alternative fuel (i.e., CNG), (2) the potential safety hazard associated with the leakage of compressed natural gas, and (3) the increased useage of alternative fuels in the public and private sector.

During the refueling of the transit bus, a safety-related defect occurred that involved the leakage of compressed natural gas (CNG) from a CNG relief valve on a cylinder of the transit bus.

Based on copies of correspondence between the manufacturer and the public transit firm, which this contractor obtained, this contractor learned that the CNG leakage problem involved two components. First, a manufacturing process failure allowed a 4500 p.s.i. "poppet" (i.e., a pressure relief valve) to be installed on the CNG cylinder instead of a 5400 p.s.i. poppet, and second, the fittings to the body(ies) on the pressure relief valves were over-torqued at some point, either during the installation or the production process.

The resulting leakage prompted either the replacement of all poppets, or at a minimum, their testing to insure the correct poppet was in place. According to the information provided to this contractor, this defect resulted in over twenty-seven seperate incidents throughout North America, none of which reportedly caused any injuries.

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TRC/IU REMOTE ALLEGED SAFETY-RELATED DEFECT REPORT

TRC/IU CASE NO. 94-19

BEST AVAILABLE

**FLEET - PUBLIC TRANSIT VEHICLE
LOCATION -**

INCIDENT DATA

Location/Street: Compressed
next to a City Street

City/Township:

Area/Type: Urban, commercial

Incident Date/Time: 1994 @ 3:00 a.m.

Investigating Police Agency: Fire Department

Incident Type: Transit Bus - fuel leakage

**Occupant Injury Severity
(air bag vehicle):** No Injury (AIS-0)

VEHICLES¹

Case Vehicle¹

Year: 1993

Make:

Model: RTS00

Body Type: Transit bus

V.I.N.: 1TUMDTEA0PR-----¹

Mileage: Unknown

Windshield damage/source: Not applicable

Active Restraints: Unknown

Passive Restraints: None

Fleet: Public transit vehicle

Tow status: Not towed as a result of this incident

¹ This Vehicle Identification Number passed the check digit test.

INCIDENT SEQUENCE (CONTINUED)

valve failures occurred at the Transit Authority's bus refueling station, the valve manufacturer⁴ was able to identify two possible causes for the failures (see Appendix C, letter dated [1994]):

- (1) a manufacturing process failure allowed a 4500 p.s.i. "poppet" (i.e., a pressure relief valve) to be installed on the CNG cylinder instead of a 5400 p.s.i. poppet, and
- (2) the fittings to the body(ies) on the pressure relief valves were over-torqued at some point, either during the installation or the production process.

The Transit Authority indicated⁴ in a letter sent to the manufacturer of the (see Appendix C, letter dated [1994]) that both of the potential reasons for failure cited above by the valve manufacturer were of sufficient likely cause that the manufacturer of the transit buses should agree to have all the pressure relief valves replaced or, at a minimum, tested⁶ to ensure that the correct poppet had been installed and the fittings properly torqued.

After the valve manufacturer inspected the defective internal components (i.e., poppets) from the thermal units (i.e., cylinders) exchanged with the Transit Authority, the valve manufacturer determined⁴ (see Appendix D) that besides the units being in poor condition, nine out of ten showed evidence of over-tightening (i.e., excessive torque). Of greater concern to the valve manufacturer was the finding that six of the nine showed evidence of severe excessive torque with some accompanying trigger ball movement. According to the valve manufacturer⁴, any appreciable amount of trigger ball movement results in a weakened trigger which may be susceptible to premature failure under high stress conditions such as simultaneous high pressure and temperature loading. The valve manufacturer pointed out that two of the three pressure relief valve failures were attributed to premature trigger failure, which resulted from over-tightening; the third failure was due to the installation of a lower rated poppet in a higher-rated cylinder.

The valve manufacturer (see Appendix D) also indicated to the manufacturer of the transit buses that they learned that their installer's practice of "tweaking" or "re-adjusting" the pressure relief valves, in order to realign the thermal trigger to a preferred orientation, may have occurred more often than they believed; this practice may have caused a weld failure.

Finally, the valve manufacturer determined⁴ that all the pressure relief valves that this manufacturer supplies, throughout [redacted] need to be replaced and, due to the fact that their spare parts supply was low, they decided that a retrofit campaign was "the way to go". Essentially⁴, the valve manufacturer has set up a schedule with the transit bus manufacturer that will have the Transit Authority take so many buses out of service, replace the defective units, and then return the buses back to service. Eventually,

⁶ The correspondence implies that the testing and/or replacement of the valves on the transit bus manufacturer's buses was to be undertaken by the valve manufacturer.

INCIDENT SEQUENCE (CONTINUED)

all the defective units will be replaced. Until all transit buses are fixed, the
at the Transit Authority intends⁷ to only fill the CNG cylinders
two-thirds full, hopefully preventing any further failures. As of this report⁷, there have
been no other failures, and the retrofiting is scheduled to be completed within the next
three to five months.

⁷ This statement is based on our telephone conversation with this individual.

Appendix A:

**REPORT OF THE
FIRE DEPARTMENT HAZARDOUS MATERIALS ENGINEER**

C A D
FUNCTION => (A)=ADD (M)=MODIFY

COMPANY (R14) ALARM TYPE HAZMAT
WPB01 AUS INCIDENT # EXP-NUM 0 YR 94 ALRM TM
TIME ON SCENE 1525 TIME CLEAR 1552 ZIP-CODE 0000 CENSUS TRACT
ADDRESS NO DIR NAME TYPE STREET
OCCU NAME TELE UNKNOWN RM/APT NO N/A
OWNER NAME SAME ADDR: SAME TELE UNKNOWN
METHOD OF ALARM 911 SYSTEM / 7 TYPE OF SITUATION FOUND CNG LEAK 41
ACT-TKN INVESTIGATED 3 BOX SHFT C ALARMS 1 MUTUAL AID RECD: 0 GIVN: 0
NUM FF AT SCENE 025 NUM ENGINES 03 NUM AERIALS 01 NUM OTHER VEHS 05
--- COMPLETE IF FIRE OR CASUALTY *---*
INJURE-FF OTHERS --- FATALITIES-FF OTHERS --- COMPLEX --- 00
FIXED PROP-USE --- / 000 MOBILE PROP TYPE --- / 00
--- ALL IGNITIONS: *---*
AREA FIRE ORGN --- / 00 LEV OF ORGN --- / 0 TERM-STAGE --- / 0
EQUIP INVOL IN IGNIT --- 00 FORM OF HEAT OF IGNIT. --- 00
TYPE MAT.IGN --- 00 FORM MAT IGN --- 00 IGN. FAC --- 00
F4=PAGE FORWARD F5=PAGE BACK SEND=UPDATE
P S W 3
C A D
TEXTFIRS INFORMATION - PAGE 2 92

--- FOR STRUCTURE FIRE ONLY: *---*
STRUC-TYPE --- CONSTR-TYPE --- CONSTR-METHOD ---
EXT-FLAME DAMAGE --- EXT-SMOKE DAMAGE ---
EXT-WATER DAMAGE --- FIRE-CONTR DAMAGE ---
DETECTOR WORK? --- SPRINKLER WORK? ---
FLAME SPREAD BEYOND ROOM OF ORIGIN(MAT.WITH MOST FLAME) ---
SMOKE SPREAD BEYOND ROOM OF ORIGIN(MAT.WITH MOST SMOKE) ---
AVE OF FLAME TRAVEL --- AVE OF SMOKE TRAVEL ---
--- ALL FIRES: *---*
METHOD OF EXTINGUISHMENT --- \$\$ LOSS ---
PROP. DAMAGE CLASS --- TIME FROM ALARM TO AGENT APPL. ---
--- ALL INCIDENTS: *---*
OFFICER IN CHARGE: RANK: CAPT. TEX-FIRS:
REPORTED BY (IF DIFF.) --- TXFR# --- DATE: 94
MOBILE PROP YEAR MAKE MODEL ---
SERIAL NUMBER --- LIC NUMBER ---
EQ-INV-IGNT YR MK MD SR --- VLT ---
F4=PAGE FORWARD F5=PAGE BACK SEND=UPDATE
P S W 3
C A D
TEXTFIRS INFORMATION - PAGE 3 94

NARRATIVE: RELIEF VALVE ON SIXTY POUND COMPRESSED NATURAL GAS CYLINDER
RELEASED CONTENTS OF CYLINDER WHILE BEING REFILLED AT REFUELING STATION.
THIS SET OFF SEVERAL PREMISE ALARMS AT THE REFUELING STATION. GAS
QUICKLY DISAPATED. THERE WERE NO INJURIES AND NO DAMAGE.

Appendix B:

REPORT FILED WITH THE

(LP) DIVISION

OF THE

LP-Gas Division

Tel. No. _____
Emergency No.: _____

RRC USE ONLY	
Postmark Date	_____
File Number	_____
District Number	_____

REPORT OF LP-GAS/CNG INCIDENT - ACCIDENT

INSTRUCTIONS: Section 9.61 of the LP-Gas Safety Rules and Section 13.36 of the Regulations for Compressed Natural Gas require this report to be filed within 14 days from the date the incident/accident was initially reported to the _____ This report must be signed by an official representative of the licensee reporting and filing the report. Please type or print in black ink for microfilming purposes

PART A Licensee Reporting LPG CNG (Mark applicable box)

1. COMPANY NAME: _____
2. PRINCIPAL BUSINESS ADDRESS: _____
3. LPG ON PREMISES VEHICLE WHERE INCIDENT/ACCIDENT OCCURRED 4. CNG ON PREMISES VEHICLE WHERE INCIDENT/ACCIDENT OCCURRED

PART B Incident Accident - Identification Information

1. NAME OF ENTITY INVOLVED: _____
2. FULL MAILING ADDRESS: _____
3. DATE OCCURRED: Month _____ Year 1994 Time: (24 hr. clock) _____ Unknown
4. LOCATION OF INCIDENT/ACCIDENT
 - a) In State _____ (city, county) _____
 - b) Out of State _____

c) Identify Physical Location _____ **Fleet Fuel Service Island UHue**

5. DRIVER/LICENSEE INFORMATION: (give nearest mile marker, highway, street, or intersection)

- a) Driver's full name, who last serviced container: _____ SSN: N/A
- b) Driver's full name, if involving LPG/CNG transport or bobtail registered with the commission: _____ SSN: N/A
- c) Licensee name servicing/owning container: _____ License Number: _____

PART C Deaths/Injuries (If multiple deaths or injuries continue on separate sheet)

1. TOTAL FATALITIES 0 a) Licensee employee(s) 0 b) non-employee(s) 0
2. NAME: _____ (age) _____ and (SSN): _____ *if licensee employee*
3. TOTAL INJURIES 0 a) Licensee employee(s) 0 b) non-employee(s) 0
4. NAME: _____ (age) _____ and (SSN): _____ *if licensee employee*

PART D Type of Installation/Equipment (Check any which apply)

- | LPG | | CNG | |
|---|--|--|---|
| <input type="checkbox"/> (AGRL) Agricultural | <input type="checkbox"/> (FMCT) Farm Cart | <input type="checkbox"/> (PUBL) Public Facility | <input type="checkbox"/> (CGCC) CNG Pl. Compressor Storage |
| <input type="checkbox"/> (B) Bobtail | <input type="checkbox"/> (HECC) Health Care Center | <input type="checkbox"/> (PVCP) Private Cyl. Filling Plant | <input type="checkbox"/> (CGCV) CNG Commercial Vehicle |
| <input type="checkbox"/> (BS) Bulk Storage | <input type="checkbox"/> (INFL) Industrial Forklift | <input type="checkbox"/> (PVTR) Private Trans. Only | <input type="checkbox"/> (CGDS) CNG Pvt. Dispenser System |
| <input type="checkbox"/> (CEXR) Cylinder Exchange Rack | <input type="checkbox"/> (LOAD) Loading Rack | <input type="checkbox"/> (RECV) Recreational Vehicle | <input type="checkbox"/> (CGGT) CNG Government Trans |
| <input type="checkbox"/> (CFP) Cylinder Filling Plant | <input type="checkbox"/> (MAHO) Manufactured Housing | <input type="checkbox"/> (RES) Residence | <input type="checkbox"/> (CGLC) CNG Lic. Compressor Storage |
| <input type="checkbox"/> (CFSS) Cyl. Filling/Service Sta. | <input type="checkbox"/> (MBLV) Mobile Fuel Vehicle | <input type="checkbox"/> (SBS) School Bus | <input type="checkbox"/> (CGLS) CNG Lic. Dispenser System |
| <input type="checkbox"/> (COMM) Commercial | <input type="checkbox"/> (MHSO) Mobil Home Subdivision | <input type="checkbox"/> (SCHL) School | <input type="checkbox"/> (CGPT) CNG Public Transportation |
| <input type="checkbox"/> (CVTR) Commercial Veh. Trans. | <input type="checkbox"/> (PBTR) Public Transportation | <input type="checkbox"/> (SS) Service Station Only | <input type="checkbox"/> (CGPV) CNG Private Vehicle |
| <input type="checkbox"/> (EMSB) Emergency Stand-By | <input type="checkbox"/> (PMMP) Private Motor Fuel Storage | <input type="checkbox"/> (T) Transport | <input type="checkbox"/> (CGSB) CNG School Bus |
| | | | <input type="checkbox"/> (CNGT) CNG Transport |
| | <input type="checkbox"/> (GEOT) General/Other _____ | | |

PART E Product Information

1. Specify name of product storage/release: _____ 2. Odorization: a) odorized b) non-odorized
3. If loss of product occurred, give estimated amount equal to or more than 1.0% of gross amount delivered or withdrawn:
 - a) Liquid loss LPG only .. Est. gross gallons _____
 - b) Vapor loss CNG only Est. cubic feet 9035 SCE/65gal.
4. Were bulkheads/emergency shut-off valves installed? Yes No N/A
5. Did product ignite? Yes No 6. Did explosion occur? Yes No If Yes, explain under PART J

PART F Gas Leak/Origin of Problem (Check any which apply)

- | | | | |
|---|--|---|---|
| <input type="checkbox"/> 001 Pump | <input type="checkbox"/> 007 Low PSI Hose/Line | <input type="checkbox"/> 013 Underground pipe | <input checked="" type="checkbox"/> 019 Pressure relief valve |
| <input type="checkbox"/> 002 Compressor | <input type="checkbox"/> 008 Hose/Metal flex-connector | <input type="checkbox"/> 014 Aboveground pipe | <input type="checkbox"/> 020 Emergency shut-off valve (ESV) |
| <input type="checkbox"/> 003 Vaporizer | <input type="checkbox"/> 009 Break away coupling | <input type="checkbox"/> 015 Appliance control | <input type="checkbox"/> 021 Filter valve in tank |
| <input type="checkbox"/> 004 Gas Meter | <input type="checkbox"/> 010 Gas cock | <input type="checkbox"/> 016 Hose end valve | <input type="checkbox"/> 022 Evacuation/Drain valve |
| <input type="checkbox"/> 005 In-Line Valve | <input type="checkbox"/> 011 Pipe union | <input type="checkbox"/> 017 Tank service valve | <input type="checkbox"/> 023 Gauging device |
| <input type="checkbox"/> 006 High PSI Hose/Line | <input type="checkbox"/> 012 Pipe flare fitting | <input type="checkbox"/> 018 Service regulator | <input type="checkbox"/> 024 Cylinder/tank metal |
| | <input type="checkbox"/> 080 Other _____ | | |

PART G LPG/CNG Container Type/Location/Condition (Check any which apply)

- | | | | |
|---|---|--|--|
| <input checked="" type="checkbox"/> 001 DOT cylinder | <input type="checkbox"/> 006 Bulk size (1,000 W.G. or more) | <input type="checkbox"/> 011 Inside building | <input type="checkbox"/> 016 Container dented |
| <input type="checkbox"/> 002 ASME container | <input type="checkbox"/> 007 Bolt mounted tank | <input type="checkbox"/> 012 Ext. tank corrosion | <input type="checkbox"/> 017 Container scraped |
| <input type="checkbox"/> 003 Aboveground tank | <input type="checkbox"/> 008 Process tank | <input type="checkbox"/> 013 Int. tank corrosion | <input type="checkbox"/> 018 Container hole/fracture |
| <input type="checkbox"/> 004 Underground tank | <input checked="" type="checkbox"/> 009 Vehicle mounted | <input type="checkbox"/> 014 Container culped | <input type="checkbox"/> 019 Broken weld seam |
| <input type="checkbox"/> 005 Domestic size (999 W.G. or less) | <input type="checkbox"/> 010 Outside building | <input type="checkbox"/> 015 Container gauged | <input type="checkbox"/> 020 Container ruptured |

PART H Container Identification/Owner Information (If more than two containers, continue on separate sheet)

Container No. 1

Container No. 2

- Mfg. Name: _____
- Mfg. Ser. No.: _____
- Working Press: _____
- Water Cap.: _____
- Year Built: _____
- If bottling or transport unit, specify RRC LPG Form 4 decal no. _____ RRC CNG Form 1007 decal no. _____ None
- Date tank/cylinder was last serviced with LPG/CNG _____ Gross gallons _____ cubic feet _____ delivered.
- Nameplate damaged/destroyed? Yes No If Yes, indicate which container No. 1 No. 2
- Were container(s) subjected to severe heat impingement or damaged? Yes No If LPG/CNG container(s) are involved in incident/accident or vehicle collision/rollover, attach _____ photograph(s).
Number _____
- If owner of container(s) is different from licensee, give mailing address of tank/cylinder owner below.

(Name) _____ (Address) _____ (City, State) _____ (Zip Code) _____

PART I Suspected Causes (Check any which may have contributed to cause)

- NATURAL FORCE DAMAGE**
 - 001 Lightning
 - 002 Wind force
 - 003 Flooding
 - 004 Freezing weather
- MECHANICAL FORCE DAMAGE**
 - 005 Vehicle collision
 - 007 Rollover during transit
 - 008 Physical abuse/damage during transit
 - 009 Piping damaged by convet. equip.
- MECHANICAL FAILURE**
 - 011 Appl./control malfunction
 - 012 Valve malfunction
 - 013 Regulator malfunction
 - 014 Equip. malfunction
 - 016 Cracked/worn threads
 - 017 Pipe corr./failure
 - 018 Carbon monox. emissions
 - 019 Flex-conn./hose failure
- HUMAN ERROR**
 - 021 Violation of safety rules
 - 022 Improper pressure check
 - 023 Uncapped gas-cock/pipe
 - 024 Improper gas transfer method
 - 025 Violation of traffic laws
 - 026 Pull-away during transfer
 - 027 Overfilled cylinder/tank
 - 028 Improper system installation method
 - 029 Improper operator usage
 - 030 Improper appl. vent
 - 031 Improper tank purge
 - 032 Improper line purge
 - 050 Other _____

PART J Summary of Incident/Accident (Please specify mfg. name, model, date mfg. for any defective LPG/CNG equip. involved in incident/accident.)

pressure relief valve burst disk failed at below rated pressure during
the refueling of coach. Vent loop line blew out of vent manifold line
fittings. Has replaced the pressure relief valve and re-secured the line.
CONTROLS Pressure Relief Valve Device. PN _____ (Failure still under investigation)

PART K Name of Official Submitting Report

I declare under penalties prescribed in Section 116.143 and Section 116.142, Texas Natural Resources Code, this report was prepared by me and the data and facts stated therein are true, correct, and complete to the best of my knowledge.

- Printed name _____
- Date of initial knowledge of incident/accident: (MM-DD-YY) 24
- Authorized signature _____
- Date report completed: (MM-DD-YY) 24

This report is made to comply with the provisions of 16 TAC sections 9.81 and 13.36 and is NOT a determination of responsibility or fault.

Return to:

Page 2

(LPG FORM 20/CNG FORM 1020)

Appendix C:

LETTERS FROM THE TRANSIT AUTHORITY

TO THE

1994

Warranty and Sales Engineering

Dear

Re: Failure of Pressure Relief Valve (Valve)

has had a 3rd Pressure Relief Valve failure in the fleet. An immediate response to resolving this problem needs to be initiated before a serious incident involving a fire or injury occurs. On 1994 the first valve failed on Coach

I contacted to relay this problem on the first failure. His response was less than favorable, so did what we felt prudent at the time.

A second valve failed on Coach on This valve failed in the same manner as the one on Coach I spoke with about these failures when he arrived on the On the I prepared a memo to to address this problem. had left before I had a chance to give him the letter

A third failure has occurred. On a valve failed and the vent manifold line came apart on Coach Since this incident occurred during fueling has reported this problem to the as is required by law. The problem is with the pressure relief valve P/N and the vent manifold connectors failing to hold together when the pressure relief valves fail.

feels there is a need to address this problem at the highest priority and request an immediate response to getting this problem corrected by

Sincerely,

Quality Assurance Specialist

xc:

1994

Re: Failures of Pressure Relief Valves

Dear Mr.

The recent failures of the pressure relief valves has created a very safety sensitive issue for our organization and the community we serve. Regulatory agencies at the State and City level are questioning the safety of the. Consequently, we feel some action must be taken quickly to resolve the problem with the pressure relief valve.

Personnel from Controls have explained to us that they identified 2 possible causes for the valve failures:

- 1) A manufacturing process failure which allowed a 4500 psi "poppet" to be installed versus the 5400 psi poppet.
- 2) Fittings to body(s) on valves were over torqued at some point during the installation/production process.

We believe both potential reasons for failure are sufficient cause to have all valves replaced or at a minimum be tested to ensure the correct poppet parts are installed and the fittings have been correctly torqued.

In view of the fact these coaches are under warranty, we feel it is the responsibility of to develop a course of action, provide replacement valves and supply an adequate labor force to correct this potentially hazardous situation.

A report was due to the
which explained the problem; however, it was submitted
incomplete due to the problem not being resolved
satisfactorily. Consequently, your immediate attention to
this matter in a timely manner is important.

We look forward to your reply and working together to solve
this issue.

Sincerely,

Director of Vehicle Maintenance

XC:

Appendix D:

LETTER FROM THE

TO THE

AND A

LETTER FROM THE

TO THE

Chairman
Commissioner
Commissioner

Director

Fax.

LIQUEFIED PETROLEUM GAS DIVISION
"YOUR SAFETY IS OUR BUSINESS"

1994

MANAGER VEHICLE MAINTENANCE

Subject: Cylinder Relief Valve Failure

Subsequent to our initial conversation, in regard to the subject, I have contacted the relief valve manufacturer and I have discussed the matter with Mr. [redacted] Engineering Manager and [redacted] of [redacted] has since faxed me a copy of his letter to [redacted] indicating the cause of the subject failure and their course of action in the matter.

If you have any questions herewith, please advise.

Sincerely,

PLANS APPROVAL/ACCIDENT SECTION

cc: File

1994

Page -2-

In view of this situation, and given the need to replace the _____ units at our earliest opportunity, we have elected to "break into" our production schedule this week to manufacture approximately 150-175 additional "TMC Style" thermal units. These units will have priority scheduling through our shop, with initial production sub-lots available in about ten (10) days.

The availability of the expanded pool of replacement valves should make it easier to schedule a series of retrofit campaigns at _____. Because of the number of units involved (346 remaining), we will still need to rebuild a number of the returned lock-tightened units on a priority basis in order to keep up with the flow. Thus, we would appreciate your continued cooperation in returning the removed units directly to us as quickly as possible.

Also, per our conversation, I have instructed our Sales Department to make these replacement units available to you or your customers on a no-charge memo billing basis. This is irrespective of the fact that we have still not been paid for all of the original order by your supplier, and our opinion that our shop practices and quality assurance procedures were not responsible for the vast majority of the problems you and your customers are experiencing. As I indicated, _____ Companies have a long established policy of coming to the assistance of customers who, for one reason or another, are having problems - irrespective of all the details as to how the problems occurred or who may have been at fault. Of course, hindsight being 20/20, one could argue that we should have opted for the higher "IP" option initially, but given the trouble we're having disassembling the lock-tightened units, our initial decision is more understandable.

On the broader subject of "bullet-proofing", I believe I mentioned that we are in receipt of two (2) welded thermal units returned (for warranty) from another customer. Concurrently, it has come to our attention that the installer practice of "tweaking" or re-adjusting, to realign the thermal trigger to a preferred orientation may have been more common than earlier believed. Obviously, welded units are not easily tweaked, but a determined effort to do so may lead to weld failure.

In light of this development, we have elected to ratchet the IP factor one more notch. To this end, we have special ordered stainless drive pins. We intend to begin installing the pins as soon as they're available. Thermals that have been configured (drilled) for welding will also be drive-pinned on the opposite hex face. Units not prepared for welding will be double drive-pinned on opposing hex flats. We believe this anchoring process will raise the IP factor to a ten (10) which is roughly equivalent to

1994
Page -3-

"steel jacket bullet proofing".

I have instructed my people to stay in close contact with you as our expanded inventory pool becomes available. And, again, we regret all the inconvenience this problem is causing you and your customers.

Please feel free to contact me if you have any further thoughts or suggestions.

Sincerely,

1994

1954

Confirming our phone conversation last week, we have completed our inspection of the internal components from the thermal units returned (exchanged) from [redacted] and [redacted] and it is apparent that the [redacted] units are generally in much poorer condition than the [redacted] units. Nine (9) out of ten (10) from [redacted] show evidence of "over-torqueing". Of greater concern is the finding that six (6) of nine (9) showed severe "over-torqueing" with some accompanying trigger ball movement. This is potentially serious because any appreciable amount of trigger ball movement results in a "weakened" trigger which we theorize may be susceptible to premature failure under high stress conditions such as simultaneous high pressure and temperature loading.

In contrast, the [redacted] units are generally in excellent condition, although there were several with double sets of internal ball marks, which indicate some re-torqueing has occurred.

Of course, it is always risky to draw conclusions from relatively small sample sizes, but the fact that two (2) of the three (3) [redacted] failures were attributed to premature trigger failure resulting from over-torqueing (the third was traced to factory installation of a lower pressure rated [redacted] poppet), coupled with the information that the [redacted] valve/tank systems were assembled via a different route from [redacted] systems, would lead us to conclude that there is a strong possibility that the conditions we observed on the single bus set would be pervasive throughout the [redacted] fleet.

Given this background, it would normally be our recommendation that priority be given to exchanging the older design lock-tightened units at [redacted] with our new welded model (with the higher "IP" factor). However, given the fact that the [redacted] exchange is already proceeding, and is essentially tying up all of our over-run inventory, this does not seem to be an available option. To complicate the situation further, we are experiencing a fair amount of difficulty disassembling the lock-tightened returned units and, as a result, the "casualty rate" is slowly eating up our meager supply of spare parts.