Annual Report on Liquefied Petroleum Gas (LPG) Related Accidents

(2012 version)

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1. Introduction

This Annual Report contains accidents that occurred in 2012 related to facilities for supplies and consumptions of LPG at home or on business, which are regulated by the Act on the Securing of Safety and the Optimization of Transaction of Liquefied Petroleum Gas (hereinafter, the "LPG Act"). This report also contains analyze the data of the accidents in 2012 by comparing with those in the last nine years (2003 to 2011).

2. Definitions

2.1 Definition of accidents

(1) LPG accidents

[1] Leakage — A case in which liquefied petroleum gas (hereinafter, "LPG") leaked, but it did not catch fire and cause human damages such as poisoning and asphyxiation. However, in this report, leakage of a very little amount of LPG from joints as little as soap bubbles formed when those of threaded parts or rubber tubes are soaked by soap water is excluded.

[2] Leakage and explosion — Cases in which LPG leaked, and it resulted in an explosion or a fire caused by the explosion, as follows.

A. Leakage and explosion, when the explosion resulted from leaked gas only.

B. Leakage, explosion and fire, when a fire broke out following explosion caused by leaked gas.

[3] Leakage and fire — A case in which a fire that is not limited to that recognized as a fire by the fire department resulted from leakage of LPG excluding those covered by [2] above. Here, a fire without leakage, which is caused by the overheating or the failure of LPG appliances including their accessories or by spreading of flames from a cooking oven, grill, etc., is not classified as a LPG accident.

[4] Poisoning and asphyxiation — A case in which human damages of CO poisoning and asphyxiation are caused due to incomplete combustion, leakage of LPG, or leakage of exhaust gas from exhaust pipes, etc., at LPG consumption facilities.

(2) Other accidents (not classified as LPG accidents)

[1] Accidents caused by suicide, damage by intention, mischief, theft, or other similar causes

[2] Accidents resulting from a natural disaster

Example) Accidents caused by facilities' damages resulting from collapse of houses due to earthquake

Example) Accidents caused by facilities' damages resulting from flood and landslide

Even if accidents are resulted from natural disasters, however, those caused by defects in toppling prevention measures, fallen snow prevention measures (snow shelters, protective boards), or other insufficiencies in safety measures, are classified as LPG accidents.

[3] Accidents involving portable cooking stoves and gas cartridges

[4] Other accidents not categorized in the LPG accidents of (1) above

2.2 Classification of human damages

Classified as follows according to the level of damage.

Death: when a person was confirmed to have died within about five days from the time of accident

Seriously injured: when a person suffered an injury at the time of accident that took 30 days or more for full recovery

Slightly injured: when a person suffered an injury at the time of accident that took less than 30 days for full recovery

3. LPG accidents

3.1 Occurrences of accidents in the past

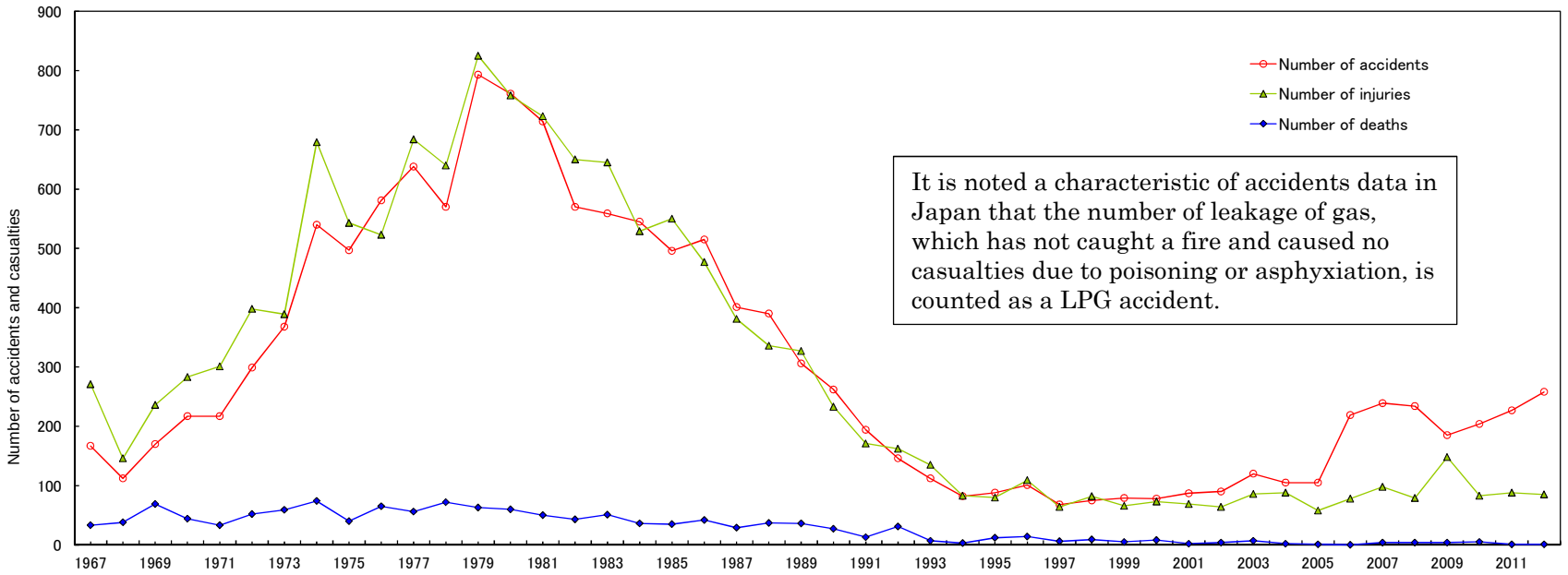

Figure 1: Accident occurrences and casualties by year

Table 1: Change in the number of accidents and casualties by year

Year	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Number of accidents	167	112	170	217	217	299	368	540	497	581	638	570	793	761	714	570	559	545	496	515	401	390	306	262	194	146	112	82	88	101	68	75	79	78	87	90	120	105	105	219	239	234	185	204	227	258
Rate to the previous year	34	▲33	52	28	0	38	23	47	▲8	17	10	▲11	28	▲4	▲6	▲20	▲2	▲3	▲9	4	▲22	▲3	▲22	▲14	▲26	▲25	▲23	▲27	7	15	▲33	10	5	▲2	12	3	33	▲13	0	109	9	▲2	▲21	10	11	12
Number of deaths	33	38	69	44	33	52	59	74	40	65	56	72	63	60	50	43	51	36	35	42	29	37	36	27	13	31	7	3	12	14	6	9	5	8	2	4	7	2	1	0	4	4	4	5	1	1
Number of injuries	271	146	236	283	301	398	389	679	543	523	684	640	825	758	723	650	645	529	550	477	381	336	327	233	171	162	135	83	80	109	64	82	66	73	69	64	86	88	58	78	98	79	148	83	88	85

Figure 1 shows the number of accidents that occurred between 1962 and 2012 and the resulting casualties. Looking at the data by decade, the number of accidents increased gradually during the 1960s along with the increase in LPG consumption and diversification of users.

In the 1970s, the number of accidents continued increasing along with the number of households using LPG and reached a peak in 1979 with 793 accidents, causing 63 casualties. This was the year that marked the highest number of casualties, at a level similar to that of 1974.

Soon after entering the 1980s, a large-scale city gas explosion took place that resulted in enormous human damages marked by 15 deaths and 222 seriously and slightly injured persons. The number of accidents was 761 that year. The number of accidents peaked out this year and started showing a downward tendency, reducing greatly to 570 in 1982.

Thereafter, the number of accidents continued declining linearly from the late 1980s, falling below 100 in 1994, to 82.

The year 1997 saw the lowest number of accidents (68) since enactment of the LPG Act. In the 2000s, the number of accidents remained above 100 until 2012, although the number of deaths has been on the decrease.

3.2 Accident situations by phenomenon

The numbers of accidents by phenomenon in the past decade are shown below.

Table2: Number of accidents by phenomenon

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Leakage	34	41	46	137	113	115	84	76	116	155
Leakage and explosion (Fire)	75	56	46	70	64	53	45	60	55	48
Leakage and fire (Excluding explosion)	2	1	2	6	51	60	42	60	45	44
CO poisoning and asphyxiation	9	7	11	6	11	6	14	8	11	8
Total	120	105	105	219	239	234	185	204	227	255

- Number of accidents by phenomenon

  Looking at the accidents that occurred in 2012, the number of leakage-only accidents was 155, showing an increase of 39 from the previous year. On the other hand, the number of leakage and explosion (fire) accidents was 48, a drop of seven from the previous year. Furthermore, the number of leakage and fire accidents (excluding explosion) and the number of CO poisoning and asphyxiation accidents have continued decreasing slightly.

  Overall, the number of leakage accidents has increased in recent years while that of explosion caused by leakage has declined.

  However, the total number of accidents has increased, although slightly.

  Table 3: Number of CO poisoning accidents (excluding asphyxiation) by year and casualties

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Number of Accidents	9	6	10	5	11	6	14	8	10	8
Of the above, the number of Class B or highr class accidents	4	1	1	0	3	2	6	3	3	2
Number of deaths	4	0	1	0	2	2	3	3	1	1
Number of injuries	17	21	22	13	29	8	85	16	32	37
Of the above, the number of Class B or highr class accidents	1	7	0	0	9	0	65	7	16	23

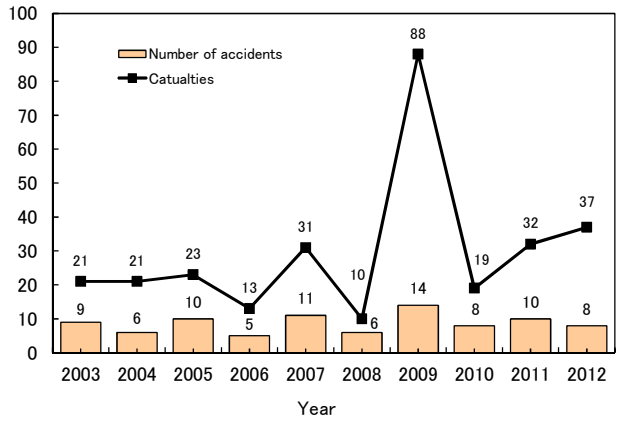

Figure 2: Number of CO poisoning accidents by year and casualties

Observing the change in the number of CO poisoning accidents that occurred between 2003 and 2012 and the accompanying casualties both remained at steady levels. However, the number of casualties increased to 88 in 2009.

The increase is attributed to the large number of casualties per accident.

Table 4: Number of buried pipes accidents by year and casualties

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Number of Accidents	4	12	12	17	21	31	24	18	18	15
Of the above, the number of Class B or highr class accidents	0	1	0	1	0	0	0	0	0	0
Number of deaths	0	1	0	0	0	0	0	0	0	0
Number of injuries	1	4	6	3	1	2	0	2	0	0
Of the above, the number of Class B or highr class accidents	0	0	0	2	0	0	0	0	0	0

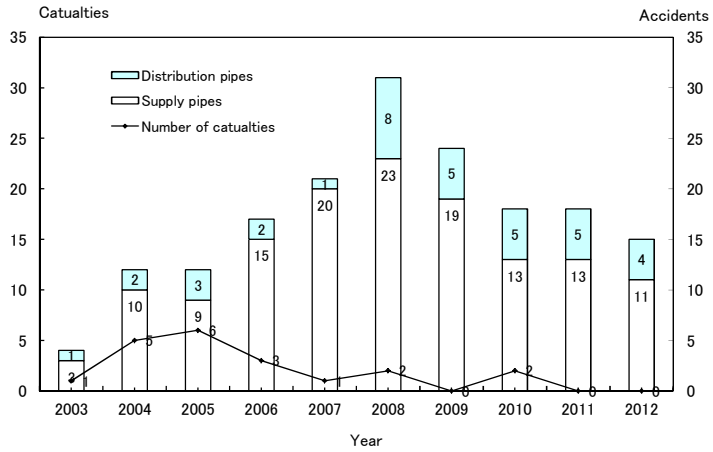

Figure 3: Number of buried pipes accidents by year and casualties

Observing changes in the both number of buried pipes accidents that occurred between 2003 and 2012 and casualties, it is shown that there have been no casualties since 2011. On the other hand, the number of accidents peaked in 2008 and has continued decreasing just slightly since then.

A large number of supply pipes accidents have taken place each year, mainly resulting from damages and deterioration due to corrosion.

4. Analysis of accident situations

The following kinds of LPG accidents that have occurred frequently were analyzed.

(1) CO poisoning accidents

As shown in Table 3 and Figure 2, eight CO poisoning accidents occurred in 2012, showing a decrease of two from the previous year. Two of eight were Class B accidents, resulting one fewer than in the previous year. The breakdown of eight accidents is shown below.

[1] Accident caused by use of compact water heater that is not equipped with an incomplete combustion prevention device in an unventilated room

[2] Accident caused by use of commercial floor mounted heater whose adjusted pressure was abnormal due to clog in the equipment

[3] Accident caused by inappropriate ventilation because the exhaust port of a noodle cooker was covered by a pot

*A noodle cooker is a device for boiling noodles

[4] Accident caused by use of noodle cooker in an unventilated kitchen

[5] Accident caused by use of commercial oven in an unventilated kitchen

[6] Accident caused by use of commercial dish washing machine in an unventilated school kitchen

[7] Accident caused by use of commercial oven in a kitchen with a ventilation port clogged by dirt

[8] Accident caused by inadequate ventilation due to a bird's nest built inside a ventilation pipe of a forced exhaust (FE) instant gas water heater

*FE refers to combustion devices that take in the air inside a room and discharge exhaust outdoor by force. A typical example is an instant gas water heater.

(2) Buried pipes accidents

Table 4 and Figure 3 show that 15 accidents involving buried pipes took place in 2012, a drop of three from the previous year. Eleven of fifteen accidents involved supply pipes, which was two fewer than in the previous year, and four involved distribution pipes, one fewer than the previous year. Accidents of Class B or higher classes did not occur. (Between 2003 and 2012, only two accidents of Class B or higher classes occurred; see Table 4)

Causes of accidents include damages in nine accidents (supply pipes in seven accidents and distribution pipes in two accidents) and deterioration due to corrosion in six accidents (supply pipes in four accidents and distribution pipes in two accidents).

(3) Bulk supply accidents

In 2012, 13 accidents involving bulk supply (supply facilities only) occurred, showing an increase of six from the previous year. The 13 accidents were as follows. All accidents were in the bulk storage tank side.

*Bulk supply refers to supply of liquefied petroleum gas into bulk storage tanks from portable LPG generators (bulk tank trucks). (See Figure 4)

[1] Gas leakage from liquid outlet valve (3 accidents)

[2] Gas leakage from equalizing valve (1 accident)

[3] Gas leakage caused by error in detachment of level gauge (1 accident)

[4] Damage to safety valve caused by frozen water content (1 accident)

[5] Gas leakage caused by damage to diaphragm of regulator (1 accident)

[6] Accidents caused by actuation of safety valve of vaporizer (2 accidents)

[7] Damages caused by snow (3 accidents)

[8] Damage to supply facilities due to error by building demolition workers (1 accident)

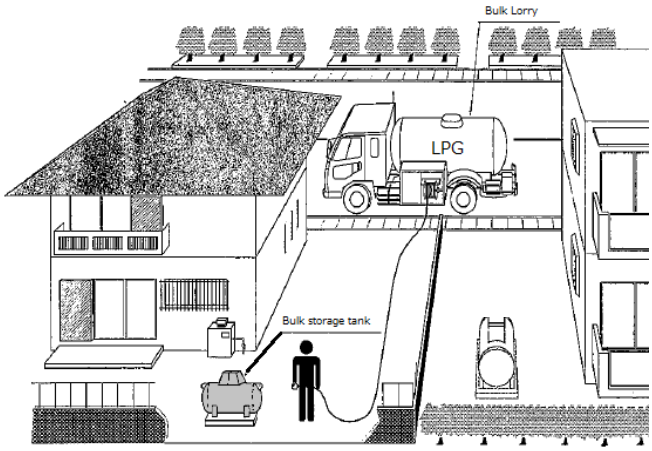

Figure 4: Bulk supply system

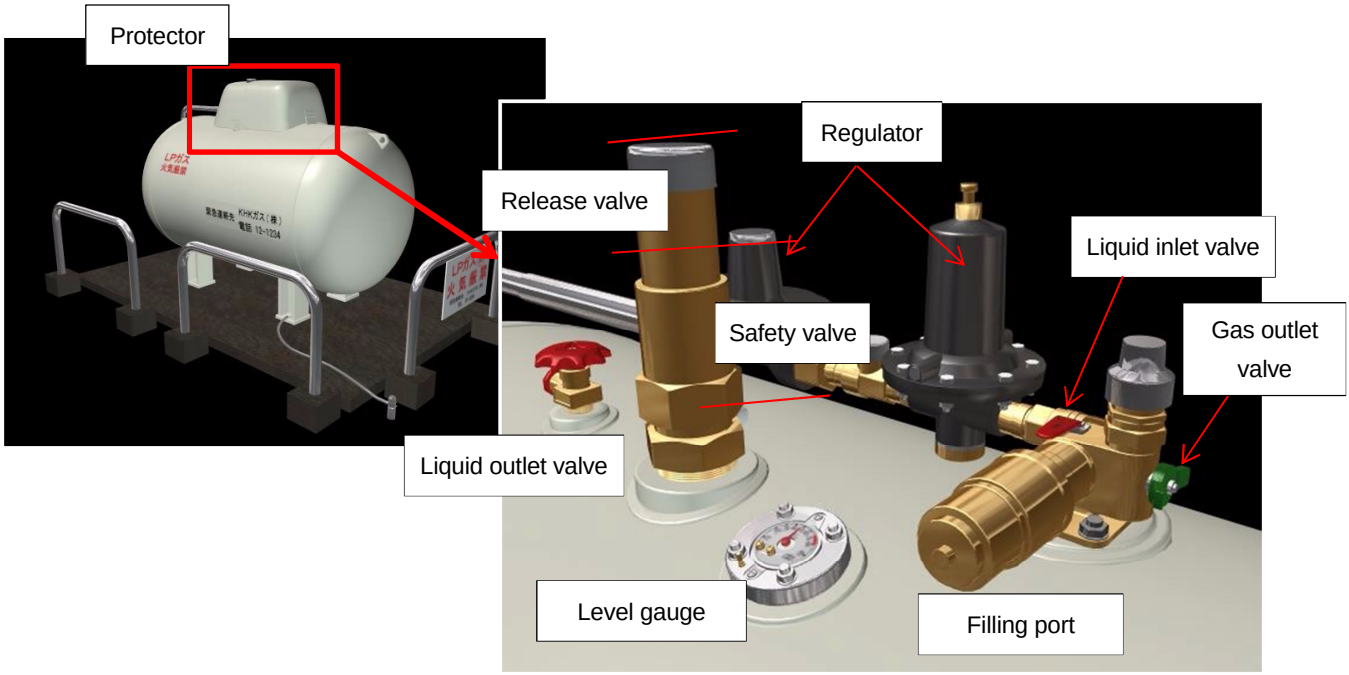

Figure 5: Bulk storage tank

5. Accident classification

When an accident occurs, it is classified as follows according to the degree of loss.

	Contents of loss
Class A	(1) Deaths 5 or more (2) Deaths plus serious injuries 10 or more (3) Casualties (death plus injury) 30 or more (4) Direct property damage 200 million yen or more (5) Any accident affecting the public, or which could have developed into a large scale disaster
Class B	(1) Deaths 1 to 4 (2) Serious injuries 2 to 9 (3) Casualties (injury) 6 to 29 (4) Direct property damage 200 million yen or more (5) Accidents repeatedly occurring at the same works (6) Any accident affecting the public, or which could have developed into a large scale of disaster.
Class C	Other than Classes A and B

6. List of major accidents that occurred in 2012

Accident title	CO poisoning while using compact water heater	CO poisoning while using noodle cooker	Leakage and explosion
Date	February 6	February 21	August 18
Death/ seriously injuries/ minor injuries	1/0/1	0/1/21	0/2/1
Overall toll	2	22	3
Substance name	CO gas	CO gas	LPG
Scale	-	-	-
Primary phenomenon/ secondary phenomenon	CO poisoning/ -	CO poisoning/ -	Under investigation/ -
Situations of handling	While being operated	While being operated	While in a halt
Accident causes (main causes)/ (secondary causes)	Incomplete combustion of LPG appliance/ -	Error in equipment handling/ -	Under investigation/ -
Ignition source	-	-	Under investigation
Accident outline	Two users were found collapsed on the floor of a house attached to a mechanical processing factory, and their relatives alerted the fire department. At the hospital where the two were taken, it was confirmed that one of them died due to CO poisoning and the other one was slightly affected. At the site of the accident, heated water was running from an open-type water heater, and its burner and heat exchanger fins were confirmed to be clogged by soot. Under the circumstances, the cause of the accident is believed to be the room filling with exhaust containing carbon monoxide caused by incomplete combustion of the water heater and non-use of a ventilating fan.	Noodle cookers were being used during a hands-on learning class for Japanese noodle-making, held at a community facility. A total of 22 persons, including 16 high school students, four teachers, and two instructors, complained that they had headaches and felt sick. They were diagnosed with CO poisoning at the hospital where they were taken. The cause of the accident is believed to be the accumulation, in the room, of exhaust containing carbon monoxide, which generated because of incomplete combustion that resulted from blocking of the exhaust port of the noodle cooker by another pan.	An explosion took place at a restaurant after closing, while employees were working inside, causing serious injuries to two persons and minor injuries to one. The cause of the accident is under investigation. It is noted that their gas meter (with a maximum working flow rate of 7 m^3/hour), whose valid period of verification prescribed by the Measurement Act, has expired.

