Annual Report on Liquefied Petroleum Gas (LPG) Related Accidents

(2013 version)

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1. Introduction

This Annual Report contains accidents that occurred in 2013 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 analyses the data of the accidents in 2013 by comparing with those in the last nine years (2004 to 2012).

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

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3. LPG accidents

3.1 Occurrences of accidents in the past

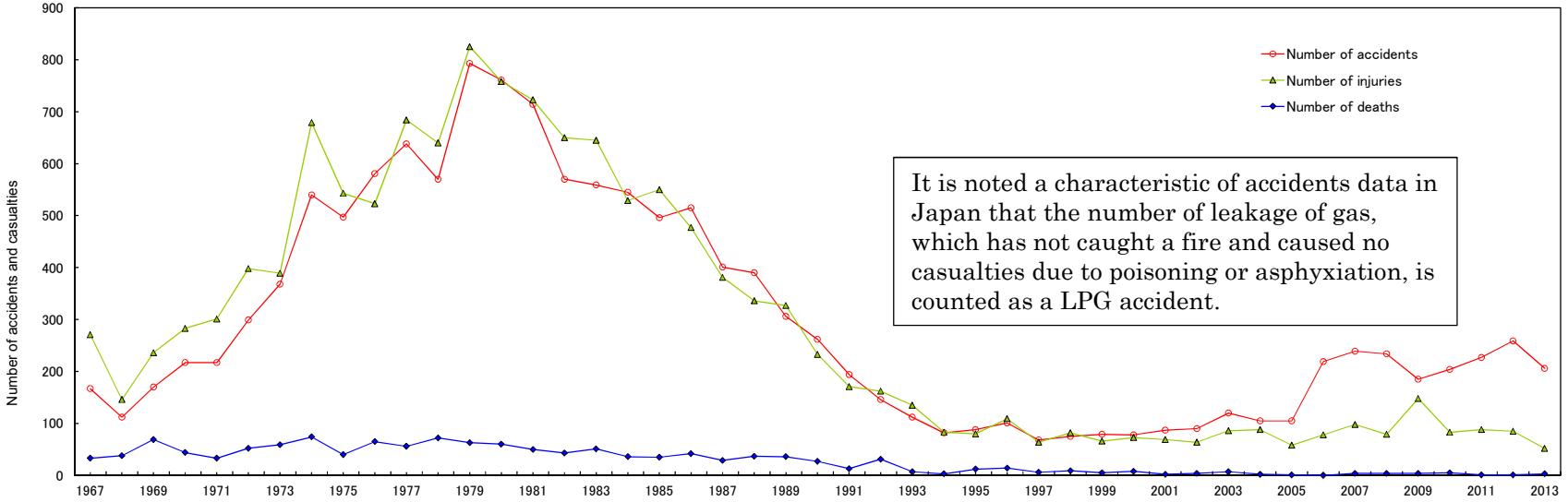

Figure 1: Accident occurrences and casualties by year

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	2013
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	259	206
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	14	▲20
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	3
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	52

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Figure 1 shows the number of accidents that occurred between 1967 and 2013 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 2013, although the number of deaths has been on the decrease.

3.2 Accident situations by phenomenon

Looking at the accident situations by phenomenon that occurred in 2013, the number of leakage-only accidents that did not start fire or explosion were more than half of total accidents. The number of leakage-only accidents was 109, showing a decrease of 50 from the previous year. The number of leakage and explosion (fire) accidents was 48, showing the same number as the previous year. The numbers of accidents by phenomenon in the past decade are shown below.

Table2: Number of accidents by phenomenon

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Leakage	41	46	137	113	115	84	76	116	159	109
Leakage and explosion (Fire)	56	46	70	64	53	45	60	55	48	48
Leakage and fire (Excluding explosion)	1	2	6	51	60	42	60	45	44	43
CO poisoning and asphyxiation	7	11	6	11	6	14	8	11	8	6
Total	105	105	219	239	234	185	204	227	259	206

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, four CO poisoning accidents occurred in 2013, showing a decrease of four from the previous year. Two of four were Class B accidents, resulting the same number as the previous year. The breakdown of four accidents is shown below.

[1] Accident caused by use of commercial oven in an unventilated kitchen (two accidents)

[2] Accident caused by inadequate ventilation of a convection flue (CF) bath heater

*CF refers to ventilation system that takes in the air inside a room and discharge exhaust outdoor through vent by natural ventilation force.

[3] Accident caused by use of commercial dish washing machine in an unventilated dish washing room

Incidentally, the reason why the number of casualties increased to 88 in 2009 was attributed to the large number of casualties per accident in 2013.

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

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Number of Accidents	6	10	5	11	6	14	8	10	8	4
Of the above, the number of Class B or highr class accidents	1	1	0	3	2	6	3	3	2	2
Number of deaths	0	1	0	2	2	3	3	1	1	2
Number of injuries	21	22	13	29	8	85	16	32	37	4
Of the above, the number of Class B or highr class accidents	7	0	0	9	0	65	7	16	23	1

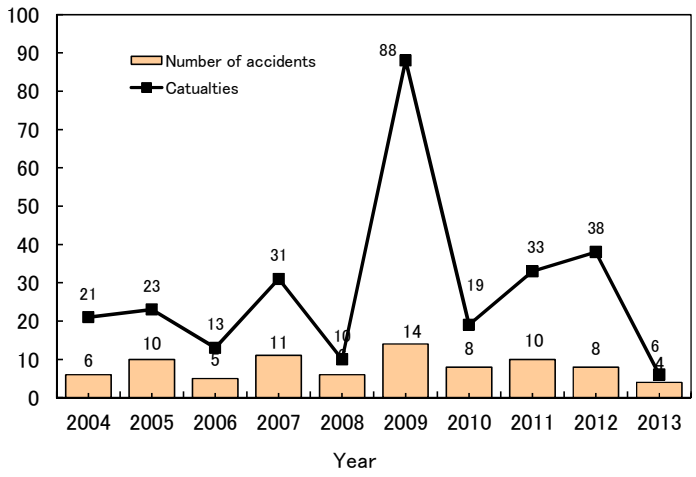

Figure 2: Number of CO poisoning accidents by year and casualties

(2) Buried pipes accidents

The pipes that are installed between LPG cylinders and a gas meter are called supply pipes, and are installed between a gas meter and consumption devices like heaters are called distribution pipes in Japan. Pipes are installed on the ground or underground. The number of supply pipe accidents is greater than distribution pipe accidents.

Table 4 and Figure 3 show that 25 accidents involving buried pipes took place in 2013, an increase of nine from the previous year. 20 out of 25 accidents involved supply pipes, in which eight accidents were increased from the previous year, and the other five accidents involved distribution pipes, in which one accident was increased from the previous year. Then one accident of Class B occurred.

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Causes of accidents include damages in 20 accidents (supply pipes in 18 accidents and distribution pipes in two accidents) and deterioration due to corrosion in four accidents (supply pipes in two accidents and distribution pipes in two accidents).

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

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Number of Accidents	12	12	17	21	31	24	18	18	16	25
Of the above, the number of Class B or highr class accidents	1	0	1	0	0	0	0	0	0	1
Number of deaths	1	0	0	0	0	0	0	0	0	1
Number of injuries	4	6	3	1	2	0	2	0	0	2
Of the above, the number of Class B or highr class accidents	0	0	2	0	0	0	0	0	0	1

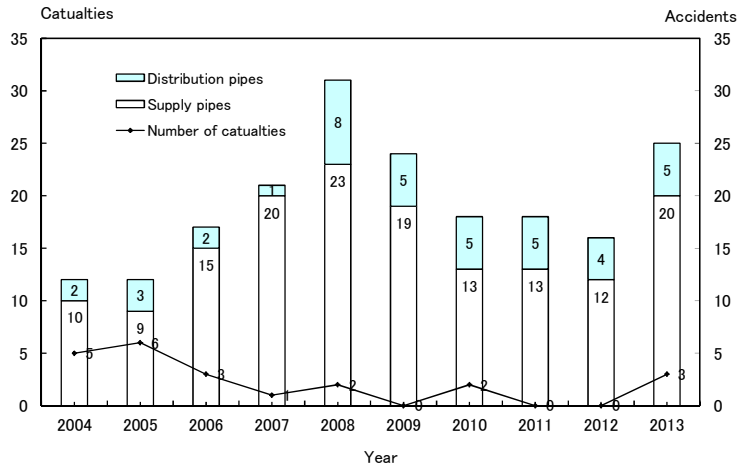

Figure 3: Number of buried pipes accidents by year and casualties

(3) Bulk supply accidents

In 2013, six accidents involving bulk supply (supply facilities only) occurred, showing a decrease of seven from the previous year. The six accidents were as follows.
*Bulk supply refers to supply of liquefied petroleum gas into bulk storage tanks from portable LPG generators (bulk tank trucks). See Figure 4.

[1] Damages caused by snow (two accidents)
[2] Gas leakage caused by error in replacing of regulator
[3] Gas leakage caused by corrosion of supply pipes
[4] Gas leakage from liquid outlet valve
[5] Gas leakage from supply pipes caused by car collision

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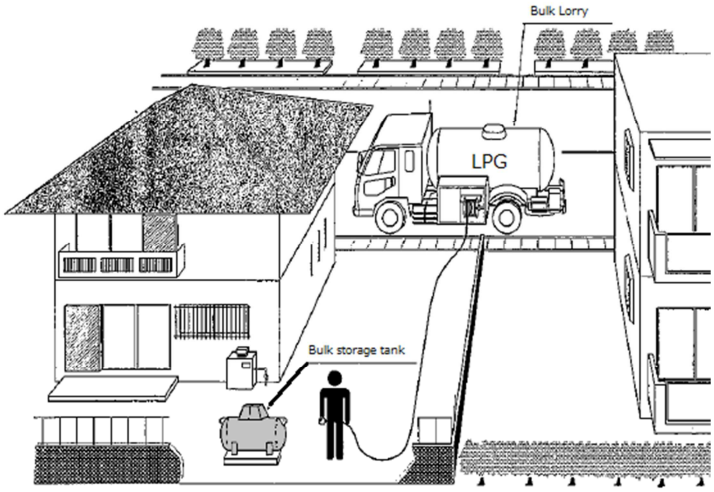

Figure 4: Bulk supply system

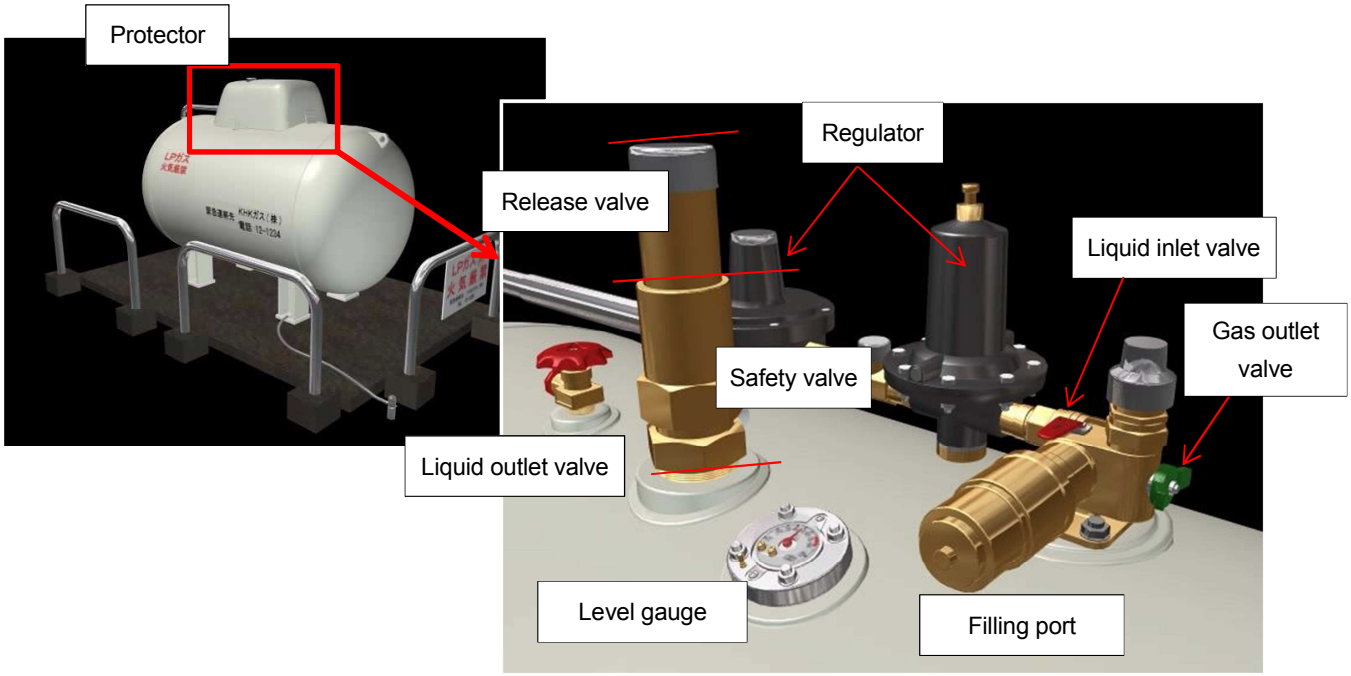

Figure 5: Bulk storage tank

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

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6. List of major accidents that occurred in 2013

Accident title	CO poisoning while using a commercial oven in an unventilated room	CO poisoning caused by inadequate ventilation of a convection flue (CF) bath heater	Gas Leakage and oxygen deficiency caused by damaged buried supply pipes while digging the road
Date	June 12 approx. 15:30	July 5 unknown time	November 16 approx. 9:48
Death/ seriously injuries/ minor injuries	1/0/1	1/0/0	1/0/0
Overall toll	2	1	1
Substance name	CO gas	CO gas	Oxygen deficiency
Scale	-	-	-
Primary phenomenon/ secondary phenomenon	CO poisoning / -	CO poisoning / -	Oxygen deficiency / -
Situations of handling	While being operated	While being operated	While being operated
Accident causes (main causes)/ (secondary causes)	Stagnation of CO gas caused by inappropriate ventilation / -	Incomplete combustion caused by drop of the combustion efficiency/ -	LPG leakage / Oxygen deficiency
Ignition source	-	-	-
Accident outline	It was alerted the fire department that two users were found collapsed on the floor at a bakery. At the hospital where the two were taken, it was confirmed that one of them died due to carbon monoxide poisoning and the other one was slightly affected. At the site of the accident, a commercial oven was used in a room where all windows were closed and a ventilation system was stopped. Under the circumstances, the cause of the accident is believed to be the room filling with exhaust containing carbon monoxide caused by lack of ventilation.	One user died from CO poisoning during taking a bath at an apartment house. The cause of the accident is assumed to be the accumulation, in the room, of exhaust containing carbon monoxide which generated because of incomplete combustion that result from drop of the combustion efficiency by deposit on the heat exchanger of the bath heater. However, details are unknown.	When a contractor was digging on a road to bury new gas pipes (polyethylene pipe) at one meter depth under the ground, he damaged existing buried supply pipes so gas leakage started. He went into the dug hole to stop the gas leakage from the damaged portion and died because of oxygen deficiency at a hospital where he was transported to. At the site of the accident, he damaged buried supply pipes by a power shovel and entered the hole to stop gas leakage without confirmation of gas density of inside the hole. The cause of the accident is oxygen deficiency.

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