Annual Report on High Pressure Gas Related Accidents

(2017 version)

The High Pressure Gas Safety Institute of Japan (KHK)

1. Introduction

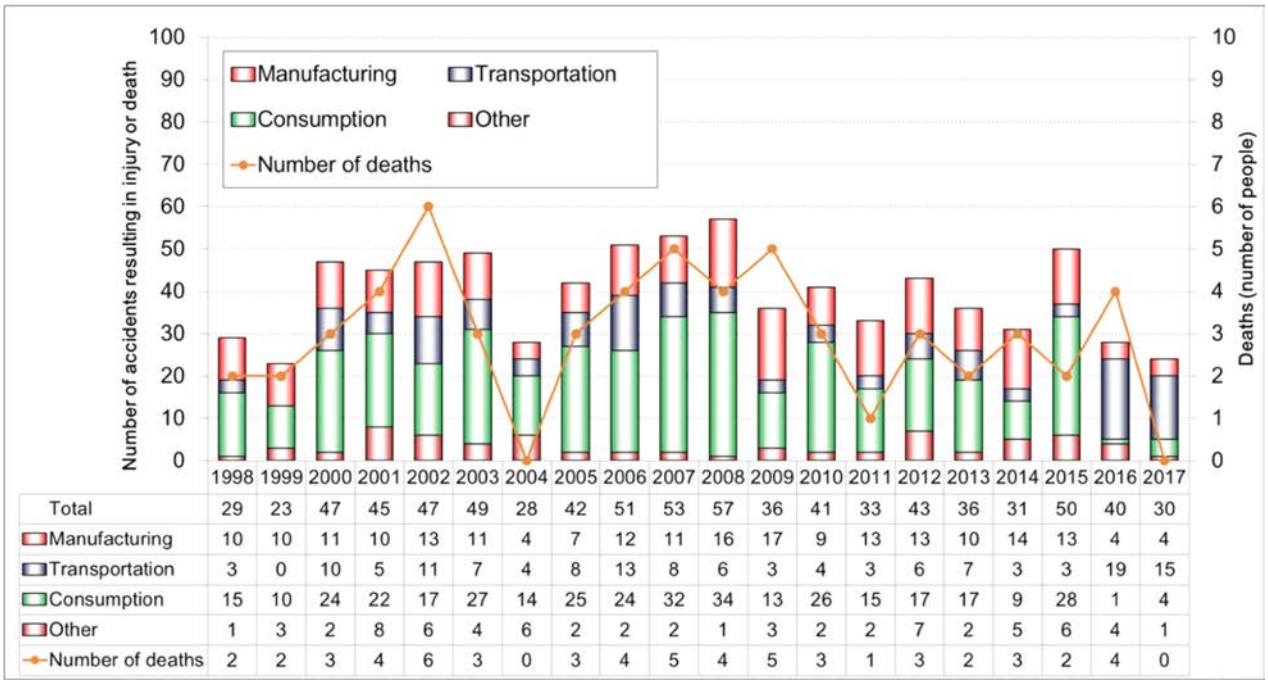
This Annual Report is a compilation of statistics on accidents related to the High Pressure Gas Safety Act that occurred between 1998 and 2017, with a focus on accidents resulting in injury or death, especially those occurred at manufacturing plants for high pressure gas.

Note that among high pressure gas-related accidents, this Annual Report excludes those involving general consumers, which pertain to the Act on the Securing of Safety and the Optimization of Transaction of Liquefied Petroleum Gas.

> About accidents resulting in injury or death
> "Accidents resulting in injury or death" refer to accidents resulting in death, serious injury, or minor injury to a total of one or more people.
> The definitions of death, serious injury, and minor injury are as follows.
> Death: the victim dies within five days of the occurrence of the accident.
> Serious injury: the victim requires at least 30 days for treatment of injuries.
> Minor injury: the victim requires less than 30 days for treatment of injuries.

2. Changes in the numbers of accidents resulting in injury or death and of deaths related to the High Pressure Gas Safety Act

The changes in the numbers of accidents resulting in injury or death and of deaths related to the High Pressure Gas Safety Act between 1998 and 2017 are shown in Fig. 1. Between 23 and 57 accidents resulting in injury or death occur each year, with numbers remaining steady overall. The number of deaths range between one and six people per year.

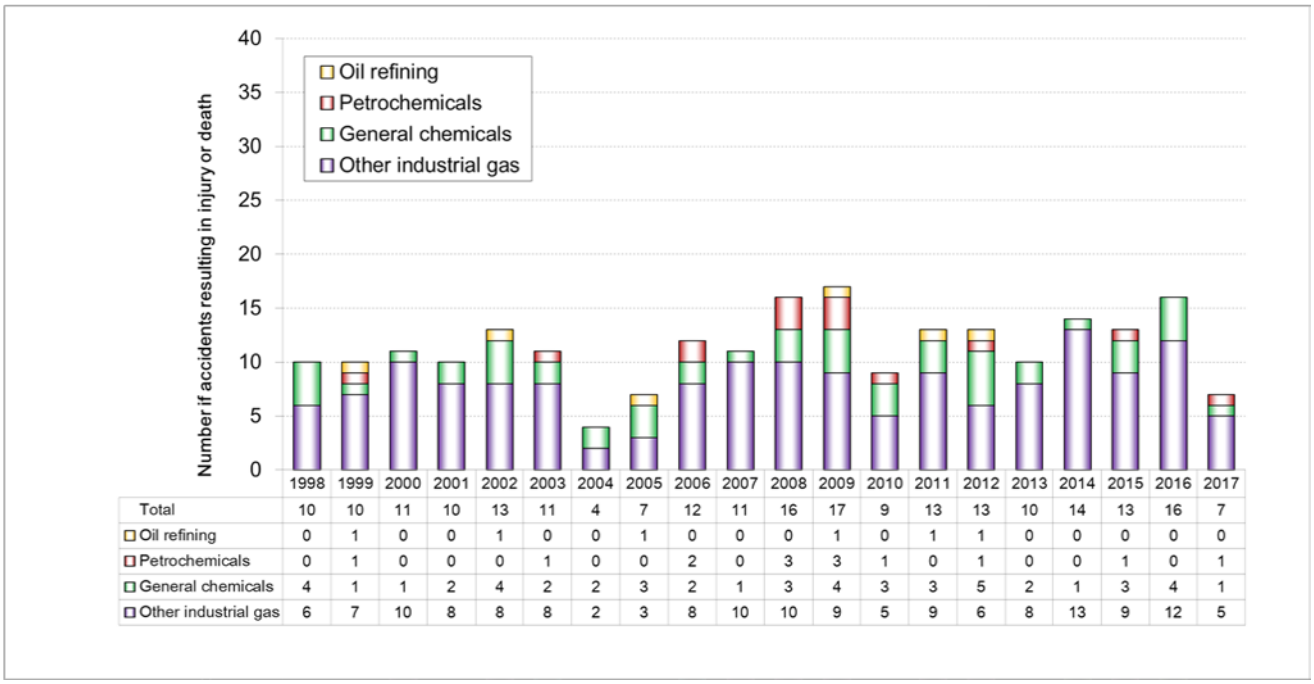


	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total	29	23	47	45	47	49	28	42	51	53	57	36	41	33	43	36	31	50	40	30
Manufacturing	10	10	11	10	13	11	4	7	12	11	16	17	9	13	13	10	14	13	4	4
Transportation	3	0	10	5	11	7	4	8	13	8	6	3	4	3	6	7	3	3	19	15
Consumption	15	10	24	22	17	27	14	25	24	32	34	13	26	15	17	17	9	28	1	4
Other	1	3	2	8	6	4	6	2	2	2	1	3	2	2	7	2	5	6	4	1
Number of deaths	2	2	3	4	6	3	0	3	4	5	4	5	3	1	3	2	3	2	4	0

Fig. 1: Changes in the numbers of accidents resulting in injury or death and of deaths related to the High Pressure Gas Safety Act (1998 - 2017)

3. Changes in the numbers of accidents resulting in injury or death and of deaths at manufacturing plants for high pressure gas

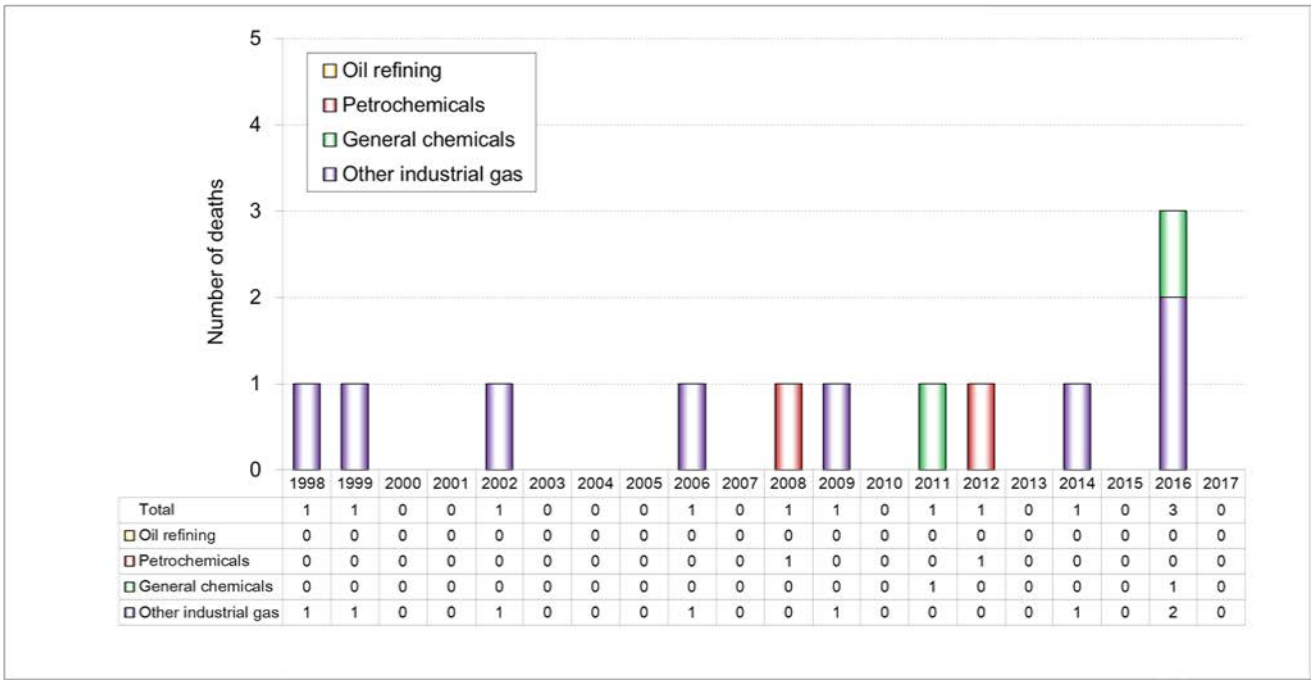
The changes in the numbers of accidents resulting in injury or death and of deaths at manufacturing plants for high pressure gas between 1998 and 2017 are shown in Fig. 2. The total number of accidents resulting in injury or death fluctuates with a maximum of 17 per year. Looked at by industry, the largest number of accidents resulting in injury or death occur in the “Other industrial gas” field. The “Other industrial gas” field includes filling stations, ironworks, food manufacturing, etc. The second-largest number of accidents resulting in injury or death occurs in the “General chemicals” field, with the number of accidents resulting in injury or death occurring in the “Other industrial gas” and “General chemicals” fields together making up around 90% of all accidents resulting in injury or death.



	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total	10	10	11	10	13	11	4	7	12	11	16	17	9	13	13	10	14	13	16	7
Oil refining	0	1	0	0	1	0	0	1	0	0	0	1	0	1	1	0	0	0	0	0
Petrochemicals	0	1	0	0	0	1	0	0	2	0	3	3	1	0	1	0	0	1	0	1
General chemicals	4	1	1	2	4	2	2	3	2	1	3	4	3	3	5	2	1	3	4	1
Other industrial gas	6	7	10	8	8	8	2	3	8	10	10	9	5	9	6	8	13	9	12	5

Fig. 2: Change in the numbers of accidents resulting in injury or death at manufacturing plants for high pressure gas (1998 - 2017)

Fig. 3 shows the numbers of deaths in accidents occurring at manufacturing plants for high pressure gas. There have been 12 deaths over the past 20 years. Looked at by industry, a large number of deaths, those of eight people, have occurred in the “Other industrial gas” field. The “Other industrial gas” field encompasses accidents which take place at filling stations and in refrigerating and air conditioning, and the causes of accidents resulting in deaths include the bursting of containers, leakage of poisonous gases, etc. On the other hand, there have been no accidents resulting in deaths in the “Oil refining” field between 1998 and 2017.



	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total	1	1	0	0	1	0	0	0	1	0	1	1	0	1	1	0	1	0	3	0
Oil refining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petrochemicals	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0
General chemicals	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0
Other industrial gas	1	1	0	0	1	0	0	0	1	0	0	1	0	0	0	0	1	0	2	0

Fig. 3: Change in the numbers of deaths at manufacturing plants for high pressure gas (1998 - 2017)

4. Analysis of accidents resulting in injury or death at manufacturing plants for high pressure gas by type of phenomenon

4.1. Breakdown of types of phenomenon involved in accidents resulting in injury or death at manufacturing plants for high pressure gas (2017)

The breakdown of the types of phenomenon involved in the 11 accidents resulting in injury or death which occurred at manufacturing plants for high pressure gas in 2017 and the numbers of resulting deaths are shown in Table 1. Among the types of phenomenon involved in accidents resulting in injury or death, "Leakages" were the most common, with five incidents, followed in descending order by "Fires, explosions," "Bursting, ruptures, etc." and "Other."

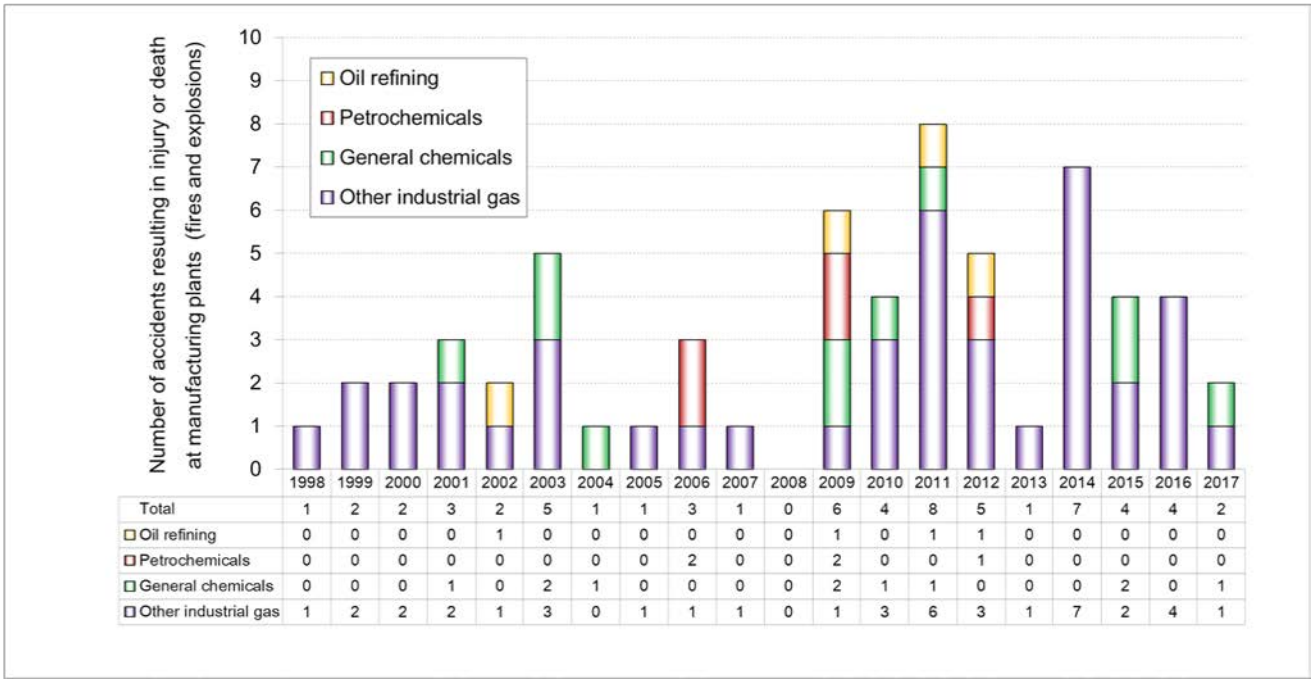
Note that accidents in which leakages led to explosions or fires are classified as "Explosions" or "Fires."

Table 1: Breakdown of types of phenomenon involved in accidents resulting in injury or death at manufacturing plants for high pressure gas (2017)

Phenomenon causing the accident		Number of cases	Number of deaths
Leakages		5	0
Fires, explosions		2	0
	Leakages → Fires	1	0
	Fires	1	0
	Explosions	0	0
Bursting, ruptures, etc.		0	0
Other (oxygen deficiency within the tank)		0	0
Total		7	0

4.2 Changes in the numbers of accidents caused by fires and explosions and of resulting deaths at manufacturing plants for high pressure gas

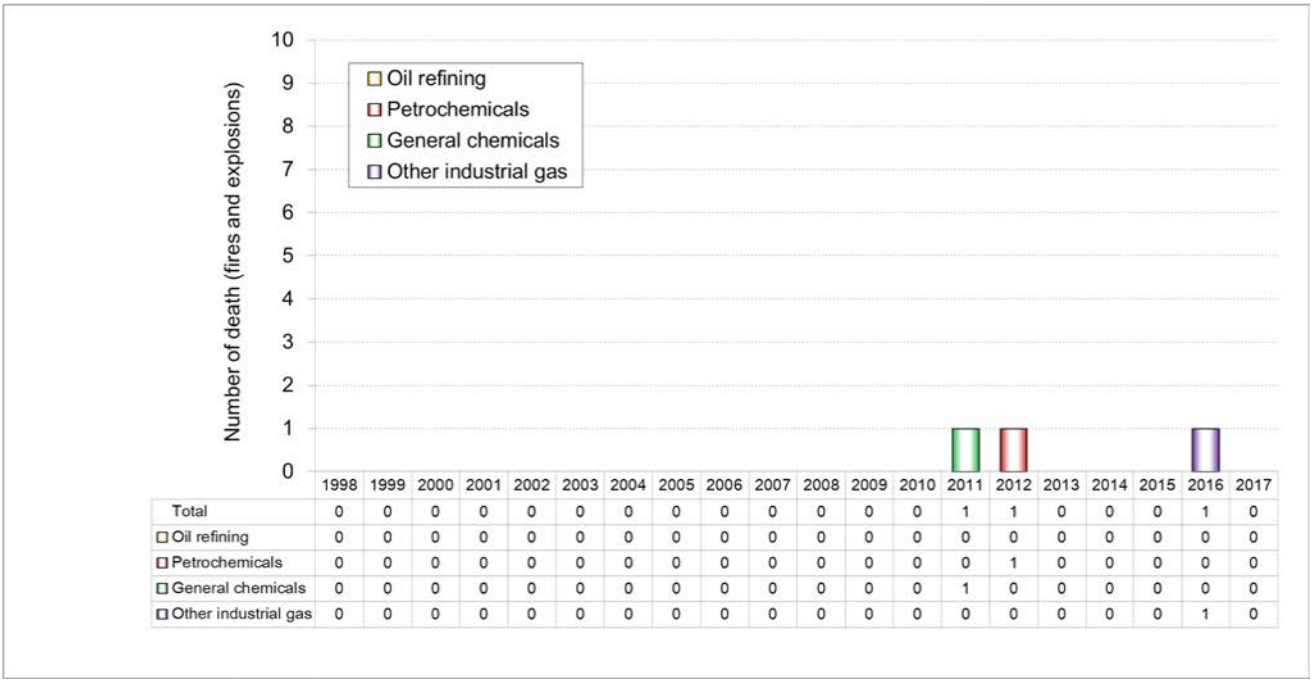
Of the accidents resulting in injury or death which occurred at manufacturing plants for high pressure gas between 1998 and 2017, the change in the numbers caused by fires and explosions is shown in Fig. 4. Looked at by industry, many of the accidents resulting in injury or death caused by fires and explosions occurred in the "Other industrial gas" field, a similar trend to that seen in Fig. 2.



	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total	1	2	2	3	2	5	1	1	3	1	0	6	4	8	5	1	7	4	4	2
Oil refining	0	0	0	0	1	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0
Petrochemicals	0	0	0	0	0	0	0	0	2	0	0	2	0	0	1	0	0	0	0	0
General chemicals	0	0	0	1	0	2	1	0	0	0	0	2	1	1	0	0	0	2	0	1
Other industrial gas	1	2	2	2	1	3	0	1	1	1	0	1	3	6	3	1	7	2	4	1

Fig. 4: Change in the numbers of accidents caused by fires and explosions at manufacturing plants for high pressure gas (1998 - 2017)

Fig. 5 shows the change in the numbers of deaths at manufacturing plants for high pressure gas related to accidents caused by fires and explosions. There were three deaths in the 20 years between 1998 and 2017. By comparison with Fig. 3, we can see that of the accidents resulting in injury or death, which occurred at manufacturing plants for high pressure gas, nine deaths were caused by accidents other than fires or explosions.

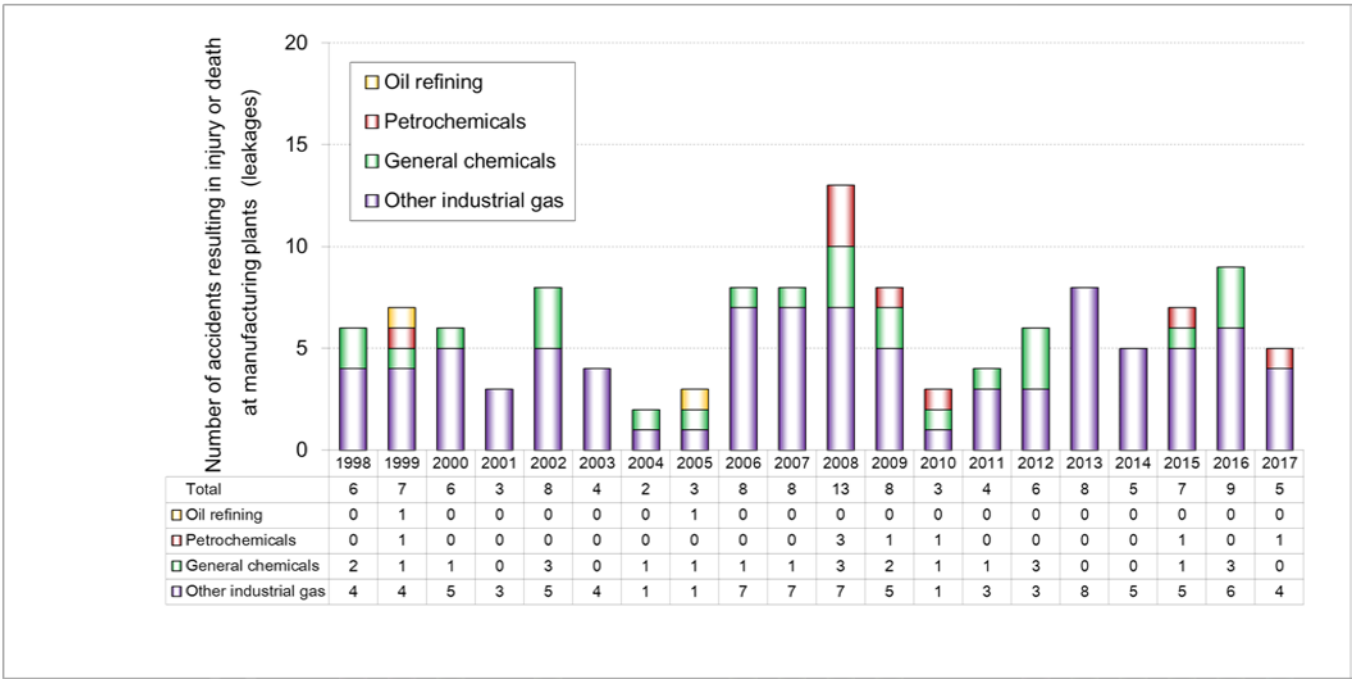


	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0
Oil refining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petrochemicals	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
General chemicals	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Other industrial gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0

Fig. 5: Change in the numbers of deaths due to accidents caused by fires and explosions at manufacturing plants for high pressure gas (1998 - 2017)

4.3 Changes in the numbers of accidents caused by leakages (excluding leakages which led to fires or explosions) and of resulting deaths at manufacturing plants for high pressure gas

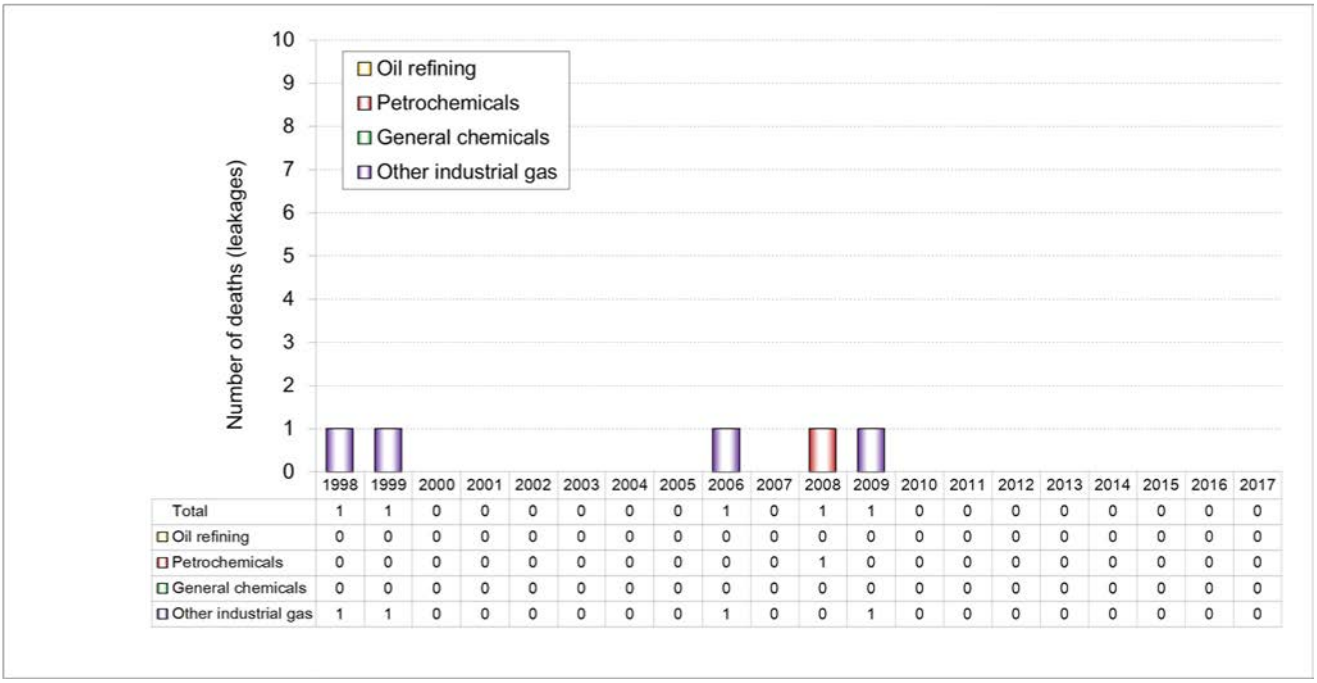
Of the accidents resulting in injury or death, which occurred at manufacturing plants for high pressure gas between 1998 and 2017, the change in the number caused only by leakages is shown in Fig. 6. Looked at by industry, many of the accidents resulting in injury or death caused by leakage occurred in the “Other industrial gas” field, a similar trend to that seen in Fig. 2.



	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total	6	7	6	3	8	4	2	3	8	8	13	8	3	4	6	8	5	7	9	5
Oil refining	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Petrochemicals	0	1	0	0	0	0	0	0	0	0	3	1	1	0	0	0	0	1	0	1
General chemicals	2	1	1	0	3	0	1	1	1	1	3	2	1	1	3	0	0	1	3	0
Other industrial gas	4	4	5	3	5	4	1	1	7	7	7	5	1	3	3	8	5	5	6	4

Fig. 6: Change in the numbers of accidents caused by leakages at manufacturing plants for high pressure gas (1998 – 2017)

Fig. 7 shows the change in the numbers of deaths at manufacturing plants for high pressure gas related to accidents caused by leakages. There were five deaths in the 20 years between 1998 and 2017. The main cause of accidents resulting in deaths was leakage of poisonous gases.



	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total	1	1	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0
Oil refining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petrochemicals	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
General chemicals	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other industrial gas	1	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0

Fig. 7: Change in the numbers of deaths due to accidents caused by leakages at manufacturing plants for high pressure gas (1998 -– 2017)

From Figs. 3, 5, and 7, we can see that the greatest number of deaths arose from accidents caused by leakages, followed by fires and explosions. Other causes of accidents resulting in deaths include the bursting of containers and oxygen deficiency during the overhaul inspection of storage tanks.

Contact for inquiries related to this document

The High Pressure Gas Safety Institute of Japan (KHK)
Information & International Affairs Department
International Affairs Division
4-3-13 Toranomon, Minato-ku, Tokyo 105-8447
TEL: +81-3-3436-2201 FAX: +81-3-3438-4163
Web: http://www.khk.or.jp/english/index.html
MAIL: oversea@khk.or.jp