

Annual Report on High Pressure Gas Related Accidents

(2015 version)

The High Pressure Gas Safety Institute of Japan (KHK)

1. Introduction

This Annual Report analyzes and evaluates accidents relating to the High Pressure Gas Safety Act that occurred from January to December 2015, with an aim of contributing toward future high pressure gas safety measures.

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

2. Accidents relating to the High Pressure Gas Safety Act

The number of accidents relating to the High Pressure Gas Safety Act per year remained around 100 until 1999. Subsequently, it has increased since 2000 and has remained at a high level in recent years. However, fewer accidents occurred in 2015 than in the previous year.

One of the causes of the increase in number of accidents in recent years is the increase in number of theft and loss of containers (hereinafter, “theft and loss accidents”). However, it is difficult to discuss theft and loss accidents by statistically treating them along with explosion, leakage, and other ordinary disasters (hereinafter, “disaster accidents”), because of characteristic differences. Thus, this Annual Report summarizes and analyzes the high pressure gas-related accidents by separating the theft and loss accidents from the disaster accidents.

Also, the accident countermeasures manuals were revised in 2011, resulting in significant changes in the definitions of accidents and items of accident causes. Thus, the analysis and evaluation on accident causes and others below were conducted separately for the years up to 2010 and those after 2011.

2.1 Changes in number of accidents and analysis/evaluation

(1) Changes in number of accidents by year

Figure 1 shows the number of the High Pressure Gas related accidents that occurred in the latest decade (2006 to 2015).

In the last five years, the number of accidents occurring in 2011 was 1084, and thereafter 957 in 2012, 836 in 2013, 787 in 2014, and 729 in 2015. The number of accidents in 2015 was the lowest of these years.

Here, the increase in the number of accidents in 2011 was mainly due to the report of 94 accidents that caused by the Great East Japan Earthquake.

Also to note is that the number of theft and loss accidents was 300 in 2015 and this number was fewer than that of 406 in 2014.

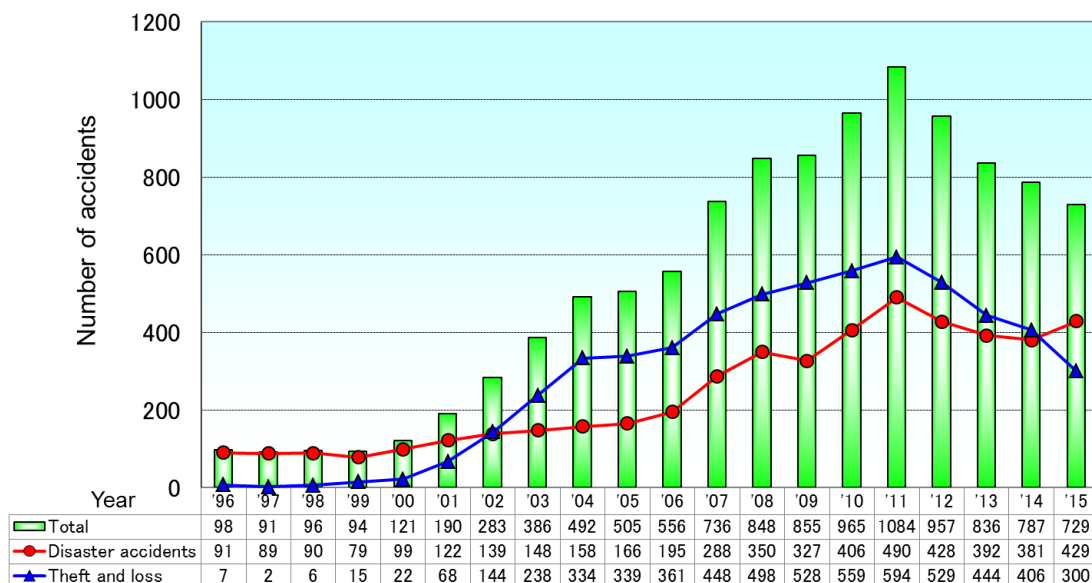


Figure 1 Changes in number of the High Pressure Gas related accidents

(2) Numbers of accidents by category

From this section onwards, the focal point of discussion is placed on disaster accidents.

Figure 2 shows the results of statistic treatment of the disaster accidents that occurred in the last two decades (1996 to 2015), according to accident categories. A notable feature is that the number of accidents has been on the increase since 2000 even though it had been around 100 accidents every year until 1999.

The breakdown of the 429 disaster accidents that occurred in 2015 shows, in decreasing order, 305 disaster accidents occurring at production works (71%), 80 during consumption (19%), 24 during transportation (6%), and 20 others (5%).

As can be seen, the majority of disaster accidents had taken place at production works, and the ratios of accidents in 2015 were fairly similar compared to those during the last five years. Thus, it is clear that accident occurrences at production works have remained at a high level.

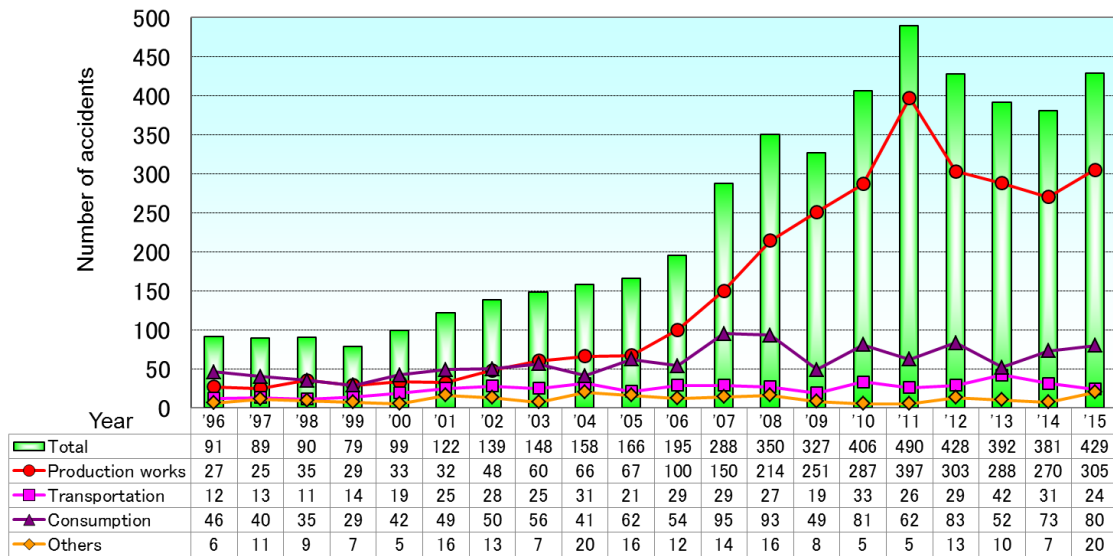


Figure 2 Changes in number of disaster accidents by accident category

(3) Analysis and evaluation based on accident causes

Mentioned above, the definitions of accidents and items of accident causes were changed in 2011. Then Table 1 and Figure 3 shows the results of the disaster accidents statistics by causes which occurred during the five years between 2011 and 2015.

Looking at the 429 disaster accidents in 2015, 203 (47%) were caused by inadequate facility maintenance and management, 87 (20%) were caused by inadequate facility design and fabrication defects, and 46 (11%) were caused by human factors, together accounting for 78% of the total.

It is important to take countermeasures against inadequate facility design and fabrication defects, and inadequate facility maintenance and management, as well as human error prevention measures such as education and training.

Table 1 Analysis and evaluation based on accident causes in disaster accidents (2011 to 2015)

Year	Inadequate facility design and fabrication defects				Inadequate facility maintenance and management							Organizational defects				Human factors		Others					Grand total	
	Inadequate design	Fabrication defects	Inadequate construction management	Total	Inadequate corrosion control	Inadequate inspection management	Inadequate inspection	Inadequate transfer management	Inadequate seal management	Inadequate container management	Total	Inadequate organizational operation	Inadequate operational standards	Inadequate information conveyance	Total	Faulty operation and judgment	Inappropriate actions	Total	Natural disaster	Traffic accident	Others	Theft		Total
2015	54	9	24	87	85	30	13	28	26	21	203	2	6	1	9	40	6	46	4	17	63	0	84	429
2014	53	14	19	86	72	19	11	29	26	17	174	0	15	6	21	33	6	39	6	16	39	0	61	381
2013	38	14	23	75	77	28	18	23	33	19	198	0	15	1	16	50	4	54	3	18	28	0	49	392
2012	35	11	10	56	65	65	8	28	31	11	208	0	13	1	14	69	13	82	11	14	43	0	68	428
2011	22	17	11	50	67	66	8	38	28	19	226	0	8	1	9	45	4	49	86	7	63	0	156	490
Total	202	65	87	354	366	208	58	146	144	87	1009	2	57	10	69	237	33	270	110	72	236	0	418	2120

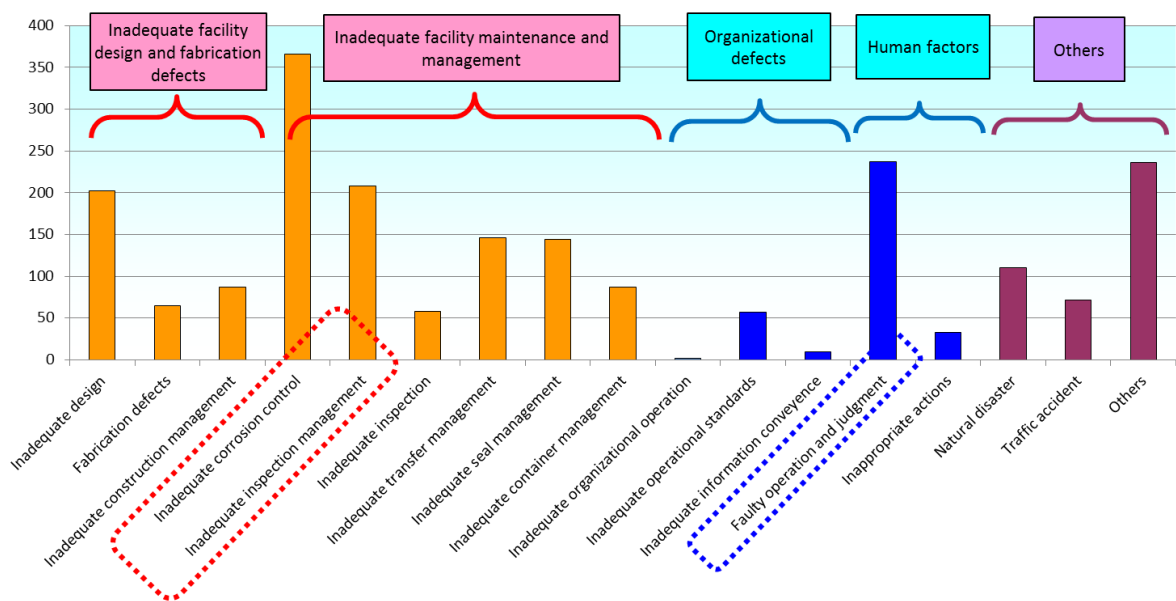


Figure 3 Analysis and evaluation based on accident causes in disaster accidents (2011 to 2015)

2.2 Analysis based on phenomenal categories, human damages, and accident classifications

(1) Analysis based on phenomenal categories

Figure 4 shows the statistical results of the disaster accidents that occurred during the last two decades (1996 to 2015), classified by phenomenon categories.

The number of disaster accidents in 2015 was 429, and looking at accident phenomena, spout/leakage accounted for 390 accidents (91%), burst/rupture for 17 accidents (4%), explosion for 7 accidents (2%) and fire for 7 accidents (2%), in that order. The majority of these accidents were spout/leakage.

During the last five years, spout/leakage accounted for 1,860 accidents (88%), burst/rupture for 128 accidents (6%), fire for 78 accidents (4%), and explosion for 27 accidents (1%), in that order.

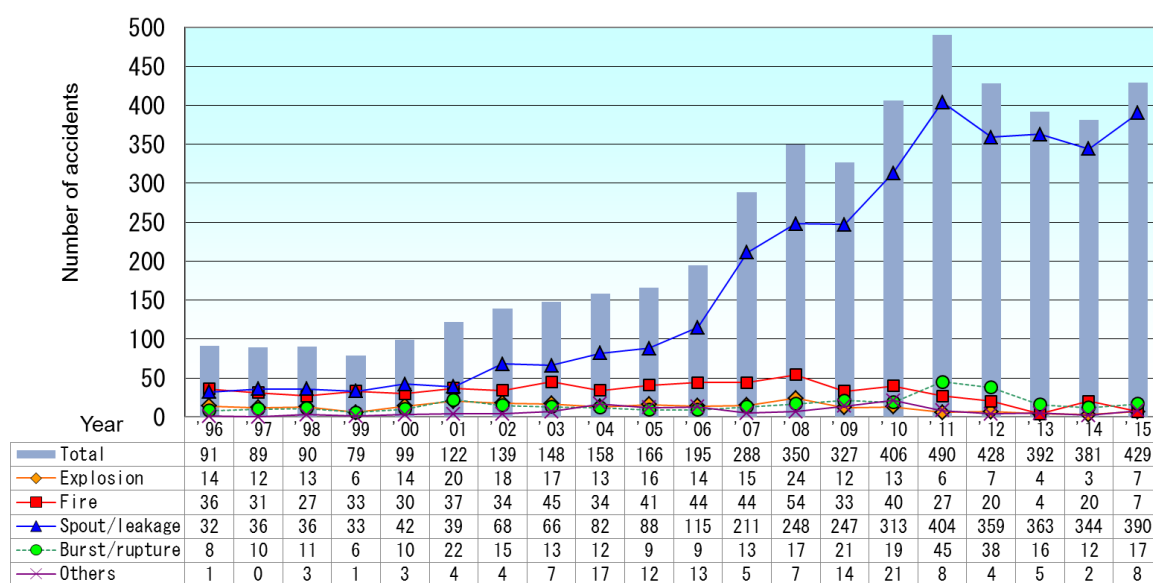


Figure 4 Change in number of disaster accidents by phenomenon category

(2) Analysis based on human damages

Figure 5 shows the statistical results of the disaster accidents that occurred during the last two decades (1996 to 2015), classified by human damages.

The number of accidents resulting in injury or death was 48 in 2015, accounting for 11% of the 429 disaster accidents. The number of persons suffering injury or death was 68, making the number of casualties per physical injury accident 1.42.

The results of the same calculation for the 2,120 disaster accidents, 190 physical injury accidents, and 348 casualties in the last five years indicate a ratio of physical injury accident of 9% and a number of casualties per physical injury accident of 1.83.

The number of physical injury accidents was 48 in 2015, which was larger than the 30 that occurred in 2014. On the other hand, the number of casualties decreased to 68 in 2015, from 74 in 2014.

The greatest number of casualties per accident in 2015 was 7 persons, who were injured by the accident involving the generation of carbon monoxide during LP gas consumption in a food plant.

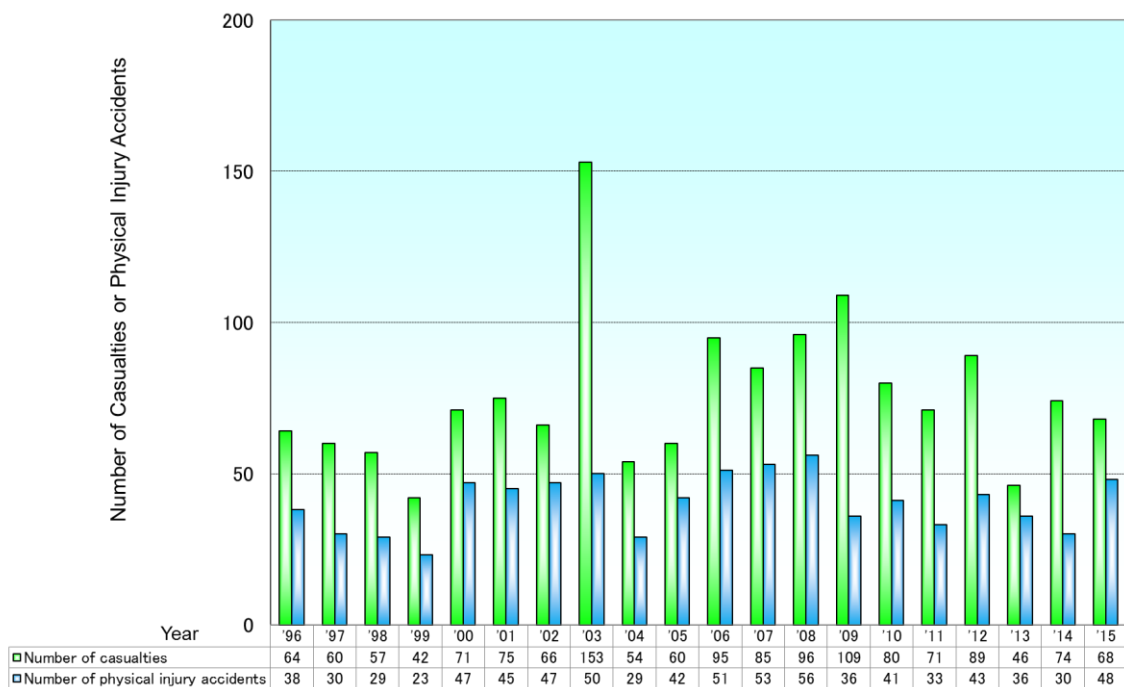


Figure 5 Change in number of physical injury accidents and casualties in disaster accidents

(3) Analysis based on accident classifications

Figure 6 shows the statistical results of disaster accidents that occurred during the last two decades (1996 to 2015), classified by accident classifications.

No Class A accident occurred in 2015.

Fewer than 10 Class B accidents took place each year until 2005, which increased to 25 in 2006. More than 50 Class B accidents occurred after in 2008, but reduced to 38 in 2015.

The 38 Class B accidents in 2015 consist of 5 cases of Class B1 accidents, and 33 cases of B2 accident.

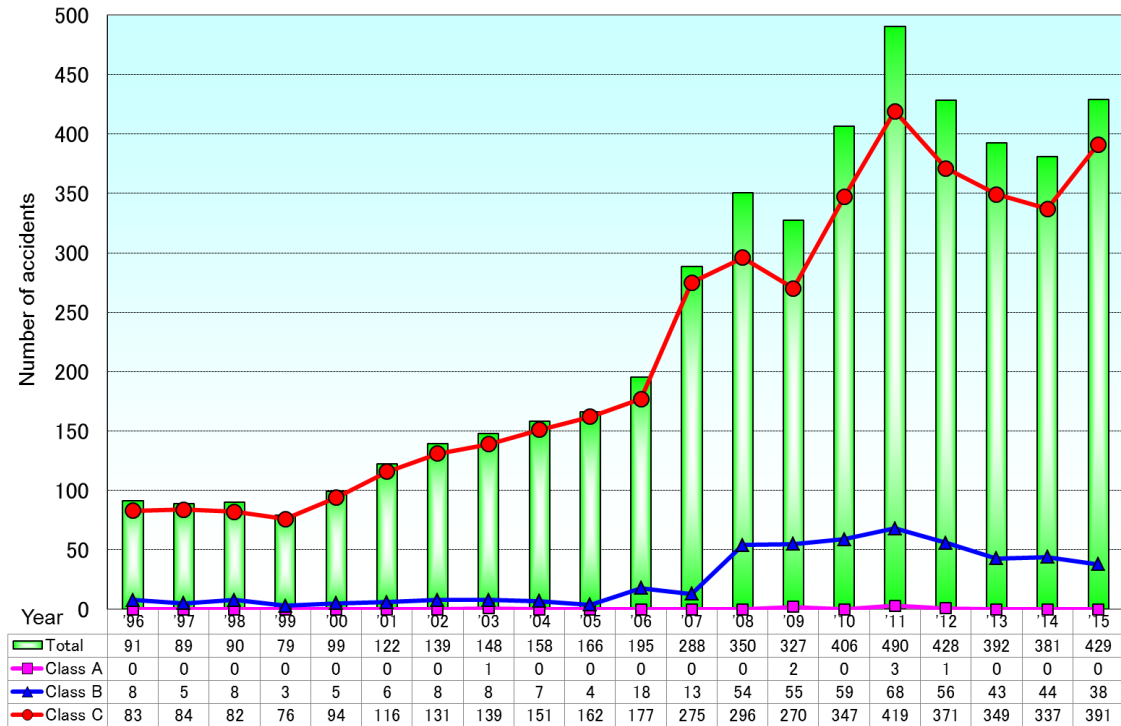


Figure 6 Changes in number of disaster accidents by accident classification

Table 2 Definition of classification by 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	500 million yen or more	
	(5) Any accident affecting the public, or which could have developed into a large scale disaster		
Class B	Class B1	(1) Deaths	1 to 4
		(2) Serious injuries	2 to 9
		(3) Casualties (injury)	6 to 29
		(4) Direct property damage	100 to 500 million yen
	(5) Any accident affecting the public, or which could have developed into a large scale disaster		
Class B2	Accidents repeatedly occurring at the same works during one year (excluding Class A and Class B1 accidents)		
Class C	Other than Classes A and B		

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