

An introduction to treatment of methyl bromide waste stocked in grain storage enterprises of China

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Abstract

The elimination and substitution of methyl bromide in China was completed in 2008. However, about 20 tons of methyl bromide waste still remained in grain storage enterprises across the country. Most of these methyl bromide stocks were more than 40 years old, cylinders were corroded, and some leaked, resulting in potential safety hazards. Both the State Administration of Grain and the Ministry of Environmental Protection of China launched a program to eliminate methyl bromide stocks in 2013 under the support of UNIDO, and Chengdu Grain Storage Research Institute (CSR) was selected as the technical force to carry out the program. Compared with various treatment methods, CGSSIR has confirmed the approach “rational utilization of methyl bromide waste” as the operation guideline. All of the methyl bromide stocked in enterprises from 13 provinces (including local branch companies of Sinograin and COFCO) were successfully eliminated. In each treatment field, the specialists and technical supporters cooperated to methyl bromide stocks in accordance with the operation manual. After more than four months, a total of 414 waster cylinders (222 cylinders containing methyl bromide, 192 empty bottles) stocked in 44 grain storage enterprises were successfully treated for disposal, and the disposal quantity of methyl bromide waste was about 19,926 kg.

Keywords: methyl bromide, treatment, grain storage

1. Background

The project of Methyl Bromide (MBr) Phase-out in Chinese Grain Storage Sectors was successfully completed in 2008. However, mothballed MBr products remained in a number of grain depots across the country in 2012. Most of these methyl bromide wastes were 40 to 50 years old, cylinders were corroded, and some leaked, resulting in potential safety hazards to those enterprises which contained these wastes. In 2013, the Chengdu Grain Storage Research Institute (CSR) was selected as the technical force by the State Administration of Grain and Ministry of Environmental Protection, under the support of UNIDO, to be responsible for the disposal of the mothballed MBr products. Companies were reluctant to assist with disposal because of leakage risks in long-distance transportation of cylinders with serious corrosion, the cost of intra-province transfer, safety issues, and lack of disposal techniques (Fig. 1).



Figure 1 Steel Cylinders containing MBr with serious corrosion.

2. Measures for disposal of the scrapped MBr

There were three feasible measures to dispose these scrapped MBr cylinders. The first was to send them to qualified hazardous substance management centers. The second was to ask MBr manufacturers to recycle. The last is to develop rational utilization and regeneration techniques.

2.1. Send the scrapped MBr to qualified hazardous substance management centers

It is a routine and feasible measure to dispose the scrapped chemicals. Hazardous substance management centers, qualified by the State Environmental Protection Administration, mainly dispose products such as pesticide solids, pesticide liquid, dust, waste liquid and gas, which have not been involved in MBr. They also have no abilities to dispose the scrapped MBr.

2.2. Ask for MBr manufacturers to recycle

As manufacturers possess the qualification of MBr production, it seemed to be a feasible scheme to ask for MBr producers to recycle. It was discovered that Mothballed MBr mainly was produced by the Nanjing Chemical Plant, Shandong Changyi Chemical Plant, Shandong Junan Chemical Plant and Lianyungang Bromide Co., Ltd. About 89% of MBr manufacturers have already been in transformation or cancellation. So far, Zhejiang Jianxin Chemical Plant, Lianyungang Bromide Co., Ltd. and Shandong Changmin Chemical Plant are still producing MBr. After contacting with them, these manufacturers were reluctant to assist. One of the main reasons is leakage risks in transportation. The sporadic grain storage sectors, high costs for transportation, and the lack of proper procedures were also factors.

2.3. Rational utilization and regeneration

Corroded cylinders were unfit for long-distance transportation. The most economic, safe and effective of disposal was to develop rational utilization and regeneration. The mothballed MBr could be rationally used for fumigation in equipment warehouses and empty warehouse of grain storage sectors. The advantages and disadvantages of the three methods are listed in Table 1.

Table 1 Comparison of three kinds of methods for disposal of scrapped MBr.

Measures	Advantages	Disadvantages	Result
Send to qualified hazardous substance management centers	A routine and feasible measure to dispose the scrapped chemicals	1. Objects involved in MBr 2. Unable to dispose scrapped MBr	Difficult to realize
Ask for MBr manufacturers to recycle	Qualification of MBr production	1. Leakage risks in transportation 2. Beyond the quality maintenance life 3. More cost on transportation in intra-provinces 4. More procedures of transportation in intra-provinces 5. Still need adjustment on production crafts	Dangerous to transport
Rational utilization and regeneration	1. Stable chemical performance 2. Out of quota management 3. Technical maturation	More requirements on technicians	Safe, Economic and Effective

3. Specific treatment scheme of the storage MBr for typical depots

A plan for Operational Regulation of Rational Use and Safe Disposal for Scrapped MBr was formulated. There were three specific treatment schemes, i.e., two operability procession programs for the storage MBr in which steel cylinders may be opened up properly or not respectively, and one for empty bottles, shown in Fig. 2.

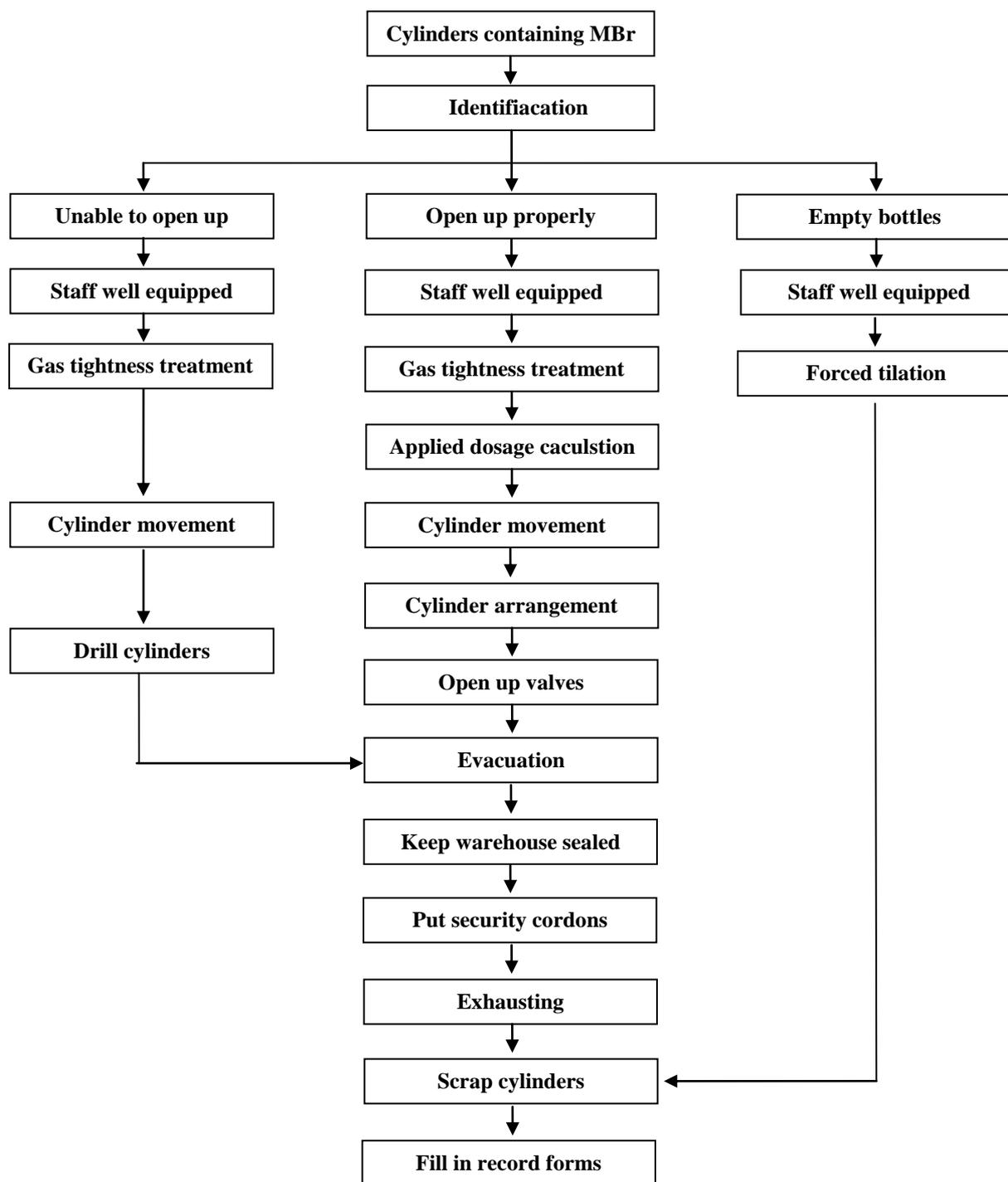


Figure 2 Specific treatment scheme of scrapped MBr.

4. On-site disposal of the scrapped MBr

In Chinese grain industry, the use of MBr had a wide distribution and plenty of involved depots. Professionals were divided into two working groups, and sent to grain sectors of 13 provinces, as well as local branch companies of Sinograin and COFCO, to dispose storage MBr. Under the support of the grain administration of province and the central enterprises, the scrapped MBr was disposed. In each field treatment, the specialists and technical supporters cooperated to deal with these scraps in terms of the operation manual.

Based on sufficient protection and emergency preparations as well as keeping the rule of safety first in mind, the chemical waste were investigated and the results were recorded. Meanwhile, a practice program was established and performed according to the actual situation. All the on-site processing details (including image data showed in Fig. 3) were carefully recorded. Specific disposal on mothballed MBr in grain storage sectors of China are described as follows:



Figure 3 On-site processing.

Table 2 Disposal on Mothballed MBr in grain storage sectors.

Located province	Depot name	Disposal quantity (Kg)	Cylinder number	Open up directly	Water drilling
1 Hebei	1 Sanhe depot, Langfang city	370	8	2	5
	2 Baoda grain & oil purchase and sale Co., Fengnan District, Tangshan	183	3	2	0
	3 Xushui county Administration of Grain (stored in Heping National Grain Depot)	562	10	8	1
2 Liaoning	4 The second grain depot, Taian	2275	53	17	10
	5 Hengxing grain & oil purchase and sale Co., Beizheng	169	4	0	2

Table 2 (Con.).

Located province	Depot name	Disposal quantity (Kg)	Cylinder number	Open up directly	Water drilling	
3	Shanxi	6 Shangguo National depot, Anyi, Yanhu district, Yuncheng	210	2	2	0
		7 Yuci Grain depot	1211	12	11	1
		8 Yangqu National grain depot	980	13	10	3
		9 Pingyao County Grain collection and storage station	88	2	1	1
		10 Xiangning County Chengguan Grain collection and storage station, Lingfen	424	4	3	1
4	Heilongjiang	11 Xiangfu depot, Hailun city	500	10	4	6
5	Yunnan	12 Provincial school of business information and engineering	6	24	5	0
6	Jiangsu	13 Zhengchang National depot, Nantong	490	12	1	5
		14 Jurong depot	107	1	1	0
		15 Lingtong depot, Xiliang industril limited Co., Xian	295	7	6	0
		16 Qianyang County Grain collection and storage station	90	2	0	2
		17 Yao depot of Wugong county administration of grain	315.5	7	6	0
7	Shanxi	18 Xixiang county grain & oil depot	156	3	3	0
		19 Shangnan Grain&oil negotiation purchase and sale Co.	331	5	4	1
		20 Shangnan Shima grain purchase and sale Co.				
		21 Shanyang grain&oil purchase and storage Co.	459	10	7	0
		22 Hanyin grain&oil purchase and storage Co.				

Table 2 (Con.).

Located province	Depot name	Disposal quantity (Kg)	Cylinder number	Open up directly	Water drilling		
8	Jiling	23 State Administration of grain, Tonghua	315	3	3	0	
		24 National depot, Changbaishan	295	3	2	1	
		25 Songjianghe National depot, Fusong County	105	1	0	1	
		26 Fusong depot, State Administration of grain of Fusong	210	2	2	0	
9	China Grain Reserves Co.	27 Yingkou Depot, Sinograin	2000	0	0	0	
		28 Taigu Depot	106	1	1	0	
		29 Liuhe Depot, Sinograin					
		30 Kuerle Depot, Sinograin	475	11	3	0	
10	Gansu	31 Lanzhuang grain depot limited Co., Lanzhou	1067.5	40	10	0	
		32 Jiaojiawan grain depot Limited Co.	180	3	3	0	
		33 Xiaoxiping Depot, Lanzhou	2106	66	22	9	
		34 Wangjiadun grain & oil depot limited Co.	272	7	5	0	
		35 Fengtian grain & oil purchase and sale Co., Pingliang city	364	12	0	1	
11	Xinjiang	36 Tianshan National depot, Kuerle	1055	18	6	0	
		37 Shanxian county grain & oil purchase and storage Co.	131	3	3	0	
		38 Dayingfang National depot, Hami	949	16	15	1	
12	Henan	39 Yao depot, State Administration of Grain, Guangshan county, Xinyang city	80	1	0	1	
		40 Xiguan yao depot, luoshan county, Xinyang city	115	2	0	2	
		41 Mingquan National depot	282	9	0	2	

Table 2 (Con.).

Located province		Depot name	Disposal quantity (Kg)	Cylinder number	Open up directly	Water drilling
13	China Grains and Oils Group Co.	42 Wuyu National depot, Jilin	0	0	0	0
		43 Keshan depot	20	1	1	0
14	Hainan	44 Haikou grain reserve limited Co.	350	10	1	0
15	Shandong	45 Chaoyuan grain collection and storage station	545	18	0	1
Total			20244	419	170	57

5. Conclusion

After more than four months of endeavor, a total of 419 steel cylinders stocked in 45 grain storage enterprises were treated for disposal, and the disposed quantity of methyl bromide was about 20,244 kg. The mothballed methyl bromide products remained in Chinese grain industry have been successfully eliminated.

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