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# paper 13

## **Destruction of Abandoned Chemical Weapons in China**

by  
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# **DESTRUCTION OF ABANDONED CHEMICAL WEAPONS IN CHINA**

## **CONTENTS**

<b>I. INTRODUCTION</b>	<b>1</b>
<b>II. CWC OBLIGATIONS</b>	<b>3</b>
Declarations and disposal	5
<b>III. LOCATIONS AND CONDITIONS OF ACW</b>	<b>9</b>
Prospects for determining the locations and conditions of ACW	17
<b>IV. RETRIEVAL, STORAGE, AND DESTRUCTION OPERATIONS</b>	<b>18</b>
Retrieval operations	18
Storage operations	21
Destruction operations	22
Prospects for retrieval, storage, and destruction operations	28
<b>V. LOGISTIC BARRIERS</b>	<b>29</b>
OPCW inspections	30
<b>VI. COSTS</b>	<b>31</b>
Inspections	31
Destruction	32

Verification of destruction	34
Prospects for meeting costs	35
<b>VII. CONCLUSION</b>	<b>36</b>
<b>VIII. ACRONYMS</b>	<b>38</b>
<b>IX. REFERENCES</b>	<b>39</b>
<b>APPENDIX I: GEOGRAPHIC LOCATION OF KNOWN SITES</b>	<b>42</b>
<b>APPENDIX II: GLOSSARY OF CWC-RELATED TERMS</b>	<b>43</b>
<b>TABLES AND FIGURES</b>	
<b>Table 1: Classifications of Old and Abandoned Chemical Weapons</b>	<b>4</b>
<b>Table 2: Overview of CWC Obligations</b>	<b>4</b>
<b>Table 3: Information on the Abandonment of Chemical Weapons on the Territory of Another State Party (Abandoning State Party)</b>	<b>7</b>
<b>Table 4: Information on Abandoned Chemical Weapons on the Territory of a State Party (Territorial State Party)</b>	<b>8</b>
<b>Table 5: ACW Locations</b>	<b>9</b>
<b>Table 6: Joint Investigative Surveys of ACW in China</b>	<b>14</b>
<b>Table 7: Destruction Methods of Chemical Weapons Components</b>	<b>25</b>
<b>Table 8: Japanese Agents and the Order of Destruction</b>	<b>26</b>
<b>Table 9: Overview of Cost Responsibilities</b>	<b>31</b>
<b>Table 10: Estimated Costs of Destruction of ACW in China in 1996 US Dollars</b>	<b>33</b>
<b>Figure 1: Status of Bulk Agent Declared by China</b>	<b>23</b>
<b>Figure 2: Status of Chemical Munitions Declared by China</b>	<b>24</b>



## I. INTRODUCTION

The *Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on Their Destruction* (CWC) is a multilateral treaty which obligates its signatories to destroy their chemical weapons within ten years of the treaty's entry into force. It also bans the development, production, stockpiling, transfer, and use of chemical weapons. In addition, there is a special obligation to destroy weapons abandoned by one State Party to the CWC on the territory of another State Party. This paper identifies some of the logistic, technical, legal, and financial problems in destroying abandoned chemical weapons (ACW) in China.

The CWC was opened for signature on 13 January 1993 in Paris, and entered into force on 29 April 1997. To date 165 nations have signed, and 92 have ratified, including China and Japan. To implement the treaty, the Organisation for the Prohibition of Chemical Weapons (OPCW) has been established in The Hague, the Netherlands. The OPCW's main functions are to carry out verification activities and ensure treaty compliance.<sup>1</sup>

The CWC is a complex document. While the various articles and annexes to the Convention at first glance provide a blueprint for the treaty's implementation, in many ways the annexes do not go far enough and leave many details unaddressed. The Preparatory Commission tasks a body of specialists (called an Expert Group) to address these unresolved issues. While the Expert Group on Old and Abandoned Chemical Weapons (OACW) has been meeting since 1993, at least six of the tasks assigned to it by the Preparatory Commission remained unaddressed at the time the Convention entered into force.

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<sup>1</sup> There are 3 organs within the OPCW: the Conference of States Parties, the Executive Council, and the Technical Secretariat. The Conference is comprised of delegates from States Parties to the Convention (nations that have signed, ratified, and deposited their instruments of ratification with the Secretary General of the United Nations in New York) and is the principal organ of the OPCW. The Conference makes recommendations and takes decisions on Convention-related questions, and oversees the implementation of the Convention and the activities of the other two organs. The Executive Council is the executive organ of the OPCW and is responsible to the Conference. The Council, among other functions, supervises the Technical Secretariat, cooperates with National Authorities, and considers matters regarding compliance and non-compliance with the Convention. The Technical Secretariat assists the Conference and the Council. The Secretariat, among other functions, carries out verification measures provided for in the Convention.

Chemical weapons were first used on a large scale during wartime by Germany in World War I. There were other episodes of chemical warfare use after World War I—one of the better documented cases being Italy's use of chemical weapons in Ethiopia (*League of Nations, Official Journal*, 1936). Japan is estimated to have produced at least seven million chemical munitions prior to 1945 (*FBIS Daily Report*, FBIS-EAS-94-233, 5 December 1994, pp. 6-7; Ki, 1996, p. 37), of which at least four million are unaccounted for (Haug, 1996). Accounts of the number of chemical weapons attacks in China from 1937 to 1945 range from 889 to 2,900 (Brown, 1968; *FBIS Daily Report*, FBIS-EAS-96-159, 14 August 1996). By the end of 1945 the Chinese suffered an estimated 80,000 casualties and 10,000 fatalities as a result of Japanese use of chemical weapons (Ki, 1996, pp. 304-306, 329-330). Thus, Japan seems likely to have used more chemical weapons in China than in any other country. Since the end of World War II, China has cited up to 2,000 injuries resulting from ACW of Japanese origin (Conference on Disarmament (CD) 1127 and Correction 1, 18 February 1992).

In 1992 China announced that over two million chemical weapons had been abandoned on its territory (CD/1127, 1992). China has now become the State Party with the greatest number of ACW on its territory. It has been agreed by the OACW Expert Group that China and Japan will exercise their right to conclude a mutually agreed plan for destruction of ACW (PC-VI/B/WP.5, Annex, Attachment 3, p. 25). Bilateral talks are ongoing but there are a number of problems which must be overcome for the successful destruction of ACW in China.

This paper will attempt to provide an overview of some of the logistic, technical, legal, and financial problems of the destruction of abandoned chemical weapons in China. It is divided into the following five sections:

- CWC Obligations;
- ACW in China - Their Locations and Conditions;
- Retrieval, Storage, and Destruction Operations;
- Logistic Barriers; and
- Costs.

## II. CWC OBLIGATIONS

The provisions regarding abandoned chemical weapons (ACW) in the Convention may at first not seem overly cumbersome. Some of them, however, are quite convoluted, and more than one interpretation is possible. In order to gain an understanding of how countries are to proceed on this issue, it is necessary to understand the treaty requirements for managing and disposing of ACW. While this paper focuses on the chemical weapons which Japan left in China, it should be emphasized that these requirements apply to any State Party which declares ACW on its territory or admits to having abandoned chemical weapons on another State Party's territory.

The CWC defines old and abandoned chemical weapons in the following manner:

"Old Chemical Weapons" means:

- a) Chemical weapons which were produced before 1925; or
- b) Chemical weapons produced in the period between 1925 and 1946 that have deteriorated to such extent that they can no longer be used as chemical weapons.

Chemical Weapons Convention (CWC) Art. II para. 5

"Abandoned Chemical Weapons" means:

Chemical weapons, including old chemical weapons, abandoned by a State after 1 January 1925 on the territory of another State without the consent of the latter.

CWC Art. II, para. 6

Table 1 shows where the definitions of abandoned chemical weapons and old chemical weapons overlap.

**TABLE 1: CLASSIFICATIONS OF OLD AND ABANDONED CHEMICAL WEAPONS<sup>2</sup>**

<b>Chemical weapons produced before 1925</b>		<b>Chemical weapons produced between 1925 and 1946</b>	<b>Chemical weapons produced after 1946</b>
Considered as Old Chemical Weapons only	<i>Usable</i>	Considered as Chemical Weapons (if OCW or ACW are usable, they are treated as Chemical Weapons)	Considered as Chemical Weapons and/or
	<i>Unusable</i>	Considered as Old Chemical Weapons and/or Abandoned	Abandoned Chemical Weapons

The basic obligations of the CWC with respect to ACW are listed in Table 2.

**TABLE 2: OVERVIEW OF CWC OBLIGATIONS**

<b>Territorial State Party (TSP) (China)</b>	<b>Abandoning State Party (ASP) (Japan)</b>
Declare chemical weapons abandoned on its territory	Declare chemical weapons abandoned on other's territory
Cooperate with ASP in destruction	Destroy <sup>3</sup> ACW and underwrite costs
Destroy ACW on its territory when ASP cannot be identified or is not a State Party	
<b>OACW Expert Group Meeting Decision</b>	
The ASP and the TSP will conclude a mutually agreed upon plan of destruction	

Source: CWC, Art. II, para. 5

<sup>2</sup> In this paper, the term ‘chemical weapons’ refers to chemical weapons in the general sense. However, when it is written in upper case, it refers to categories of chemical weapons as specified in the Convention. A strict procedure for disposal of Chemical Weapons is established in the Convention and includes *inter alia*, a 10-year disposal deadline, intensive verification measures of CW storage and destruction sites, and requirements for the order in which various agents are to be destroyed.

<sup>3</sup> It should be kept in mind throughout this paper that some interpret ‘destruction’ to include verification of destruction and its costs, and some interpret ‘destruction’ to mean destruction only, with no verification.

The specific requirements for declaring and destroying ACW are spelled out in the Verification Annex of the Convention. If the identity of the country which has abandoned chemical weapons is known, this country is required to destroy these weapons with the cooperation of the TSP. Other issues clarified in the Verification Annex include how the OPCW inspections are to be carried out, the right of the TSP to seek consultations with the ASP in drafting a plan to destroy the weapons, and the types of requests both States Parties can make to the OPCW and the Executive Council.

The requirements to declare and destroy ACW are far from simple. There are any number of interpretations on how to declare ACW, and how to destroy them. Rather than making attempts at such interpretations, this paper instead identifies the basic requirements for declaration and destruction of ACW.

### **Declarations and disposal**

The OPCW needs to know how many of the abandoned chemical weapons are ‘old,’ since this classification affects how the weapons are destroyed and the cost of that destruction. Because of the overlap in the definitions of ACW and OCW, determining which chemical weapons are old, and which are abandoned, is not a straightforward task. As Table 1 shows, some weapons can be both old and abandoned. Determining which chemical weapons are abandoned is more complicated if the ASP is not known. Japan is most likely the party which abandoned chemical weapons in China, although the Technical Secretariat of the OPCW will conduct an inspection of the weapons themselves to make a final determination of the identity of the ASP.

ACW can be classified as ‘old’ if they are in such a poor condition that they are deemed ‘unusable’ by the Technical Secretariat. The criteria for judging whether a chemical weapon is usable or unusable is not explicitly defined in the Convention and has been a matter of ongoing debate in the OACW Expert Group. It is likely that a method of assessment will be developed that addresses the risk a weapon poses. For example, any old chemical munition whose components can be diverted for use in a modern chemical weapon is likely to be classified as ‘usable.’ Each State Party must itself declare which weapons are old in the initial declaration, which requires judgment about the weapon’s usability. The OPCW then verifies the declaration,



and either confirms or challenges the State Party's classification of a weapon as unusable. In all cases, the decision to modify destruction requirements rests with the Executive Council. Samples of other types of information to be submitted in declarations are in Tables 3 and 4.

The advantages in having old chemical weapons considered unusable is that the Executive Council may then grant the State Party responsible for chemical weapons disposal more flexibility in terms of the destruction deadlines and order in which the weapons must be destroyed<sup>4</sup>. But if a majority of weapons are found to be usable, more money will be needed to dispose of them than if they were unusable due to the exigency with which they must be destroyed. It should be noted that chemical weapons produced between 1925 and 1946 which are usable, and all weapons produced after 1946, even if designated 'abandoned,' are subject to the same destruction requirements as those applied to Chemical Weapons unless the TSP (with or without the ASP) requests the Executive Council to rule otherwise. Weapons produced before 1925 are treated as toxic waste.

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<sup>4</sup> The 'order of destruction' is a timetable that stipulates when different categories of weapons are to be destroyed, such as within a year of entry-into-force (EIF) of the Convention, or within two years of EIF, and so on. Category 1 consists of chemical weapons that are military agents and highly toxic chemicals with limited commercial use and their parts and components; Category 2 consists of chemical weapons on the basis of all other chemicals and their parts and components; and Category 3 consists of unfilled munitions and devices, and equipment specifically designed for use directly in connection with employment of chemical weapons. For more information see Verification Annex, Part IV(A), Section C of the CWC.

**TABLE 3: INFORMATION ON THE ABANDONMENT OF CHEMICAL WEAPONS ON THE TERRITORY OF ANOTHER STATE PARTY (ABANDONING STATE PARTY)**

Each State Party that has abandoned chemical weapons on the territory of another State Party shall provide the following information to the extent that it is available, and as precisely as it can.<sup>5</sup> The information is to be submitted separately for each abandonment location.

<b>Name of the State Party</b>
<b>Name of Territorial State Party</b>
<b>Location (for purposes of verification):</b> Name Address Co-ordinates Mailing address
<b>Abandoned Chemical Weapons:</b> Type(s)
Condition
Number
Estimated gross weight
<b>Other relevant information:</b> Date of abandonment
Form of abandonment
Toxic chemical in bulk (a) Type of toxic chemical and identification mark
(b) Name of toxic chemical
(c) Purity when produced or filled
(d) Quantity (specified by toxic chemical)
(e) Year of production
Munitions and devices
(a) Name
(b) Type, calibre, structure and materials
(c) Detonation device and its structure and characteristics, type of explosive
(d) Year of production
(e) Identification mark
(f) Filled toxic chemical

<sup>5</sup> This declaration is due not later than 30 days after the Convention enters into force. In case that the State accedes to the Convention later, the declaration is due not later than 30 days after it has acceded to the Convention.

(g) Nominal weight per item
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(h) nominal weight of chemical fill per item
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Source: *Expert Group on Old and Abandoned Chemical Weapons: First Report*, PC-V/B/WP.14, 26 November 1993, Annex, Appendix 1, p 13

#### **TABLE 4: INFORMATION ON ABANDONED CHEMICAL WEAPONS ON THE TERRITORY OF A STATE PARTY (TERRITORIAL STATE PARTY)**

Each State Party that has abandoned chemical weapons on its territory shall provide the following information to the extent that it is available, and as precisely as it can. The information is to be submitted separately for each abandonment location.

<b>Name of the State Party</b>
<b>Location (for purposes of verification):</b> Name Address Co-ordinates Mailing address
<b>Abandoned Chemical Weapons:</b> Type(s) Condition (current) Number Estimated gross weight
<b>Other relevant information:</b> Date of discovery Name of abandoning State Party Please specify whether known or presumed Status when discovered Name of toxic chemical (if known) Accessibility of CW Supplementary information

Source: *Expert Group on Old and Abandoned Chemical Weapons: First Report*, PC-V/B/WP.14, 26 November 1993, Annex, Appendix 1, p 14

### III. LOCATIONS AND CONDITIONS OF ACW

Before Japan can make its declarations to the OPCW, it must determine what was left behind in China. This is no easy task. At the end of World War II, incinerating documentation was a part of the pre-surrender protocol (Kurata, 1980; Kurata, 1992). While some documents from the US occupation forces remain, the most authoritative information to date is based on Chinese discoveries. All information known about ACW in China is summarized in Table 5.

**TABLE 5: ACW LOCATIONS<sup>6</sup>**

(Quantities are not cumulative; different reports refer to same weapons)

Location	Type	Number	Agent	Status
<b>Hebei Province</b>				
Gaocheng	75mm	50	phosgene	

Source: CD/1127, 1992

Shijiazhuang	gas shells	6 out of 50 confirmed Japanese		
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Source: *Kyodo News*, "Japanese Gas Shells in China Continue to Cause Damage," 4 November 1991, cited in *BBC Monitoring Service, Summary of World Broadcasts*, 6 November 1991

<sup>6</sup> Some locations are approximate due to ambiguous references. In some news reports the nearest large town is cited. For example, the munitions stored at Haerbaling are often listed at Dunhua, a larger town 50 km to the west. Weijin may be the more exact location of the bulk agent listed under Meihokou. There is a possibility the 50 shells at Gaocheng and the 50 shells at Shijiazhuang are the same munitions.

Location	Type	Number	Agent	Status
<b>Heilongjiang Province</b>				
Acheng	munitions	> 300		
	bulk	10 tons		
Bayan	munitions	> 100		
Fujin	75, 90, 105, and 150mm	> 100,000		
Shangzhi	bulk	1.1 tons		
Sunwu	105, 150mm	513		
	smoke cylinders	4 boxes		
	bulk	2 barrels		

Source: CD/1127, 1992

Qiqihaer	75, 150mm	248		partially buried
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Source: Yasuyoshi Ichihashi, Deputy Director, Center for the Promotion of Disarmament and Nonproliferation (Tokyo), personal communication, 5 February 1997.

Shuangcheng	munitions	11		
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Source: Yasuyoshi Ichihashi, Deputy Director, Center for the Promotion of Disarmament and Nonproliferation (Tokyo), personal communication, 5 February 1997.

Sunwu	poison gas containers	> 500		
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Source: *FBIS Daily Report*, FBIS-EAS-94-233, 5 December 1994, pp. 6-7.

Sunwu (Beishan)	75, 105, 150mm	513		buried in a shallow pit
	toxic cylinders	4 boxes		

Source: Gyoen Ko [Xiaoyan Gao in Chinese], *Nihongun no Iki Doku Gasu Heiki* [The Japanese Army's Abandoned Chemical Weapons], (Tokyo: Akashi Shoten, 1996) 40-43.

<b>Inner Mongolia</b>				
Hohhot	bulk	3 barrels		

Source: CD/1127, 1992

Hohhot	bulk	4 barrels		
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Source: *The Abandoned Chemical Weapons Discovered on China's Territory*, video, 1995, Government of China; Yasuyoshi Ichihashi, Deputy Director, Center for the Promotion of Disarmament and Nonproliferation (Tokyo), personal communication, 5 February 1997

Location	Type	Number	Agent	Status
<b>Jiangsu Province</b>				
Chuzhou	bulk	3 containers	mustard, lewisite	sealed
Nanjing	bulk	3 containers	diphenyl- chlorarsine	sealed

Source: *Jane's Defence Weekly*, 1 April 1995, p. 19.

Nanjing	bulk	4 barrels	mustard	
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Source: CD/1127, 1992

Nanjing	cans	3,000		
	mortar shell	1		

Source: *The Abandoned Chemical Weapons Discovered on China's Territory*, video, 1995, Government of China

<b>Jiangxi Province</b>				
Shanggao (Sixi township, Guanqiao village)	iron-sheet cans 11cm diameter 22cm long	> 200	hydrogen cyanide	

Source: *FBIS Daily Report*, FBIS-CHI-95-052, 15 March 1995, p. 2.

<b>Jilin Province</b>				
50 km east of Dunhua			mustard	buried

Source: *Kyodo News*, "Japanese Gas Shells in China Continue to Cause Damage," 4 November 1991, cited in *BBC Monitoring Service, Summary of World Broadcasts*, 6 November 1991

Dunhua	75, 90, 105, and 150mm; aerial bombs	1,800,000 (all types)		
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Source: CD/1127, 1992

Dunhua	75, 90mm	700,000	mustard	
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Source: *Jiji Press*, 2 June 1996

Dunhua	75, 90, 105, 150mm	700,000	mustard and lewisite mix	
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Source: Horie, 1996.

Location	Type	Number	Agent	Status
Dunhua		700,000	mustard and lewisite mix	possibly leaking

Source: Yuasa, 1996; *Japan Times Weekly International Edition*, 10-16 June, 1996, p. 3.

Haerbaling	munitions	365	mustard lewisite mix, pepper	excavated
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Source: *JPRS Report*, JPRS-TAC-95-002, "Delegation Confirms Japanese Weapons in Jilin," 14 June 1995.

Jilin (suburbs of)	75mm	> 40		
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Source: CD/1127, 1992

Meihekou	75, 105, 150mm			buried beneath railroad tracks near a train station
(Weijin)	bulk	74 tons	mustard and lewisite mix	solidified with lime

Source: CD/1127, 1992

Meihekou	bulk	74 tons	mustard, lewisite	Two mounds. Agent in six by three meter containers, packed in lime and concrete, covered with dirt
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Source: *JPRS Report*, JPRS-TAC-95-002, "Delegation Confirms Japanese Weapons in Jilin," 14 June 1995.

Meihekou	bulk			Two mounds. Treated with calcium hydroxide
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Source: *The Abandoned Chemical Weapons Discovered on China's Territory*, video, 1995, Government of China

Location	Type	Number	Agent	Status
<b>Liaoning Province</b>				
Shenyang	barrels	6	mustard	sealed, stored
	75mm	24		stored

Source: [Kagaku Heiki o do Shori Suru no ka?] *How to Dispose of Chemical Weapons?* NHK Special, Nippon Hoso Kyokai (NHK) Japan, broadcast 22 September 1996, 21:00 Japan Standard Time.

<b>Zhejiang Province</b>				
Hangzhou	75mm	33		

Source: CD/1127, 1992

Worth noting is that the agent from over 200,000 munitions at Shangzhi in Heilongjiang Province was drained in 1959-1960 and moved to a storage site in Meihekou (Government of China, video, 1995). It can be assumed, then, that the 74 tons at Meihekou includes this agent. The fate of the metal shells after the agents were drained is uncertain. In addition, there were 1.1 tons of bulk agent at Shangzhi. While it is likely that these agents were also moved, they have been listed in this paper as still being in Shangzhi in the absence of an explicit reference to their removal.

Supplementary information about what was declared in CD/1127 has been provided by joint investigative surveys in China since 1991, involving both Chinese and Japanese officials. The joint surveys have reviewed only a small percentage of the weapons detailed in CD/1127, and have made virtually no new discoveries in and of themselves.

Japan estimates that there are 700,000 ACW in Jilin province. China estimates 1,800,000. The Japanese approximation was made by extrapolating a cache of 450 weapons in a one cubic meter area from a pit 6.5 meters deep, and a cache of 465 weapons in a one cubic meter area from a pit four meters deep in Dunhua, to represent 700,000 for the province (Horie, 1996). Assuming a similar density of weapons, then there are over 1,500 square meters of land with deposits of chemical weapons with between 450 and 465 munitions per square meter. Another report cited 964 as the number of weapons on which the extrapolation was based (Yuasa, 1996; *FBIS Daily Report*, FBIS-CHI-96-107, 2 June 1996; *FBIS Report*, FBIS-TAC-96-007, 2 June 1996).

The surveys, which are a reexamination of what the Chinese have already discovered, can serve other uses. This includes gathering details to justify the drafting of a budget in Japan for destruction plants, assessing the suitability of China's infrastructure for retrieving and storing weapons, building destruction plants, and carrying out destruction activities. A first-hand look at the condition of the munitions will also provide both sides with an idea of what percentage will be classified as 'old.' A summary of these joint investigative survey missions is in Table 6. The geographic location of known sites can be seen in Appendix I.

**TABLE 6: JOINT INVESTIGATIVE SURVEYS OF ACW IN CHINA**

<b>Survey A: June 1991</b>		
<b>Location</b>	<b>Purpose</b>	<b>Findings</b>
Jilin: Dunhua Hebei: Shijiazhuang	To determine whether shells are of Japanese origin	At Shijiazhuang, six out of 50 shells are confirmed as Japanese.

Sources: *Jiji Press*, 5 June 1991, "Japanese Team to Probe WWII Weapons in China," and 21 February 1991, both cited in *Harvard Sussex Program CBW Events*; *Kyodo News*, "Japanese Gas Shells in China Continue to Cause Damage," 4 November 1991, cited in *BBC Monitoring Service, Summary of World Broadcasts*, 6 November 1991; *Kyodo News*, "Tokyo To Assess Chemical Weapons Left in PRC," 11 January 1993, cited in *FBIS Daily Report*, FBIS-EAS-93-006, 11 January 1993; William Brent, *AFP* (Hong Kong), 3 January 1992, cited in *FBIS Daily Report*, FBIS-CHI-92-002, January 1992, pp. 17-18.

<b>Survey B: 26 February to 13 March 1995</b>		
<b>Location</b>	<b>Purpose</b>	<b>Findings</b>
Anhui: Chuzhou Jiangsu: Nanjing Zhejiang: Hangzhou	To recover and seal weapons in containers; transport them to the storage site; conduct feasibility study on unearthing other buried weapons at Nanjing	Three containers of mustard and lewisite found at Chuzhou were sealed. Japanese writing and numbers on cans confirm Japanese origin. Three containers of diphenylchlorarsine, 4 containers of mustard, 3,000 cans and ten shells found at Nanjing. Writing on cans confirms Japanese origin. Acknowledgment that some chemical weapons were abandoned by former Japanese Army.

Sources: *Jiji Press*, "Temporary Treatment of Chemical Weapons Eyed," 9 February 1995; *Daily Yomiuri*, 19 February 1995, p 1; *Kyodo News*, "Japan Team in China to Survey Wartime Chemical Weapons," 27 February 1995; *Kyodo News*, "Japan Confirms Poison Gas Find in China," 13 March 1995; Hara, 1995; all cited in *Harvard Sussex CBW Events*; *Kyodo News*, 23 February 1995, cited in *JPRS Report*, JPRS-TAC-95-006-L, "Team To Remove WWII Chemical Weapons From PRC, Hold Talks," 6 March 1995; *Kyodo News* (Tokyo), 27 February 1995, cited in *FBIS Daily Report*, FBIS-CHI-95-038, 27 February 1995, p. 17; *Xinhua* (Beijing), 14 March 1995,

cited in *FBIS Daily Report*, FBIS-CHI-95-050, 15 March 1995, p. 4; Hadfield, 1995; *Jane's Defence Weekly*, 1 April 1995, p. 19; CD/1127; Ishizawa, 1997.

<b>Survey C: 23 May to 5 June 1995</b>		
<b>Location</b>	<b>Purpose</b>	<b>Findings</b>
Jilin: Dunhua, Haerbaling, Meihekou	To resume surveys	<p>Yellow and red markings on some 360 munitions, which had been collected from an area in Haerbaling and placed nearby in one of two storage pits, revealed them to contain mustard/lewisite and pepper agent. Another report said 356 of 366 munitions dug up from a pit were confirmed Japanese.</p> <p>At Meihekou there were two mounds with 74 tons of materiel, 6x3 meter containers, packed in lime, concrete, covered with dirt.</p>

Sources: *Kyodo News*, "Japan to Send Wartime Chemical Weapons Mission to China," 26 April 1995; *Kyodo News*, "Mission to Study Chemical Weapons Left in China," 19 May 1995; *Reuters*, "Report on Japan's Poison Gas War," cited in *International Herald Tribune*, 25 May 1995; *Reuters*, "Japan Team Verifies Chemical Arms Left in China," 6 June 1995; all cited in *Harvard Sussex CBW Events*; *Kyodo News* (Tokyo), 5 June 1995, cited in *FBIS Daily Report*, FBIS-CHI-95-108, 6 June 1995, pp. 7-8; *Korea Times*, 8 June 1995, p. 4; *Reuters*, "Japan, China to Discuss WW2 Chemical Arms Disposal," 7 June 1995; *Kyodo News*, 5 June 1995, cited in *JPRS Report*, JPRS-TAC-95-002, "Delegation Confirms Japanese Weapons in Jilin," 14 June 1995

<b>Survey D: 16 September to 1 October 1995</b>		
<b>Location</b>	<b>Purpose</b>	<b>Findings</b>
Heilongjiang Jilin Liaoning: Shenyang	To survey and seal weapons	Six drums of mustard intended for aerial spraying were sealed. 104 munitions containing mustard lewisite mix and some with irritant fill were confirmed as Japanese

Sources: *Kyodo News*, 13 September 1995, cited in *BBC SWB*, EE/D2408/G, 14 September 1995; *AFP*, "Japan to Send Third Mission to Check WWII Chemical Weapons Left in China," 13 September 1995; *Kyodo News*, "Japan Disposing of Poison Gas Left by Army in China," 30 September 1995; Sugiyama, 1995; *Jiji Press*, "Japan Seals Chemical Weapons Left in China," 2 October 1995; all cited in *Harvard Sussex Program CBW Events*; [Kagaku Heiki o do Shori Suru no ka?] *How to Dispose of Chemical Weapons?* NHK Special, Nippon Hoso Kyokai (NHK) Japan, broadcast 22 September 1996, 21:00 Japan Standard Time.

<b>Survey E: 14 May to 3 June 1996</b>		
<b>Location</b>	<b>Purpose</b>	<b>Findings</b>
Jilin: Dunhua, Haerbaling	To estimate the number of weapons, analyze chemicals, assess environmental risks, and to plan for destruction of the weapons	700,000 ACW are estimated to be in Jilin based on an extrapolation from one cache of 450 weapons in a one square meter area, and a second cache of 465 weapons; another report cited the extrapolation to be based on a find of 964 weapons.  High levels of chloride ions were discovered in the soil; no environmental damage was declared.

Sources: *China Daily*, "Weapons Disposal," 10 April 1996, cited in *Sangyo Keizai Shimbun*, cited in NAPSNet, "Chemical Weapons Left in China;" *Kyodo News*, "Japan to Send Mission on Chemical Weapons Left in China," 8 May 1996; *The Japan Times*, "Chemical Arms Team to Go to China," 8 May 1996; *Jiji Press*, "Chemical Weapons Survey Team Going to China," 8 May 1996; *Jiji Press*, "Chemical Weapons Disposal Survey Team in Beijing," 14 May 1996; *Jiji Press*, "700,000 Weapons in Donghua," 2 June 1996; Horie, 1996; *Kyodo News*, 2 June 1996, cited in FBIS-CHI-96-107 and FBIS-TAC-96-007, 2 June 1996, "PRC: Japanese Team Issues Estimate on Wartime Chemical Weapons."

<b>Survey F: 17-28 September 1996</b>		
<b>Location</b>	<b>Purpose</b>	<b>Findings</b>
Heilongjiang: Bayan, Haerbaling, Fulaerji, Qiqihaer, Shuangcheng, Sunwu Inner Mongolia: Hohhot		248 munitions of different caliber (from 75 to 150mm) are cited at Qiqihaer; 11 of 43 munitions at Shuangcheng were CW; 4 barrels of agent were confirmed at Hohhot

Sources: *Jiji Press*, 30 September 1996; cited in *Chemical Weapons Convention Bulletin*, December 1996, pp. 23-24; Yasuyoshi Ichihashi, Deputy Director, Center for the Promotion of Disarmament and Nonproliferation (Tokyo), personal communication, 5 February 1997.

<b>Survey G: 28-31 May 1997</b>		
<b>Location</b>	<b>Purpose</b>	<b>Findings</b>
Heilongjiang: a village 30 km south-southwest of Mudanjiang	To inspect new ACW finds and consider locations for ACW destruction facility	213 shells: 75mm: 20 90mm: 186 105mm: 3 150mm: 4 All were badly corroded; shells were collected over several years from a steel factory's scrap metal purchases
Liaoning: 35 km south of Shenyang		This site underwent an evaluation for suitability as a future dismantlement and analysis site for chemical weapons.
Liaoning: a village 7 km northeast of Fushun		118 shells 75mm: 101 90mm: 9 105mm: 8 150mm: 4 All were badly corroded: a few high explosive shells were found: some shells could not be verified as Japanese

Sources: *Dai Hakkai Chugoku Iki Kagaku Heiki Genchi Chosa: Kekka Gaiyo* Eighth On-Site Inspection of Abandoned Chemical Weapons Sites in China: Summary of Findings, 1 June 1997, obtained from the Center for the Promotion of Disarmament and Nonproliferation.

### **Prospects for determining the locations and conditions of ACW**

While extrapolations and estimates can be made, an exact figure of how many abandoned chemical munitions there are in China will not be arrived at until they are actually discovered. Due to a lack of records, accurate estimates are extremely difficult. However, it is possible that China, Japan, or the United States possess relevant information which has not been released. If this is the case, there may be sites where chemical weapons have not yet been unearthed. It is noteworthy that the CWC stipulates that chemical weapons buried before 1977, and which remain buried, are not required to be recovered and destroyed. Once chemical weapons have been unearthed, however, they are subject to declaration and destruction requirements of the Convention.

## **IV. RETRIEVAL, STORAGE, AND DESTRUCTION OPERATIONS**

Retrieval, storage, and destruction are core elements of the ACW disposal process. China and Japan have not revealed the details of how they will each proceed in this direction. But by examining the experiences of other nations and identifying some of the more unique factors which have bearing on ACW in China, we can assemble part of the body of information on which China and Japan will draw when they draft a mutual plan for destruction. The Convention officially states that it is the responsibility of the Abandoning State Party to provide the necessary financial, technical, expert, facility and other resources. The Territorial State Party is obliged to cooperate in each of these areas. (Verification Annex, Part IV(B), paragraph 15.)

### **Retrieval operations**

The Explosives Ordnance Disposal (EOD) Facility in Munster, Germany is a useful example of how old chemical weapons are retrieved and destroyed. Between 1978 and 1994 the Germans successfully retrieved 10,559 toxic munitions and 78,370 conventional munitions and explosives (FAFVC, 1995b). At Munster, the initial retrieval stage involves the use of metal detectors and manual handling where possible. When a munition is thought to be unstable, a small vehicle with a mechanized arm is sometimes used to lift the munition out of the ground into a specially reinforced container for transport.

The principles of public safety and environmental protection are reinforced in the CWC. If ACW present a threat, precautionary measures should be taken immediately, whether this means putting them in temporary storage, draining the munitions in the field, and/or neutralizing the agent fill. However, it is important to take into account the characteristics of a munition at the time of inspection since this can affect how it is ultimately classified. For example, the declared usability of a weapon must be confirmed by OPCW inspectors. If the weapon remains at its original location, its conditions *in situ* may yield clues as to the date of the abandonment. If a weapon was abandoned before 1925, under the CWC it is not 'abandoned,' it is 'old.' If the weapon is removed from its original resting place for safety reasons, inspectors may have to

make a decision based on incomplete information. On the other hand, final determination of the munition's age or identification of the abandoning party may not be possible until the munition is cleaned. One of the safer cleaning technologies is the jettison of frozen carbon dioxide pellets under high pressure.

While it is largely possible to tell by sight whether or not a munition is safe for handling, an x-ray is required to reveal the munition's internal design and type of fill (i.e., liquid or solid). However, due to the extent of corrosion an x-ray is not always possible and sometimes the chemical fill is not identified until destruction. In other cases, one can ascertain the fill by markings on the munition, or by agent which is leaking. If there is a cache of munitions which are identical, once the fill of one weapon is known, one can generally assume the other weapons also have the same fill.

Knowing the total weight of different types of munitions can serve as a guide in identifying ACW. For example, Japan produced 150mm howitzer shells in four chemical configurations, each of a different total weight. A 150mm shell filled with a mustard and lewisite mix weighed 31.27 kg, a phosgene and arsenic trichloride mix weighed 30.59 kg, diphenylcyanoarsine weighed 32.1 kg, and a phosgene filled shell weighed 29.53 kg (Ki, 1996, pp. 28-31). Under optimum conditions, when the shell has been properly cleaned, these weights can be used to identify the contents of the shell. However, since many munitions are corroded, mud and dirt on the outside of the shell might add to the total weight, just as leakage would subtract from the total weight.

For all destruction technologies except cryofracture (a process that freezes the munition whole so it can be shattered and disposed of) and pool technology (where a chemical process opens the shell casing), a munition must be cut open, its fill emptied, and the explosive portion separated from the chemical portion. An x-ray is required to show where it is safe to cut. Thus some sort of mobile x-ray unit will be needed for the initial recovery. The munition can then be appropriately marked and stored in designated areas based on its fill and on whether or not it is usable.

ACW are reported to have been found in over twelve Chinese provinces (Government of China, video, 1995). Based on the proximity of one location to another, an assessment will have to be made of when to stop retrieval in a given area and begin storage. If the combination of munition

deterioration and poor infrastructure dictate against transport, the weapons will either have to be stored where they are found or destroyed *in situ*. The use of a mobile destruction unit is one solution to this problem.

ACW pose another difficulty which modern-day stockpiles do not. Discovery of ACW can be unpredictable and ongoing. The Convention states that a declaration must be filed 180 days after an abandoned chemical weapon is discovered (Verification Annex, Part IV(B), paragraph 9). This applies to ACW discovered days, months, or years after entry into force. After all initial declarations have been verified, how does the retrieval team treat an extra twenty munitions it suddenly finds? To declare them again and wait for inspectors to verify them before taking any action to retrieve, store or destroy the weapons could, in some cases, be impractical and inefficient. Most likely, if a small number of munitions are found, the team may decide to remove and destroy them. The State Party has 180 days to declare such a find (CWC VA IV(B) 4, 9), and the OACW Expert Group has foreseen the possibility of consolidating finds of OCW over a given 180 day period (PC-V/B/WP.14, Annex, p. 5). When the State Party sends the relevant information concerning the discovered abandoned chemical weapons to the Technical Secretariat, it can state that the weapons were destroyed. However, the State Party may decide to wait for OPCW inspectors to verify the declaration before destroying the munitions. If there is a large cache, say 500 or more in one place that are in stable condition and pose no immediate danger, and particularly if they require confirmation by the OPCW as to their usability, destruction might be delayed. For OCW, the OACW Expert Group reached an understanding that the location of the weapons can refer to either where they were found, or to where they are kept in a storage facility. However, for ACW there is as yet no such understanding on consolidating finds and on the declared location. They may be applicable to ACW which are also OCW: chemical munitions produced between 1925 and 1946, abandoned after 1925, unusable as a chemical weapon, and hence 'old.'

The other extreme is the discovery of ACW after the Convention's destruction period has elapsed. The Convention provides no clear directions if China were to discover ACW of Japanese origin twenty years from now. The OACW Expert Group has also not made any decisions on this issue. It may be an area that China and Japan elect to address in their mutually agreed plan for destruction. Despite the lack of specific provisions, the spirit of the CWC



suggests that the obligation to destroy ACW will not cease even when discovery occurs after the destruction period expires.

### **Storage operations**

There are basically two methods of storage: bulk storage and stacked munitions. Once the weapons have been retrieved, one of these two storage types will be required. At Meihokou the mustard and lewisite mix is stored in bulk in two containers, six meters deep and three meters wide, which are packed in lime and concrete (CD/1127, 1992; *FBIS Daily Report*, FBIS-CHI-95-108, 6 June 1995).

Some storage facilities at Munster separate munitions according to type. Munitions containing solid agent are painted yellow and stored in one bunker, while munitions containing liquid agent are painted red and stored in another bunker (FAFVC, 1995a). The weapons are placed in bunkers in stacks of roughly 100, with thick walls of concrete between the stacks to limit the effects of an accidental detonation. The partially subterranean bunkers also have a portal in the door so that before service personnel enter, they can insert a detector to determine whether some munitions have leaked.

Intermediate storage is required between the time the agent is removed from the munition and destruction of the drained agent at the destruction plant in Munster. Storage in polyethylene barrels is used to handle especially corrosive agents and contaminated metal (FAFVC, 1995b). At future destruction plants in China, there will be intermediate storage areas within the destruction facility itself and possibly in other areas as well.

Aside from basic infrastructure requirements such as ample electrical power, there appear to be no immediate obstacles to Japan's building storage facilities in China which are similar in function, if not design, to those at Munster, albeit on a larger scale.

If the Technical Secretariat decides that systematic verification of storage facilities is required (cf. Verification Annex, Part IV(B), paragraph 11), those facilities will be subject to a host of verification activities. If necessary, the Technical Secretariat will conclude an agreement with China outlining the procedures for these inspection activities. Included may be continuous monitoring with on-site equipment to ensure that no weapons leave the storage facilities

undetected. OPCW inspectors will remain on-site until all chemical weapons have been removed.

### **Destruction operations**

Japan, once established as the ASP, is obligated to destroy the ACW in China within ten years after entry into force, unless the Executive Council decides otherwise. If there are, as China claims, at least two million chemical munitions on its territory, this will be a daunting task, with destruction to proceed at an average of 200,000 pieces per year, or about 909 per day, if the plant operates 220 days per year.<sup>7</sup> It is worth noting that of the 7,000,000 chemical weapons Japan produced, and thus potentially abandoned, most were of the smaller type: there were seven times as many 75mm and 90mm shells produced as there were 105mm and 150mm (Ki, 1996, p. 37). However, even if a good portion of them are declared unusable and Japan is given some leeway in how they are destroyed, their treatment will still demand time and money.

While the facility at Munster has been useful as a model, it is too small by an order of magnitude. Munster has retrieved only 10,559 old chemical munitions in 17 years, with a maximum destruction capacity of 70 munition tons per year, operating 12 hours a day for 200 to 250 days annually, but has yet to destroy all the munitions retrieved, with a backlog of 115 tons of chemical agent and 30,000 tons of contaminated earth (FAFVC, 1995b). If conventional munitions are included, the number of weapons retrieved comes to 88,929--less than half of what needs to be destroyed in one year in China.

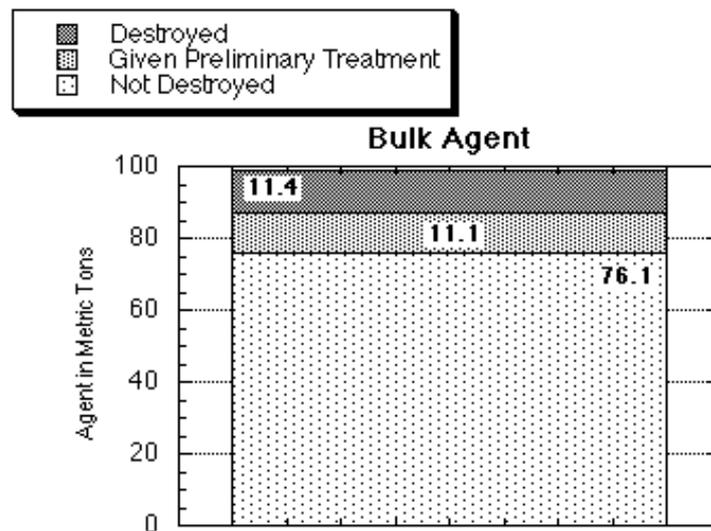
At the United States' Johnston Atoll Chemical Agent Disposal System (JACADS), a test destruction period of M-55 rockets saw 7,565 rockets processed at a rate of 27 rockets per hour for one shift. The destruction period was about seven months (*Chemical Demilitarization Update*, September 1991, p. 1), or about 1,000 rockets per month, from which we can extrapolate to 12,000 per year. It should be noted that JACADS is destroying munitions which have not been buried and subject to corrosion. As a result, the operations automating their destruction, and particularly their disassembly, are more efficient than would be the case for corroded munitions.

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<sup>7</sup> The number of operational days is set at 220 for comparison with the facility in Munster.

A decision has not been finalized yet on whether or not there will be more than one destruction facility in China.<sup>8</sup> Japanese estimates put ACW in Jilin province alone at 700,000 (Horie, 1996; Yuasa, 1996),<sup>9</sup> making the anticipated rate of destruction approximately 70,000 weapons per year in that province. Yet Japan's estimate is less than half the 1.8 million ACW in China's estimate of Jilin (CD/1127, 1992). Only a small number of ACW have been destroyed by the Chinese government. The status of bulk agent which the Chinese have declared is depicted in Figure 1, while the status of the munitions is depicted in Figure 2.

**FIGURE 1: STATUS OF BULK AGENT DECLARED BY CHINA**

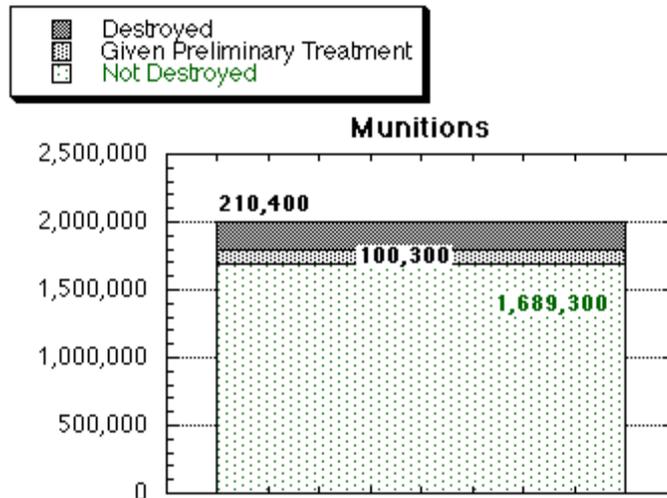


Source: CD/1127

<sup>8</sup> cf. *Nihon Keizai Shimbun*, "Chugoku ni Shori Kojo [Disposal Plants in China]," 3 January 1996 p. 1 for more than one facility, and *Yomiuri Shimbun*, "Iki no Kagaku Heiki Meguru Gimu wa? [What is the Responsibility Regarding Abandoned Chemical Weapons?]," 9 June 1996, p. 2 for only one facility.

<sup>9</sup> Only one report has cited a different estimate: 770,000. In "China Arms Dump is Surveyed," *International Herald Tribune*, 4 June 1996.

**FIGURE 2: STATUS OF CHEMICAL MUNITIONS DECLARED BY CHINA**



Source: CD/1127

While debate over destruction technologies continues, incineration and neutralization of agents still seem to be the most viable destruction methods currently available. Table 7 shows a summary of how different plants treat different components of chemical weapons. Mitsubishi Corporation is considering making a bid for the destruction of bulk agent by subcontracting a partnership of Lockheed Martin Corporation and Molten Metal Technology Incorporated, which would use the Catalytic Extraction Processing (CEP) method (*PR Newswire*, 27 March 1997; *Business Wire*, 25 September 1996; *Defense News*, 28 October 1996, p. 20).

For destruction of munitions, even if Munster's size cannot not be emulated, its destruction technologies can. The basic steps of destruction at Munster are as follows: the munition is cleaned, and the chemical portion separated from the non-chemical portion. Then the agent, contaminated metal, dunnage, and sometimes the explosive charge, are incinerated. At Munster, all components slated for incineration are placed in barrels and moved into the incineration chambers. Destruction of the explosive charge is applicable only if the munition was assembled with a fuze.

**TABLE 7: DESTRUCTION METHODS OF CHEMICAL WEAPONS COMPONENTS**

	<b>Munster (Germany)</b>	<b>JACADS (USA)</b>	<b>Chapayevsk (Russia)</b>
Chemical agent	incineration	incineration	neutralization and incineration
Contaminated metal	incineration	incineration	neutralization and incineration
Explosive charge	temporary storage	incineration	<i>not applicable</i>
Dunnage	incineration	incineration	incineration

The timeline for beginning disposal operations has not yet been finalized. However, Chinese sources state that the construction of destruction plants will occur in three stages:

1. In 1996, an assessment will be made of the physical geography of potential plant sites
2. By the end of 1996, governmental consultations on a disposal agreement will begin
3. In 1997, plant construction will start and in 1998 disposal operations will commence

*Chugoku ni Shori Kajo* [Disposal Plants in China], *Nihon Keizai Shimbun*, 3 January 1996, p. 1

This coincides with plans by the Japanese to begin destruction in April 1988, as announced by the Ministry of Foreign Affairs in the fall of 1996 (*Chemical Weapons Convention Bulletin*, No. 33, September 1996, p. 34). Since the CWC entered into force on 29 April 1997, commencement of destruction in 1998 would be in keeping with the time-line for the order of destruction of chemical weapons, which states that the chemical weapons destruction facility must be constructed within one year of entry into force.

The requirements to destroy different categories of weapons in a specific order obligates Japan to begin eliminating Category 2 and 3 weapons within one year, and Category 1 weapons within two years of entry into force of the treaty. The 'order of destruction' (Verification Annex, Part IV(A), Section C) determines when each category of weapon is to be destroyed. The breakdown of agents found in ACW in China and also produced by Japan during World War II which fall into these categories are listed in Table 8.

**TABLE 8: JAPANESE AGENTS AND THE ORDER OF DESTRUCTION**

Japanese Codename	Mixture	Location	Category of CW	Schedule of CW	Destruction Commencement
Yellow No. 1A	mustard	Various mustards and lewisites found at many sites in Heilongjiang, Jiangsu, Jilin, Liaoning provinces and the Inner Mongolia Autonomous Region	1	1	Not later than two years after entry into force (EIF) for State Party
Yellow No. 1B or A2	mustard		1	1	"
Yellow No. 1C or A4	mustard plus anti-freezing agent		1	1	"
Yellow No. 2 or A3	lewisite		1	1	"
Blue No. 1	phosgene; carbonyl chloride	Found in Gaocheng <sup>10</sup>	2	3	Not later than one year after EIF for State Party
Green No. 1	bromobenzyl [cyanide]	Both found at Bengbu, Anhui province <sup>11</sup>	2	n.a.	"
Green No. 2	chloroacetophenone		2	n.a.	"

<sup>10</sup> CD/1127, 1992; *The Abandoned Chemical Weapons Discovered on China's Territory*, video, 1995, Government of China

<sup>11</sup> *The Abandoned Chemical Weapons Discovered on China's Territory*, video, 1995, Government of China

Red No. 1	diphenyl- cyanoarsine	Found in Nanjing <sup>12</sup>	2	n.a.	"
Brown No. 1	hydrogen cyanide	Found at Shanggao <sup>13</sup>	2	3	"

Sources: Kurata, 1992; Ki, 1996.

The question of who will work in the ACW destruction plant is still being negotiated. One can easily foresee the political difficulties of employing an all Japanese crew, with no job creation for any Chinese. If we assume a mixed work force of Chinese and Japanese nationals, language becomes a problem, since neither country makes study of the other's language a part of its public education curriculum. English as a common language may be the only solution, and the resulting crash courses for workers and translation of documents will no doubt raise costs.

Japan has the technology for many aspects of the destruction process: incineration stacks, cutting machines, draining apparatus, x-ray equipment, etc. However, there are some machines Japan has less experience in developing, such as robotic equipment used to place a munition onto a production train and verify the calibre. For safety reasons, a high level of automation is desirable. US and German firms might be contracted to provide equipment (*Yomiuri Shimbun*, 9 June 1996, p. 1). In April 1996 Russian and Japanese defense officials agreed to hold future talks on chemical weapons destruction (Golts, 1996). Shortly thereafter, the Russian defense ministry requested the foreign ministry to offer its chemical weapon destruction services to Japan once discussions between Japan and China on the plant have begun (*Jiji Press*, 13 May 1996). It would be ironic indeed if Russia were to use profits obtained from its destruction of ACW in China to fund the elimination of its own stockpiles.

Jilin province is likely to host a destruction facility and some sources are already indicating Haerbaling as another site (*Daily Yomiuri*, 9 April 1997; *Yomiuri Shimbun*, 9 June 1996, p. 1). Other locations with very sizable stocks of weapons are Heilongjiang province at Fujin with 100,000 munitions and Acheng with ten tons of bulk agent. Some Chinese authorities earlier called for the weapons to be shipped to and destroyed in Japan (*Yomiuri Shimbun*, 9 June 1996, p. 1). However, the Japanese believed the dangers associated with moving the weapons were too

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<sup>12</sup> Ibid.

<sup>13</sup> *FBIS Daily Report*, FBIS-CHI-95-052, 15 March 1995, p. 2.

great (*Jiji Press*, 12 June 1996). During bilateral talks in December 1996, it was confirmed that destruction will indeed occur in China (Ishizawa, 1997).

### **Prospects for retrieval, storage, and destruction operations**

It is possible for some destruction plants in China to follow the model provided by the German facility at Munster. The scale of operations in China must be many times larger, but the process itself would be the same. While discussion of alternative destruction technologies continues, Japan must now decide what technologies it will use, so it can begin preparations for the destruction plants. Assuming the Japanese are serious about starting plant construction in 1997 and ACW destruction operations in 1998, there is very little time to begin experimental trials with other methods. It is also in Japan's interest to begin destruction as soon as possible, given the great number of munitions claimed by China.



## V. LOGISTIC BARRIERS

There are a number of technical and logistical problems which plague attempts to recover and destroy abandoned chemical weapons. One example is the question of how toxic materials will be moved. Given a solid infrastructure and stable condition of the munitions, land transport should be feasible. In Bashkortastan and Tatarstan in Russia, a local law prohibits the transport of toxic chemicals across provincial boundaries, but no such local laws seem to exist in China.

It is also important to take into consideration that retrieval operations are easiest to conduct in moderate climates. The northeastern part of China has an annual median temperature of 4-6°C . The recovery of ACW will therefore proceed in warmer months, or at least when the ground is not frozen -- which begins to take effect in September and lasts until the beginning of the spring season. However, in order to meet destruction deadlines, retrieval teams may have to work in less than optimal conditions.

The potential for contamination of water tables will also complicate retrieval operations. Many caches of ACW are in excavated pits below topsoil level. The two pits used for estimating the number of ACW in Jilin recently were four meters and six and a half meters deep (Horie, 1996). The higher the water tables or the more marshy the area, the greater the chance a leaking munition or an accidental detonation will release agent into the surrounding water supply. Alternately, the greater the elevation of the pits above sea level, the greater the danger leaking agent might run down into water sources at lower elevations. Mustard is not readily soluble in water and would persist as a danger should any of the agent contaminate an underground spring. The fact that there is a reservoir and a river in Dunhua, where many weapons have been found, underscores the problem. Chinese authorities have already made their concern about this potential threat known (*FBIS Daily Report*, FBIS-CHI-95-108, 6 June 1995, p. 7). In a recent Chinese-Japanese joint investigative survey, soil samples yielded high levels of chloride ions, suggesting leakage of chemical munitions (*FBIS Daily Report*, FBIS-CHI-96-107, 2 June 1996; *Japan Times Weekly International Edition*, 10-16 June 1996, p. 3). Chloride ions in and of themselves do not necessarily present a direct danger, if the concentrations are low enough, which may account for the Japanese reports of 'no environmental damage' in the vicinity of the weapons (Horie, 1996; Yuasa, 1996). If we assume that water contamination is a potential



danger, however, then retrieval teams should not only take steps to prevent accidental releases, but should be prepared to minimize the environmental damage if contamination does occur.

### **OPCW Inspections**

The OPCW cannot feasibly inspect every ACW site and verify every declaration for all countries. The OPCW's planning assumptions reflect a prioritization of its resources to address those sites which pose the most serious threat to the very purpose of the Convention. Of approximately 40 declared OACW sites worldwide, 12 sites will be visited per year. An average of 6 inspectors will be on-site for an average of 3 days. It is worth noting that these planning assumptions cover all declarations of ACW among States Parties, and are by no means earmarked for China and Japan alone.

## VI. COSTS

The Convention states that the Abandoning State Party is responsible for providing all technical and financial resources in order to carry out disposal activities. The Territorial State Party is only called upon to provide ‘appropriate cooperation’ in this regard (CWC VA IV(B) 15).

The phrase ‘appropriate cooperation’ is vague and could be interpreted to mean responsibilities such as direct sharing of costs, provision of supplemental personnel or equipment, or the free use of infrastructure. Because of the ambiguity, all or none of the above could be inferred. While it is possible to use the joint investigative surveys as an indicator of the level of cooperation that currently exists between China and Japan, details of the cooperation are rarely reported in open source media. For the most part, the level of cooperation China will provide Japan will have to be negotiated in the mutually agreed plan for destruction.

**TABLE 9: OVERVIEW OF COST RESPONSIBILITIES**

<b>TSP</b>	<b>ASP</b>	<b>OPCW</b>
Initial and Subsequent Inspections	Initial and Subsequent Inspections	Initial and Subsequent Inspections
Destruction	Destruction	
Verification of Destruction	Verification of Destruction	Verification of Destruction
Dues to OPCW	Dues to OPCW	

### **Inspections**

The Initial Inspection has two main goals: to confirm the declared usability of the ACW, and to decide whether or not systematic verification of storage facilities is required (CWC VA IV(B) 1). Although travel costs for OACW inspections have not been addressed by the OACW Expert Group, the costs for Chemical Weapons inspections are allocated as follows. When inspectors from The Hague travel to the State Party for an inspection, the OPCW covers travel costs from The Hague to the point of entry and back; the host State Party covers the in-country costs from

the point of entry to the inspection site and back. Subsequent inspections of Chemical Weapons can use the same cost sharing arrangement between the OPCW and the host State Party.

If the OACW Expert Group tries to allocate funds for travel costs of ACW inspectors in the same way they have been allocated for inspectors of Chemical Weapons, adjustments will have to be made for the peculiarities of OACW. When the OPCW is conducting inspections of ACW positively identified as Japanese, it could be the ASP (i.e., Japan) that foots the in-country bill. If the identity of the ASP cannot be established, then it could be China who pays the in-country costs. It should be noted that when the ASP cannot be identified, the TSP has the right to ask the OPCW and other States Parties for assistance in destroying the abandoned chemical weapons.

### **Destruction**

The actual destruction costs are high. Destruction of OCW at Munster costs DM 4.5 million per year (approx. US \$2.8 million), after an initial capital investment of DM 28 million (approx. US \$17.5 million) (FAFVC, 1995c, p. 7). If we recall that Munster has retrieved 88,929 munitions (of which only 10,559 are chemical weapons) in 17 years, this yields an average of 5,231 munitions retrieved per year, at an average cost of DM 4.5 million per year, or DM 860 per munition to date, and all the munitions have not yet been destroyed.

The US facility on Johnston Atoll (JACADS), which was constructed with a high-volume destruction capacity, involved start up costs of US \$811 million (design \$32 million, construction \$47 million, equipment purchases and installation \$207 million, systemization \$100 million, operations \$425 million) (Misiewicz, 1991).

Others have estimated the costs of destruction of ACW in China as in Table 10.

**TABLE 10: ESTIMATED COSTS OF DESTRUCTION OF ACW IN CHINA<sup>14</sup> IN 1996 US DOLLARS**

	<b>Source</b>	<b>Amount</b>	<b>Cost of...</b>	<b>Time Frame</b>
<b>A</b>	<i>Kyodo News</i> , "Chinese Monthly Focuses on Japanese Poison Gas Shells," 24 August 1994, cited in <i>Harvard Sussex Program CBW Events</i>	\$89,539,674,300	"eliminating ACW"	6 - 8 years
<b>B</b>	Hadfield, Peter. 1995. "China's Bill for Wartime Cleanup," <i>International Herald Tribune</i> , 23 March.	\$11,261,829,655	"cleaning up ACW"	<i>not stated</i>
<b>C</b>	Beal, Thom. 1995. <i>China Youth Daily</i> , cited in <i>UPI</i> , "China Wants Disposal of Japanese Bombs," 17 August; cited in <i>Harvard Sussex Program CBW Events</i>	\$1,020,000,000	"disposal"	<i>not stated</i>
<b>D</b>	<i>Nihon Keizai Shimbun</i> , "Chugoku ni Shori Kojo [Disposal Plants in China]" 3 January 1996, p. 1	at least \$1,864,975,755	<i>shori kojo o kensetsu suru</i> [construction of disposal plants]	10 - 20 years
<b>E</b>	<i>Reuter</i> , cited in <i>International Herald Tribune</i> , "Toxic Cleanup Begins in China," 15 May 1996	\$1,000,000,000	"clearing ACW"	up to nine years
<b>F</b>	<i>Yomiuri Shimbun</i> , "Iki no Kagaku Heiki Meguru Gimu wa? [What is the Responsibility Regarding Abandoned Chemical Weapons?]," 9 June 1996, p. 2	< \$11,189,854,532	<i>shori o oeru</i> [finish disposal]	10 years

<sup>14</sup> All figures adjusted for inflation using the Gross Domestic Product Deflator. Exchange rate used for 1994 Chinese yuan to US dollars for estimate A was 8.6187, from the 1995 International Monetary Fund's *Statistics Yearbook* Exchange rate used for 1995 British pounds to US dollars for estimate B was 0.634 pounds per dollar. Exchange rate used for 1996 Japanese yen (17 January to 7 August) to US dollars for estimates D and F was 107.24 yen to the dollar. British and Japanese rates calculated by averaging exchange rates listed in the *Economist*.

G	Ishizawa, Masato. 1997. <i>Nikkei Weekly</i> , "Chemical Weapons Return to Haunt Japan," 20 January 1997, pp. 1, 19.	> \$ 932,487,877	"construction of the neutralization plant and the water and electricity infrastructure"	10 years
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The general nature of these estimates illustrates how difficult the costs are to quantify. However, Japan has so far spent US \$5.1 million on the joint investigative surveys in China, and has budgeted another US \$2.75 million through March 1998 to finish plans for weapons disposal (Ishizawa, 1997).

### Verification of Destruction

The bill for verifying ACW destruction is likely to be a relatively small percentage of the total destruction costs. For example, an estimate for the costs of verifying chemical weapons destruction in Russia, which possesses a 40,000 ton stockpile of Chemical Weapons, is only nine percent of the total cost (Gorbovsky, 1996). However, this estimate also includes verification of the destruction of chemical weapons production, storage, and destruction facilities. The amount of money needed to verify destruction of the Chemical Weapons themselves would certainly be less than nine percent of the total destruction costs.

Each State Party is required to fund the OPCW based on a scale of assessment similar to that of the United Nations. For Part I of 1996, China has been assessed to pay 179,531 Dutch guilders (fl.) and Japan has been assessed to pay fl. 3,770,156 (PC-XIII/7, 14 March 1996, Annex 1, Appendix 2, pp. 21-22). These fees, which are payable to the OPCW regardless of each State Party's chemical weapon status, may or may not be considered as part of the costs of chemical weapons destruction and verification. Nevertheless the assessments will continue, in addition to any charges incurred directly by destruction.

## **Prospects for Meeting Costs**

Due to the large number of uncertainties involved in the destruction of ACW, such as the lack of data on the total number of munitions to be destroyed, estimating cumulative costs is difficult. Rather than assess the ability of Japan or China to pay an unknown amount, an attempt has been made to assess the types of costs they may face.

Different interpretations and ways of implementing the CWC could also have a major impact on financing. The most decisive factor is the assessed 'usability' of ACW and the decisions the Executive Council takes based on that information. Who pays for verification depends on progress towards defining the costs of verification and determining who is liable for what costs as well as the terms of the mutually agreed plan for ACW destruction between China and Japan.

## **VII. CONCLUSION**

Japan and China have a colossal task ahead of them. The destruction of ACW in China will be the single largest case of munitions classified as 'abandoned' under the CWC. This paper has analyzed some basic elements that might be included in China and Japan's mutually agreed plan for destruction.

### **CWC obligations**

The most important mechanism to assist Japan and China in meeting their obligations to declare and destroy ACW will be the mutually agreed plan for destruction, which has not yet been drafted. This accord should settle many of the legal and technical problems that face both countries. Among the hurdles facing the negotiations are how to determine 'usability' (this issue is also being considered by the OACW Expert Group), and to what extent destruction must be verified in accordance with the provisions of the Verification Annex, Part IV(A).

### **Status of ACW**

Estimates range from 700,000 to 2,000,000 ACW in China. The joint investigative surveys continue. One purpose of these surveys is to gather the information needed to plan physically and financially for the destruction of ACW. Perhaps more important, the surveys give China and Japan an opportunity to determine what kind of relationship they will have for the actual destruction, how much China will cooperate, and how much financial, technical, expert and facility Japan will provide.

### **Retrieval, storage, and destruction operations**

The handling of old and abandoned chemical weapons is probably one of the most hazardous types of demilitarization. To ensure the safety of workers, an extraordinary amount of knowledge and expertise will have to be applied. It seems evident that one chemical weapons destruction plant will not suffice, regardless of whose estimate of the total number of ACW in China one accepts, and irrespective of how many of the munitions are declared unusable. If destruction operations are to begin in 1998, there is not enough time to test alternative

destruction technologies with which Japan has essentially no experience. Instead, Japan is likely to adopt the US, German, or Russian approach to destruction.

### **Logistic barriers**

Many logistic challenges facing the destruction of ACW in China are unrelated to the special nature of chemical weapons. Problems such as communication failures, bureaucratic red tape, and adverse weather conditions are not uncommon. The OPCW can be expected to hire highly qualified and experienced individuals who can handle logistic barriers in a similar fashion as in the past. However, there are some exceptions, such as restrictions on the air transport of specialized equipment for field analysis of chemical weapons.

### **Costs**

ACW destruction cost estimates cover a wide range. One of the most important determinants of these charges are the number of weapons found to be unusable. Should a majority of weapons be declared unusable and thus 'old' as well as 'abandoned,' there is the possibility the Executive Council may modify destruction requirements of the Convention. Should a majority of weapons be found to be usable, more money will be needed to dispose of them than if they were found to be unusable, although the Executive Council may allow the ASP flexibility in the time-line and order of destruction. Other factors which influence cost include whether the Executive Council decides to modify (or not to modify) the provisions relating to their destruction, how intense verification operations will be, whether the verification is systematic or complementary, and who will pay for that verification. Many of these issues will be addressed in the mutually agreed plan for destruction.

## VIII. ACRONYMS

<b>ACW</b>	Abandoned Chemical Weapon
<b>ASP</b>	Abandoning State Party
<b>CAM</b>	Chemical Agent Monitor
<b>CEP</b>	Catalytic Extraction Processing
<b>CD</b>	Conference on Disarmament
<b>CBW</b>	Chemical and Biological Weapons
<b>CW</b>	Chemical Weapon(s)
<b>CWC</b>	Chemical Weapons Convention
<b>EIF</b>	Entry Into Force
<b>EOD</b>	Explosives Ordnance Disposal
<b>JACADS</b>	Johnston Atoll Chemical Agent Disposal System
<b>JSDF</b>	Japan Self Defense Forces
<b>MITI</b>	Ministry of International Trade and Industry (Japan)
<b>MOFA</b>	Ministry of Foreign Affairs (Japan)
<b>OACW</b>	Old and Abandoned Chemical Weapon(s)
<b>OPCW</b>	Organization for the Prohibition of Chemical Weapons
<b>OCW</b>	Old Chemical Weapon(s)
<b>NIPPS</b>	Neutron Induced Prompt Photon Spectroscopy
<b>PINS</b>	Portable Isotopic Neutron Spectroscopy
<b>PC</b>	Preparatory Commission
<b>PTS</b>	Provisional Technical Secretariat
<b>SIPRI</b>	Stockholm International Peace Research Institute
<b>SP</b>	State Party
<b>TS</b>	Technical Secretariat
<b>TSP</b>	Territorial State Party
<b>VA</b>	Verification Annex
<b>WP</b>	Working Paper

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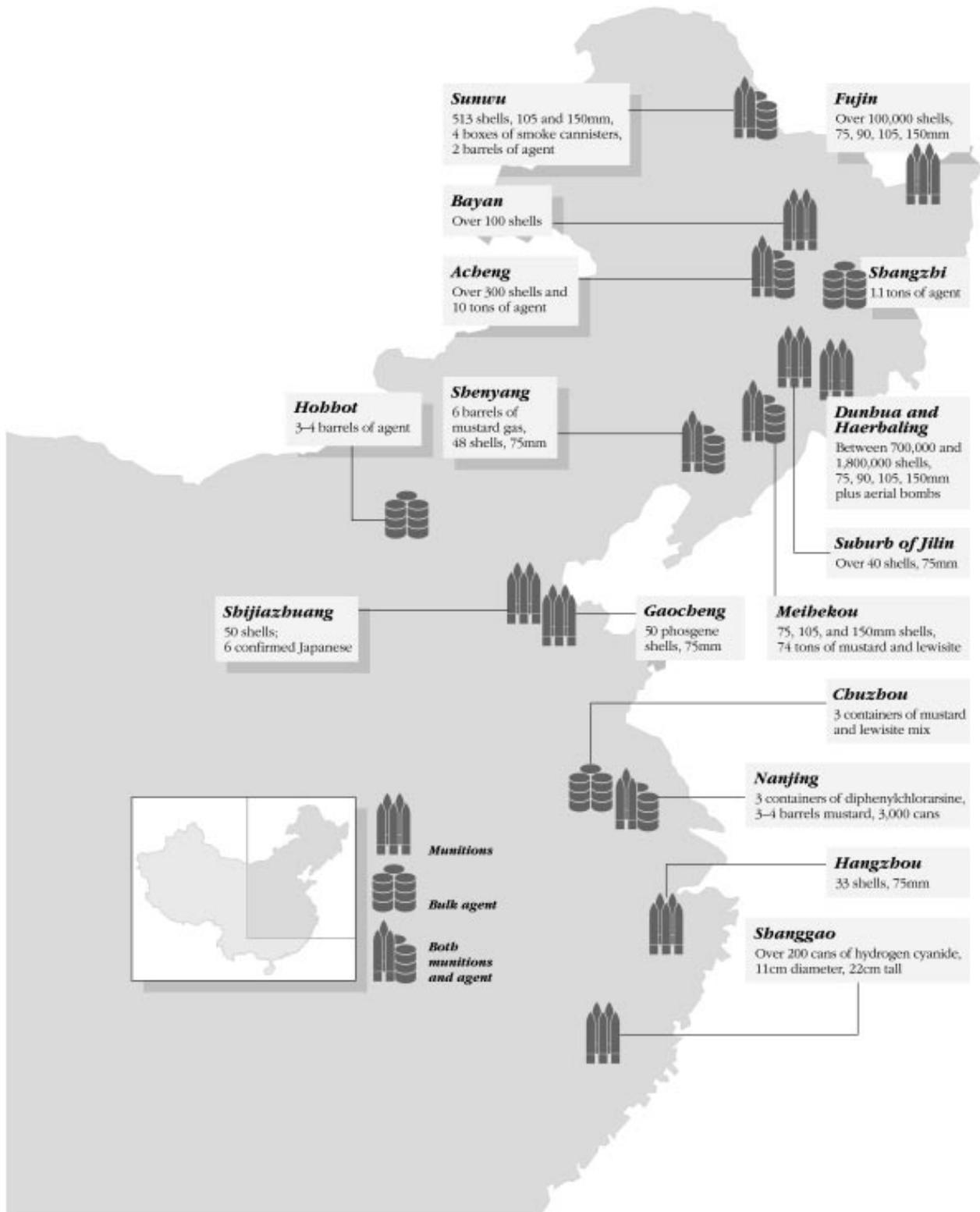
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## APPENDIX I: GEOGRAPHIC LOCATION OF KNOWN SITES



Source: BICC, 1997, *Conversion Survey 1997. Global Disarmament and Disposal of Surplus Weapons*, Oxford: Oxford University Press, p. 195

## APPENDIX II: GLOSSARY OF CWC-RELATED TERMS

*Abandoned Chemical Weapon*--"Abandoned Chemical Weapons" means:

Chemical weapons, including old chemical weapons, abandoned by a State after 1 January 1925 on the territory of another State without the consent of the latter.

CWC II 5

*Abandoning State Party*-- A State Party which has abandoned chemical weapons on the territory of another State Party.

CWC VA IV(B) 10

*Article I: General Obligations*-- Two of Article I's five paragraphs have relevance to ACW:

Each State Party undertakes to destroy chemical weapons it owns or possesses, or that are located in any place under its jurisdiction or control, in accordance with the provisions of this Convention.

CWC I 2

Each State Party undertakes to destroy all chemical weapons it abandoned on the territory of another State Party, in accordance with the provisions of this Convention.

CWC I 3

*Article II: Definitions and Criteria*-- Three paragraphs have direct relevance to OACW:

"Chemical Weapons" means the following, together or separately:

- (a) Toxic chemicals and their precursors, except where intended for purposes not prohibited under this Convention, as long as the types and quantities are consistent with such purposes;
- (b) Munitions and devices, specifically designed to cause death or other harm through the toxic properties of those toxic chemicals specified in subparagraph (a), which would be released as a result of the employment of such munitions and devices;
- (c) Any equipment specifically designed for use directly in connection with the employment of munitions and devices specified in subparagraph (b).

CWC II 1

"Old Chemical Weapons" means:

- (a) Chemical weapons which were produced before 1925; or
- (b) Chemical weapons produced in the period between 1925 and 1946 that have deteriorated to such extent that they can no longer be used as chemical weapons.

CWC II 5

"Abandoned Chemical Weapons" means:

Chemical weapons, including old chemical weapons, abandoned by a State after 1 January 1925 on the territory of another State without the consent of the latter.

CWC II 6

*Article III: Declarations*—Section B of paragraph 1 has relevance to OACW:

With respect to old chemical weapons and abandoned chemical weapons:

Declare whether it has on its territory old chemical weapons and provide all available information in accordance with Part IV(B), paragraph 3, of the Verification Annex

CWC 1(b)(i)

Declare whether there are abandoned chemical weapons on its territory and provide all available information in accordance with Part IV(B), paragraph 8, of the Verification Annex

CWC 1(b)(ii)

Declare whether it has abandoned chemical weapons on the territory of other States and provide all available information in accordance with Part IV(B), paragraph 10, of the Verification Annex

CWC 1(b)(iii)

*Article IV: Chemical Weapons*-- Which provisions of Article IV apply to ACW is open to interpretation. Article IV has 17 paragraphs.

*Chemical Weapon*-- "Chemical Weapons" means the following, together or separately:

- (a) Toxic chemicals and their precursors, except where intended for purposes not prohibited under this Convention, as long as the types and quantities are consistent with such purposes;
- (b) Munitions and devices, specifically designed to cause death or other harm through the toxic properties of those toxic chemicals specified in subparagraph (a), which would be released as a result of the employment of such munitions and devices;
- (c) Any equipment specifically designed for use directly in connection with the employment of munitions and devices specified in subparagraph (b).

CWC II 1

*Declarations*-- A formal submission to the OPCW by a State Party detailing information on its chemical weapons, old chemical weapons, abandoned chemical weapons, chemical weapons production facilities, other facilities, and riot control agents.

*Declaration Handbook*-- An effort to have all the States Parties to the Convention submit information using the same forms. Strictly speaking, States Parties do not have to conform to any format when submitting information to the OPCW, whether it be declarations on the location and disposition of its ACW or on any other topic. If any State Party so chooses, it may submit information electronically or in paper format and with any data structure it sees fit as long as the declaration provides the information required.

*Mutually Agreed Plan for Destruction--*

13. Pursuant to Article I, paragraph 3, the Territorial State Party shall have the right to request the State Party which has been established as the Abandoning State Party pursuant to paragraphs 8 to 12 to enter into consultations for the purpose of destroying the abandoned chemical weapons in cooperation with the Territorial State Party. It shall immediately inform the Technical Secretariat of this request.

14. Consultations between the Territorial State Party and the Abandoning State Party with a view to establishing a mutually agreed plan for destruction shall begin not later than 30 days after the Technical Secretariat has been informed of the request referred to in paragraph 13. The mutually agreed plan for destruction shall be transmitted to the Technical Secretariat not later than 180 days after the Technical Secretariat has been informed of the request referred to in paragraph 13. Upon the request of the Abandoning State Party and Territorial State Party, the Executive Council may extend the time-limit for transmission of the mutually agreed plan for destruction.

VA IV(B) 13-14

*Old Chemical Weapon--* "Old Chemical Weapons" means:

- (a) Chemical weapons which were produced before 1925; or
- (b) Chemical weapons produced in the period between 1925 and 1946 that have deteriorated to such extent that they can no longer be used as chemical weapons.

CWC II 6

*Regime for ACW--* This regime is nominally defined by paragraphs 8 to 18 of Part IV(B) of the Verification Annex. Details, however, are the focus of this paper.

*Schedules of Chemicals--* A section of the Annex on Chemicals, which is a compendium of substances with toxic properties and chemical weapons utility. Each of the three schedules contains a list of chemicals. Schedule 1 is meant to identify chemicals with high weapons utility and low industrial utility. Schedules 2 accordingly singles out chemicals which are also useful for making weapons, but with more civilian applications than Schedule 1. Schedule 3 chemicals are even more widely used in industry than those in the other two lists. These Schedules are thus a tool to regulate the production of chemicals that are likely to be used as chemical weapons.

*State Party (to the Convention)--*a nation that has deposited its instruments of ratification of the CWC with the Secretary General of the United Nations in New York.

*Territorial State Party--* A State Party on whose territory there are abandoned chemical weapons.

CWC VA IV(B) 8.



*Usability*-- a word coined by the Secretariat to refer the issue of whether or not a chemical weapon produced between 1925 and 1946 is still usable as a chemical weapon.

*Verification Annex*-- A reference to the Annex on Implementation and Verification, a detailed set of procedures to be followed in the fulfillment of Convention obligations. Abbreviated 'VA', the Annex has nine parts, and is several times longer than the initial 24 articles of the Convention. Part IV is most relevant to OACW and is divided into A and B. Part IV(A) is *Destruction of Chemical Weapons and Its Verification Pursuant to Article IV* and has 70 paragraphs. Part IV(B) is *Old and Abandoned Chemical Weapons* and has 17 paragraphs.