Updated Operation and Maintenance Activities of DAVINCH System

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Outline of the presentation

1. Introduction

2. OCW destruction, decontamination and dismantling work at Kanda Weapons Destruction Facility

3. Destruction of ACWs at three sites in China

4. Destruction of OCW’S and conventional ammunition and maintenance of DAVINCH facility in Poelkapelle, Belgium
1. Introduction
Lake Kussharo (2000)
- 26 50kg-yellow bombs (Lewisite/Mustard)
- Dismantling + neutralizing CWM + detonating bursters

Samukawa (2003)
- 806 CWM-filled bottles – neutralized
- Approx. 8,000m³ of contaminated soil - heat treated

Kanda (2004-)
- 2,968 OCWs, destroyed by DAVINCH
DAVINCH® system

- DAVINCH® = Detonation of Ammunition in a Vacuum Integrated Chamber

- A controlled detonation system developed by Kobe Steel to destroy chemical ammunition
How does it work?

**ammunition**
(chemical agent, energetic material)

**Donor charge**

**Evacuate**

Minimum oxygen supply

All valves are closed to isolate the chamber

**DAVINCH detonation chamber**

**Detonation**

Detonation off-gas
(CO, H2, etc.)

Solid wastes
(fragments, dust)

Ammunition (chemical and energetic material) are destroyed
How does it work?

DAVINCH detonation chamber

Detonation off-gas (CO, H2, etc.)

Valve is opened

Off-gas treatment system

Cold Plasma Oxidizer

Clean off-gas (CO2, H2O, etc.)

Solid waste
DAVINCH system in the world

- Wuhan (China, 2014 - )
- Shijiazhuang (China, 2012 -)
- Haerba Ling Project (China, 2014 -)

Poelkapelle (Belgium, 2008 - )

SECOIA (France, under construction)

Tooele (US)

Kanda (Japan, 2004 - )
2. OCW destruction, decontamination and dismantling work at Kanda Weapons Destruction Facility
Overview of Kanda Weapons Destruction Facility

- **Ammunition**
  - Underwater WW2 Japanese chemical ammunition in Kanda Port sea area

- **Activities**
  - Magnetometer detection
  - Recovery
  - Transportation
  - Identification
  - Destruction by DAVINCH
Overview of Kanda Weapons Destruction Facility

- **Destruction record (2004 - )**
  - 2,968 OCWs were destroyed
    - Red bombs (DA/DC): 2,225
    - Yellow bombs (L/HD): 743

**15kg Red Bomb**
(1.3kg of High Explosive, 368g of DA/DC)

**50kg Yellow Bomb**
(2.3kg of High Explosive, 18L of HD/L)
Decontamination was carried out by below method.

- Wet Decontamination
  Exhaust piping

- Heat treatment by electrical furnace
  Most process equipment, piping, ducts, etc.
Decontamination and Dismantling

- Surface cleaning by sand blast and pneumatic chisels, Inside of detonation chamber

- Final wipe with a damp cloth or mop, with or without a decontamination chemical, inside surface of tent and surface of equipment

After contamination level was confirmed to be below criteria, dismantled equipment and wastes were shipped to industrial waste management company.
3. Destruction of ACWs at three sites in China
Overview of DAVINCH system in China

The government of Japan selected the DAVINCH technology to eliminate the Japanese ACWs in China. Three DAVINCH systems have been deployed and operating in China.

- **Nanjing (2010-2012)**
  - First DAVINCH system in China (2 detonation chambers)
  - 35,681 ACWs were destroyed.
  - Decontaminated, dismantled and moved to Wuhan.

- **Wuhan**
  - Mobile DAVINCH systems were moved from Nanjing.
  - Destruction is completed. Decontamination process is ongoing.

- **Shijiazhuang**
  - Mobile DAVINCH system was installed in 2012.
  - Under operation since 2012.

- **Haerbaling**
  - Haerbaling is the largest burial site of ACWs.
  - A DAVINCH system was installed and is operating as one of the test destruction facilities.
ACW destruction facility in Wuhan

- DAVINCH system was installed in 2013.
- 264 ACWs were destroyed from December 2014 to May 2015.
- Destruction is completed and the facility is being decontaminated and will be dismantled.
ACW destruction facility in Shijiazhuang

- Mobile DAVINCH system was installed in 2012.
- The mobile DAVINCH system has been operating since December 2012.
- 1,692 ACWs have been destroyed.
ACW destruction facility in Haerbaing

- DAVINCH system was installed in 2014.
- DAVINCH was operated from November 2014.
- Operation was suspended during severe winter season and the facility resumed operating in the end of April 2015.
- 90 ACWs have been destructed. (As of 13 May 2015)
## Destruction record of ACWs in China

The Table below shows the quantity of ammunition destroyed in the destruction sites in China.

<table>
<thead>
<tr>
<th>Projectiles</th>
<th>Nanjing</th>
<th>Wuhan</th>
<th>Shijiazhuang</th>
<th>Haerbalng</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow shells (L/HD)</td>
<td>14</td>
<td>22</td>
<td>235</td>
<td></td>
</tr>
<tr>
<td>Red shells (DA/DC)</td>
<td>58</td>
<td>145</td>
<td>124</td>
<td>90</td>
</tr>
<tr>
<td>Blue-white shells (CG/trichloroarsin)</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>14</td>
<td>17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aerial bombs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15kg Red Bomb (DA/DC)</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>50kg Yellow Bomb (L/HD)</td>
<td></td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Canisters (toxic smoke pots)</td>
<td>35,601</td>
<td>79</td>
<td>1,259</td>
<td></td>
</tr>
<tr>
<td>Drum can containing yellow agent (L/HD)</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>1</td>
<td>3</td>
<td>54</td>
<td></td>
</tr>
</tbody>
</table>

(Pictures from http://www.caog.go.jp/acw/pdf/kaigi_10shiryo.pdf)
4. Destruction of OCW’S and conventional ammunition and maintenance of DAVINCH facility in Poelkapelle, Belgium
Overview of DAVINCH System in Belgium

- DV50 (explosive capacity of 50kg TNT eq)
- Constructed in 2007 in military site in Poelkapelle
- Owned and operated by Ministry of Defense Belgium since 2008
- More than 7,500 OCW’s and conventional ammunition were destroyed
  - Clark (DC/DA) ammunition (7.7cm – 21cm) etc.
  - High explosive shells containing arsenic smoke agent etc.
Examples of Ammunition Destroyed by DAVINCH in Poelkapelle

- **Chemical ammunition**
  - (3 x 10.5cm Clark shells) x 2 packages/shot
  - 1 x 21cm Clark shell / shot

- **Conventional ammunition**
  - (7 x 7.7cm shells) x 2 packages/shot
  - (15cm shell + 2 x 10.5cm shells) / shot
Replacement of Inner Chamber

- Old inner chamber was approaching the end of life in 2014.
  - It had been used for more than 1,700 shots
  - A large number of large conventional munitions were recently destroyed
  - Fragments from those large conventional shells damaged the inner chamber, resulting the decrease of wall thickness at the proximity of the ammunition mounting position
  - Inner chamber had started to deform at its thinnest part

- New inner chamber was manufactured in Japan in 2014 and transported to Poelkapelle from February to April 2015.
Replacement of Inner Chamber

- Inner chamber was replaced in April 2015
Summary

- DAVINCH system has been operated safely in Japan, China and Belgium.

- More than 47,000 items (chemical and conventional weapons) have been destroyed by DAVINCH world wide.

- DAVINCH Facilities have been successfully decontaminated, dismantled and moved.

- DAVINCH system is kept operational by proper maintenance including inner chamber replacement, as shown in Poelkapelle, Belgium.

- Kobe steel, Ltd will keep on operating, maintaining and improving DAVINCH system to support chemical weapons destruction efforts.