Fire-fighting against post earthquake tank fires

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2011 East-Japan Great earthquake Tsunami disaster

Japan often suffered earthquake and Tsunami.
Especially we suffered many times in Tohoku area.
However this tsunami was too bad, not experienced for 1000 year.

Nuclear plant problems

Poor management and stupid government reaction.

Larger problem than natural disaster for Japan, even nobody was killed in nuclear plant incident.

BLEVE、ＬＰＧ tank in Oil and chemical complexes

- After the 2011/Tohoku earthquake, fires and explosions occurred in Ichihara, Chiba
- Butane tank was damaged by earthquake and a fire started. Totally 17tanks were burnt, and BLEVE occurred 5 times. Fire continued for a week.
- Diameter of fire ball was about
- 400～500 m

BLEVEs were occurred after 2011 earthquake

- Earthquake in 2011 damaged an oil refinery, Kosmo, Chiba, near Tokyo.
- According to ruins and internets information, it is clear BLEVEs were occurred for several times.
- Tank and fuel; 1000, 2000, 5000kL (Real amount of LPG were not the same)
- This picture shows first BLEVES of propane, which is the largest, diameter is about 400～500 m.

LPG tanks after BLEVE

Fires in JX-Sendai Refinery

2003 earthquake and tank fire in Idemitsu Co.

- Not only 2011 eathquake, we also experienced post earthquake fire in oil complexes.
- In Japan, most fires occurred after earthquakes.
- We experienced Large oil tank fire, September 2003 caused by an earthquake.
- The fire continued

  for 44 hours.

Boilovers in Japan

- We had two boilover incidents in Japan, Yokkaicchi, 1954 and Niigata, 1964
- In June 1964, large boilover occurred in Niigata oil and chemical complex, after large earthquake.
- Fires continued for about two weeks, and several boilover occurred in a several crude oil tanks, and fuel oil tanks.
- These boilover incidents were
- The largest boilover in the world.

Activity of Fire brigades in Japan

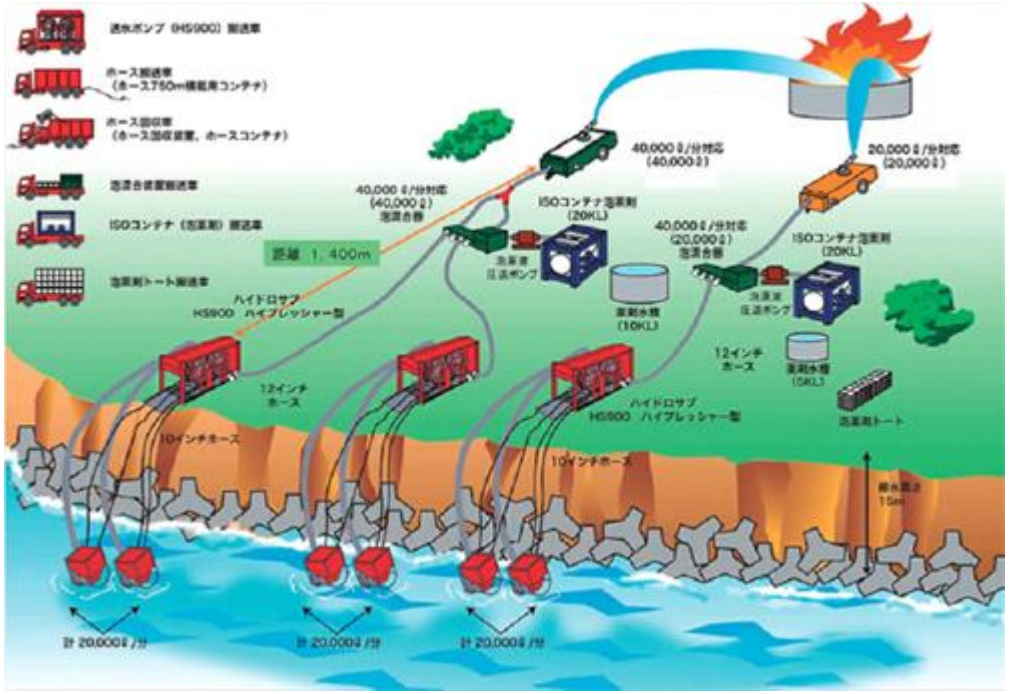
- Public fire brigades have all responsibility against fires in Japan, which include fires in oil and chemical complexes.
- However they can not do fire-fighting in oil and complexes when great earthquake occurs, because we have many normal house and building fires in city area. Also we have high-rising building and underground complexes, subway. These fires should be higher priority than those in oil and chemical complexes.

Private fire brigades

- Large oil refinery, oil terminal base, chemical companies have private fire brigades.
- We expect their activities for a few days after an earthquake occurred, public fire brigades may start fire-fighting activity after a few days.
- Japanese regulations ask these companies to have fire engine and foam, and large fire gun.
- We also ask their private firemen to do training.

Private fire brigade

Large fire-fighting gun (monitor)



Training of private firemen

- We ask fire brigade to do fire-fighting without help of local government, at least two or three days, when great earthquake occurred.
- So they study how to do fire fighting, and knowledge of boilover and gas fires…..
- Sometimes we send firemen to Texas A&M, but we should do more by ourselves in Japan.

MDPC/Fire-fighter training facilities

- MDPC= Maritime Disaster Prevention Center, Japan
- Small island in Tokyo bay

Small island(fortress) in Tokyo Bay

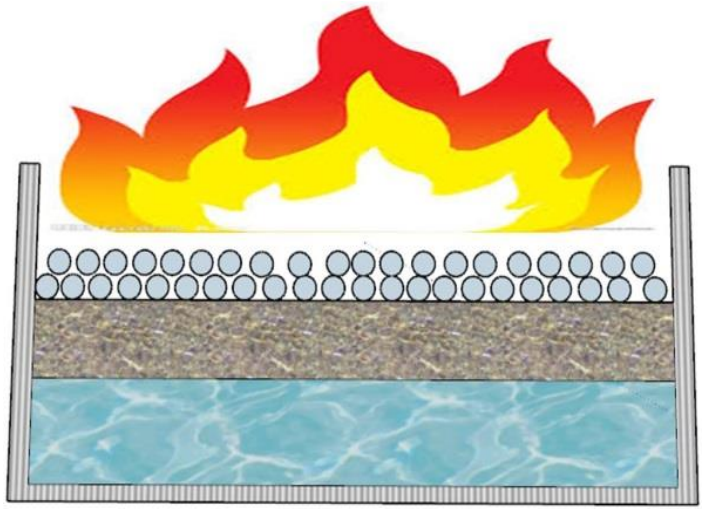
- Training facilities which may expand in the future.
- Owned by Japanese Coast Guard.

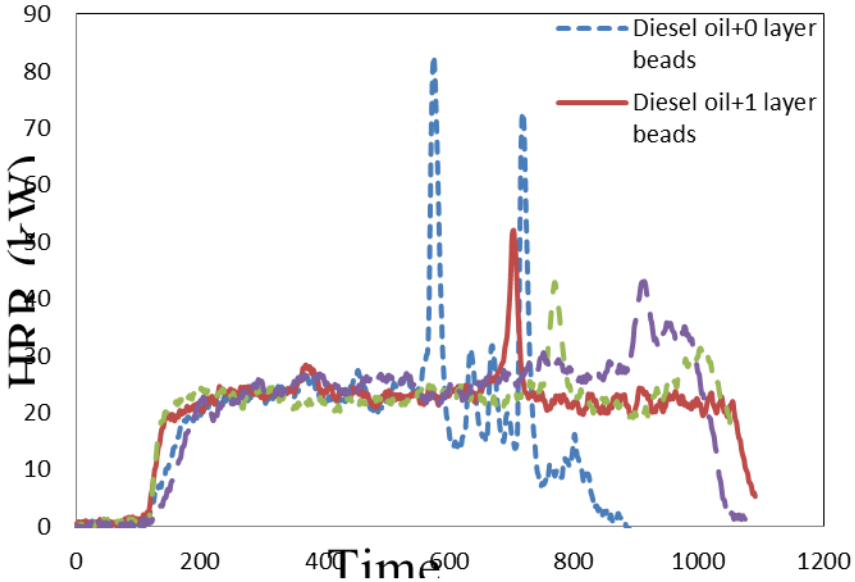
Beads used for mitigation of boilover

- Boilover is one of the most serious case in disaster in oil and chemical complexes.
- To delay boilover is very important because boilover may occur in 10 hours after a fire starts, when public fire brigade may not help pribate fire brigate.
- Beads which was manufactured by Trelleborg Offshore Co. USA, was tested in Japan and Taiwan, and gave good results to delay and mitigate boilover.

Study on effects of beads for burning of crude oil

- We used beads instead of foam to keep blanket above fuel surface, and no boilover occurred in our small scale test.
- Beads can be used for other purpose.





Conclusion

- Experience of 2011 great earthquake implies us so much things, not only huge Fukushima nuclear plant incident.
- We believe that another earthquake should occur in Tokyo area in a few decades.
- Therefore we should have stronger public and private fire brigades, so we ask fire brigade of oil and chemical company to do training by themselves.
- In regard to beads made by Trelleborg Offshore Co., it is one of good countermeasure to mitigate boilover, and we will study more.

Thank you for your attention.

If you have any question, please contact me:

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