What Happened, What Was Done and What Was Learned in CS Industry through Catastrophic Disasters in Japan

Yohei Otoki
Hitachi Cable, Ltd.
880 Isagozawa, Hitachi city Ibaraki, 319-1414, JAPAN
Tel: +81-294-42-5071 e-mail otoki.yohei@hitachi-cable.co.jp

Keywords: Disaster, earthquake, tsunami, Power plant accident, Semiconductor Industry, Recovery, Supply Chain,

ABSTRACT

The disaster in Japan and its influence on the semiconductor industry are reported. The combination of earthquake, tsunami and nuclear power plant accident caused a huge hardship to people's lives and damage to the industry. The government estimated the value of damage to be $200-$300 billion. The damage to materials and part suppliers in the disaster area placed unexpected huge burden on the supply chain of many industries such as automobile, electronics and so on. The CS industry had shortage of BT resin, Hydrogen Peroxide Solution, and Boron Oxide. Some damaged factories recovered earlier than expected by well coordinated team work and close collaboration with local residences. Through these experiences, industries should review their disaster and recovery plans once again in this globalized economy.

1. INTRODUCTION

The disaster that occurred on March 11th, 2011 in Japan gave us catastrophic damage by three kinds of devastations: earthquake, tsunami, and nuclear power plant accidents. This combination was the first time in modern history, and there were many unexpected problems in our lives and in our industries ensuing after the disaster. These multiple disasters, however, has possibility to happen again somewhere in the world. We need to learn from the experience and how we should prepare for the future disasters. Main factories in Hitachi Cable were located in the Hitachi city where we experienced the big earthquake and tsunami. There were big damages to production and to the supply chain, but fortunately, we were able to recover sooner than we expected. In this paper, the overall condition of the semiconductor industry in Japan and the recovering process of Hitachi Cable semiconductor department is reported.

2. WHAT HAPPENED

2.1 GENERAL

A huge earthquake of magnitude 9.0, the biggest in Japan and one of the five biggest in the world since 1900, occurred in the east part of Japan at 2:46pm (Japan time) on March 11th, 2011. The strong shaking continued for more than three minutes in a very wide range of from Aomori (northern part of Honshu island) to Shizuoka (middle of the island) around 500km (300miles) long as shown in Fig.1. Many aftershocks, over 500, followed the main quake. After the main quake, in the span of 3 months, some aftershocks over magnitude 5.0 were experienced.

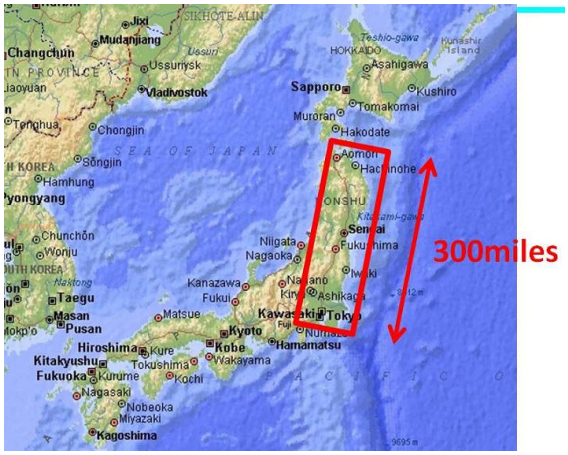

Fig.1 Disaster area. The earthquake happened in the very wide area around 100x200miles, followed by huge tsunami

The very high tsunamis between 3 – 16m high[1)] hit the seacoast of Japan 30 minutes after the main quake and destroyed everything in the area. Rikuzentakada city, for example, more than 70% of houses were destroyed or damaged[2)] and 1,650 people died out of a population of 24,000[3)] by a 17m high tsunami[1)]. More than 90% of victims were killed by the tsunami.

Following the earthquake and a 13m tsunami, Fukushima Daiichi nuclear power plant lost its cooling system to the reactors. This loss of cooling system caused the meltdown and explosion in some parts of the plant and

released radioactive materials to wide area, as shown in Fig.2[4] . The people within 20km area from the plant were evacuated.

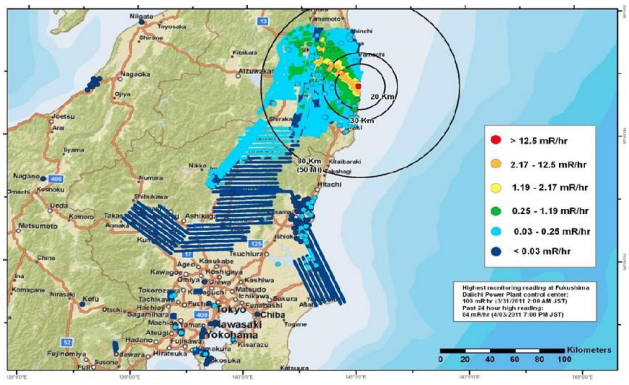

Fig.2 Map of contaminated area around the plant

The government announced 15,850 deaths and 3,287 missing (total 19,137, data of Feb.16 in 2012)[5] as well as over 370,000 buildings and houses damaged or destroyed.

The author personally visited some hard-hit places, found lots of large "empty" areas like Fig.3 even after ten months of the disaster and recovering is just on the way now.

Fig.3 Present situation in Ishinomaki city taken in the end of January 2012 by Otoki.

The disaster was devastating, but on the bright side, there were many people helping each other, and most notable thing was there were no incidents of looting or crimes associated with such disaster. Many foreign countries helped by sending assistance and volunteers. Over 149 countries and 39 organizations offered support. Over $400 million (just from the Red Cross) was collected and **1**7 countries sent Aid groups

2.2 INDUSTRY DAMAGE

Japanese government estimated the economic damage between $200-$300 billion (16-21T yen).[6] The damage by the nuclear power plant accident has not been cleared yet.

As for the electronics industry, many large companies with factories in the earthquake area, like Sony, Fujitsu, and Hitachi, were severely damaged as well as Canon's distribution depot. Many small businesses and factories producing critical components, especially automotive parts, were heavily damaged.

Even in the areas not affected by the earthquake, electricity was in short supply. Tokyo Electronic Power Company (TEPC) instituted rolling black-outs to conserve the short supply of electricity for a few weeks after the earthquake. The black-outs forced many factories to cut back on production and for some factories, they were completely shutdown. Some factories were able to keep limited production, but overall, it was major disruption to daily life.

2.3 SEMICONDUCTOR INDUSTRY

Many of the raw material companies were also seriously affected by the earthquake and ensuing black-outs and in some instances, the supply chain was none existent.

(1) Si wafers

Shinetsu Chemical had 33% market share but after the earthquake, there were spurious shortages of silicon wafers. For SUMCO, their production facilities were scattered over Japan so they were able consolidate the resources to maintain the supply better than the smaller and single factory suppliers.

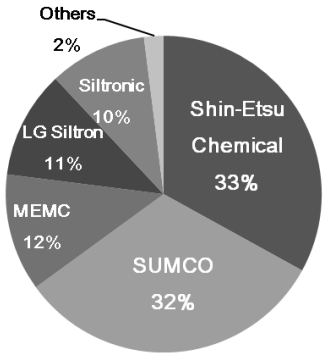

Fig.4 Market share of Si substrates in a world in 2010. Total production volume was 4million.[7]

(2) Hydrogen Peroxide Solution

Mitsubishi Gas Chemical (MGC) consumes 45% of industrial hydrogen peroxide solution (H_2O_2). When the factory was seriously damaged, the supplier carefully controlled the inventory and MGC was forced to import from outside. This is very difficult for semiconductor fabs because any change in material has significant impact in product and production yield.

(3) BT resin

MGC supplies about 50% share for BT resin which is essential for high performance RF module used in smartphones. The 2nd biggest supplier is Hitachi Chemical also located in the disaster area. With careful control of supply and demand, a great effort was done to minimize the impact, thus great disruption to the smartphone production was avoided.

Boron Oxide Boron Oxide (B_2O_3) is used for the crystal growth of semi-insulating GaAs. The biggest supplier was Tomiyama Pure Chemical Industries whose main factory was located within 5km from the nuclear power plant. Everyone was evacuated from the vicinity and even now, these areas are off limits. Fortunately, crystal growers had enough stock on hand and any shortages were supplied by other suppliers like Rasa Industries in Japan. Tomiyama Pure Chemical Industries is now constructing a new fab in a different location (Kashima-cho) away from the nuclear power plant.

2.4 RECOVERY

Some of the semiconductor fabs damaged only by the earthquake experienced early recovery much better than expected. Two examples are introduced here.

(1) Renesas Naka Factory (Ibaraki)

Renesas had high share (Fig.5) especially in automotive industry. The big damage of Naka factory caused the serious shortages of parts and many auto companies had stopped the production.

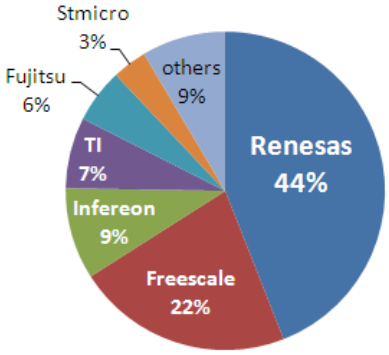

Fig.5 World share of micro computers in 2010[7)]

Renesas was estimating the restart of production in September. Thousands of people stayed to work for the recovery, including customers of Renesas as well as their suppliers. Everyone worked hard in a well organized and planned way. As a great result, Renesas re-started the production in June. They disclosed all the process in a YOU TUBE video in order to share their experience for the industry.

(http://www.youtube.com/watch?v=4P784ZXw3iU)

(2) Hitachi Cable

This company is one of the biggest CS material manufacturers and has great responsibility to support device and epitaxial customers. The main factory was damaged by the earthquake, without any lifeline just after the earthquake. The recovery project team was organized immediately and they worked very hard. Fig.6 showed the recovery process.

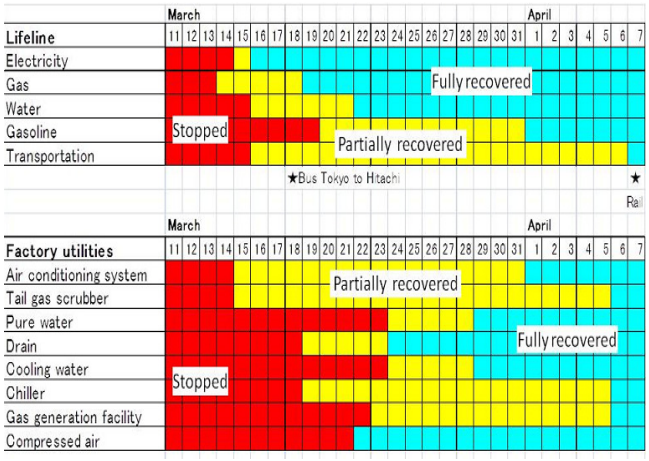

Fig.6 Recovery date of Hitachi Cable CS material factory

Recovery of basic utilities: electricity, gas and water took almost one week. The shortage of gasoline was so serious that engineers and operators used bicycles and carpool for almost one month. Fortunately the people had high morale and motivation to recover. This seemed to be a key factor.

The recovery process and the status were communicated to the customers by e-mail daily so that the customers were able to adjust their production accordingly. The information was also updated on our Web site. That kind of open information was very important for our business.

Limited production started in May utilizing the less damaged and repaired clean room. The full production was released in June after carefully checking all the lines and products.

3. WHAT WE LEARNED

3.1 Supply Chain

We had lots of problems in our supply chain. This indicated that we had to re-think and re-organize our supply chain based on what happen after the disaster. One of the biggest problems was they found the supply chain was not an ideal situation (pyramid type in Fig,7(a)), that is, many venders have common lower layer vender as shown in Fig,7(b) called barrel type, micro computer of Renesas, for example. All the supply chains have to be carefully investigated based on what happened this time and improve if necessary.

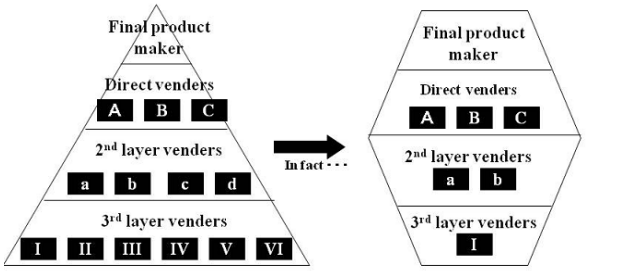

Fig.7 Types of supply chain. We found lots of barrel type in reality[7)]

3.2 Communication tool & Disaster Drill

Keeping the communication line open was extremely important at the early stage of the disaster when many lifelines including telecommunication were disrupted. The internet was quite powerful compared with conventional communication such as TV, radio and newspaper. Especially Twitter was quite useful to get localized information; especially for individuals.

Hitachi Cable employs around 10,000 people, including subsidiaries. Fortunately there were no deaths reported and only some minor injuries, even though the earthquake occurred during the day when most of the people were working inside the factories. One of the reasons for such a low injuries was the regularly held disaster drills. We strongly believe the importance of disaster drills.

3.3 Reconsidering of risk management

We observed many new types of problems and issues through these disasters in Japan and floods in Thailand. The disasters in parts of the country will have major impacts globally as we experienced. From these disasters, we can learn and implement more robust multiple supply chains. This paper attempted to introduce small part of that experience. We need to review what risk is in the whole scheme of risk management.

4. CONCLUSION

We have to re-consider the present supply chain from view point of real global market and set the pyramid type chain. We also had better improve risk management system including communication system in the emergency and disaster drill.

We faced the huge power of nature which destroyed everything, but we are also finding the great power of the people and industry to recover them with “never-give-up” spirit and with nice support from the world.

I do hope we learn a lot from the experience for our future work.

AKNOLEDGEMENT

The author would like to deeply express our great appreciation to Mr. Akihiko Tsumura of Sangyo Times, Inc. for supplying the quite useful information and data.

REFERENCES

1) http://www2.ttcn.ne.jp/honkawa/4363b.html
2) Mainichi News http://mainichi.jp/select/jiken/graph/sinsai_zusetsu/
3) Report of Rikuzentakada City
http:// www.city.rikuzentakata.iwate.jp/shinsai/shinsai-img/hazard1.pdf
4) National Nuclear Security Administration (NNSA) US Department of Energy, report, April.13th, 2011
5) Data from National Police agency on Feb.16th 2012; (see http://www.npa.go.jp/archive/keibi/biki/index.htm)
6) Government estimation in 月例経済報告等に関する関係閣僚会議震災対応特別会合資料 Mar.23rd,2011
7) Y.Tsumura, et.al. 半導体産業新聞フォーラム“半導体産業新聞が見たサプライチェーンの再構”June.16th,2011