

Apple Opens Up

IT Industry Supply Chain Investigative Report – Phase VI

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Executive Summary

The IT industry's highly developed global supply chains have brought with them better efficiency and massive profits. However, this has also created huge CSR challenges. Over the past few years, incidents such as Foxconn workers committing suicide has highlighted problems with labor rights in the IT industry and caused these problems to become more widely known. Furthermore, since April 2010, a number of Chinese environmental NGOs have released a series of Green Choice Alliance investigative reports, which have built up public recognition of pollution problems in the IT industry.

Under pressure from many different sources, more than 20 IT brands have responded to questions from environmental NGOs, and have set out to strengthen the environmental management of their supply chains. One of the brands that has undergone the biggest transformation is Apple. After a long period of reluctance and resistance, Apple finally overcame their original state of denial and began to communicate with the environmental NGOs. They then decided to comprehensively follow-up on the questions raised by the NGOs about their supply chain pollution problems. After a long process of communications and debates, in April 2012, Apple decided to conduct trial third party audits overseen by the NGOs to push its suppliers to correct their environmental violation problems.

Both Apple and the NGOs, in a step by step process, gradually came to a common understanding to push highly polluting materials suppliers to make real changes. Out of the whole IT industry the most polluting, energy and water intensive processes are the main materials production sector of the industry and more specifically, the PCB sector. In response to the questions raised by the NGOs, Apple has pushed three major global PCB suppliers to undergo third party audits, overseen by the environmental NGOs. The report will give details on improvements that have been made at these three companies and will also highlight their best practice in wastewater management, hazardous waste management and water use efficiency.

The environmental NGOs hope that Apple can take this good practice and extend it to more suppliers. The NGOs also hope that more brands and suppliers will adopt these good practices and help to clean up the highly polluting IT materials production processes.

While looking at the progress that Apple made with the environmental management of their supply chain, the report also lists a number of things that Apple needs to continually improve on. These include a number corrective actions that suppliers have still not completed, complaints from a number of local communities that they are still being affected by pollution problems, suppliers identified as having pollution records not being pushed to explain their violation records in a timely fashion, and not pushing suppliers to disclose discharge data. In addition to these points, the environmental NGOs hope that Apple can work with the government, labor groups and workers to resolve some of the problems with labor rights and occupational injuries that exist in their supply chain.

In addition to Apple, a number of other IT brands have responded to the attention they have been under, and have strengthened the environmental management of their suppliers. Under pressure from companies like Siemens, Panasonic, Nokia, Philips, Apple and Microsoft, more than 100 companies have provided explanations on the problems that they had and what corrective measures they have taken to rectify these problems. When many brands start to develop these kinds of green procurement practices it not only pushes a real reduction in emissions, but also makes a large number of suppliers realize that they need to be accountable to communities and the general public, which helps to establish a sense of environmental responsibility.

At the same time, the performance of some of the other brands has not been good. Both Canon and LG have been reported negatively by Chinese and international environmental groups for their supply chain management. To date they have still not established a search mechanism to pro-actively identify problem suppliers. Also, out of the 33 IT brands that have been ranked, HTC has not responded at all to questions raised by the NGOs about its supply chain pollution. The environmental NGOs call on consumers to let these brands know that this is not acceptable and they must change in order to help clean up the IT industry's pollution problems.

1. Apple's Transformation

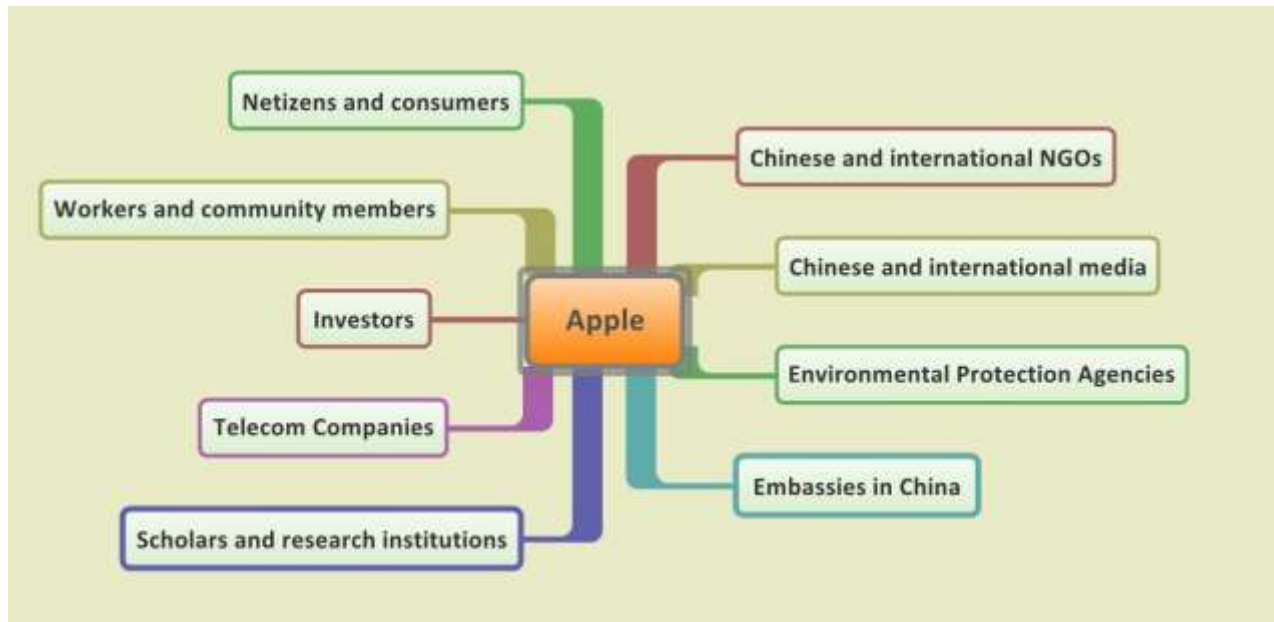
The IT industry's highly developed global supply chains have brought with them better efficiency and massive profits. However, this has also created huge CSR challenges. Over the past few years incidents such as Foxconn workers committing suicide has highlighted problems with labor rights in the industry and caused these problems to become more widely known. Furthermore, in April 2010, a number of Chinese environmental NGOs released the first in a series of Green Choice Alliance investigative reports which have looked into pollution problems in the IT industry. These reports have brought the problems of pollution and poisoning in supply chains to wider attention, and in the face of this attention, a number of IT brands have set out to strengthen the environmental management of their suppliers.

Under pressure from brands like Siemens, Panasonic, Nokia, Philips and Apple, more than 100 companies have provided explanations on the problems that they had and what corrective measures they have taken to rectify those problems. When many brands start to develop these kinds of green procurement practices it not only pushes a real reduction in emissions, but also makes a large number of suppliers realize their responsibilities to communities and the general public, which in turn helps establish a feeling of environmental responsibility.

Among all the 29 brands, the biggest transformation has been seen in Apple. In 2012, Apple went from being evasive and in denial to a point where they are now working with different stakeholders to push suppliers to correct environmental problems.

1.1 Motivation for Change Comes from Multiple Stakeholders

Figure 1: Collaboration from numerous stakeholders pushes Apple to make changes

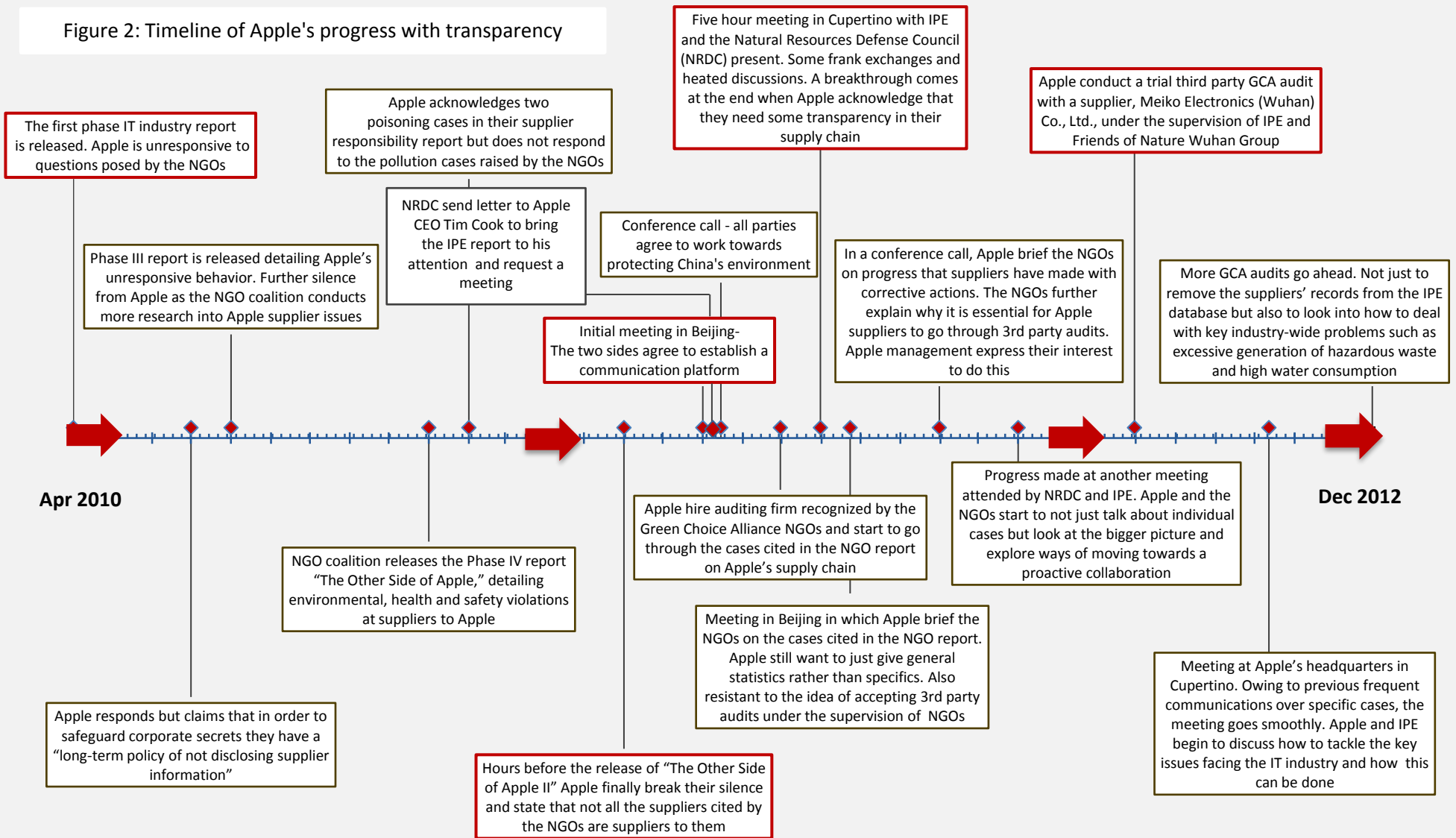


1.2 Collaboration with Numerous Stakeholders

In the Phase V IT Industry Report titled “The other Side of Apple II”, Chinese NGOs listed the pollution problems at some of Apple’s PCB suppliers. After two rounds of talks with the NGOs, Apple hired a third party auditing company approved by the NGOs to conduct internal audits on the suppliers listed in the report.

After confirming the issues, Apple pushed the suppliers to formulate and implement corrective action plans. After several rounds of discussions with IPE and NRDC Apple admitted that their supply chain management needed to be more transparent. After even more discussions, Apple finally started to require that suppliers undergo third party audits overseen by the NGOs and that suppliers should publically release proof of any corrective actions taken.

Figure 2: Timeline of Apple's progress with transparency



1.3 Apple Pushes PCB Suppliers to improve their Environmental Performance

From the brand rankings it is possible to see that Apple's overall performance lags behind that of other brands such as Siemens, Panasonic and Nokia. However, the reason that particular attention has been paid to Apple is not just because there has been a significant change in their actions, but more importantly because they have made great progress pushing main materials suppliers to implement improvements. Main materials manufacturing is the main source of pollution in the IT industry. If main materials suppliers can be encouraged to reduce their emissions and energy use through green procurement practices then it could be a key focus for greening the industry. However, it is also a where the biggest difficulties lie.

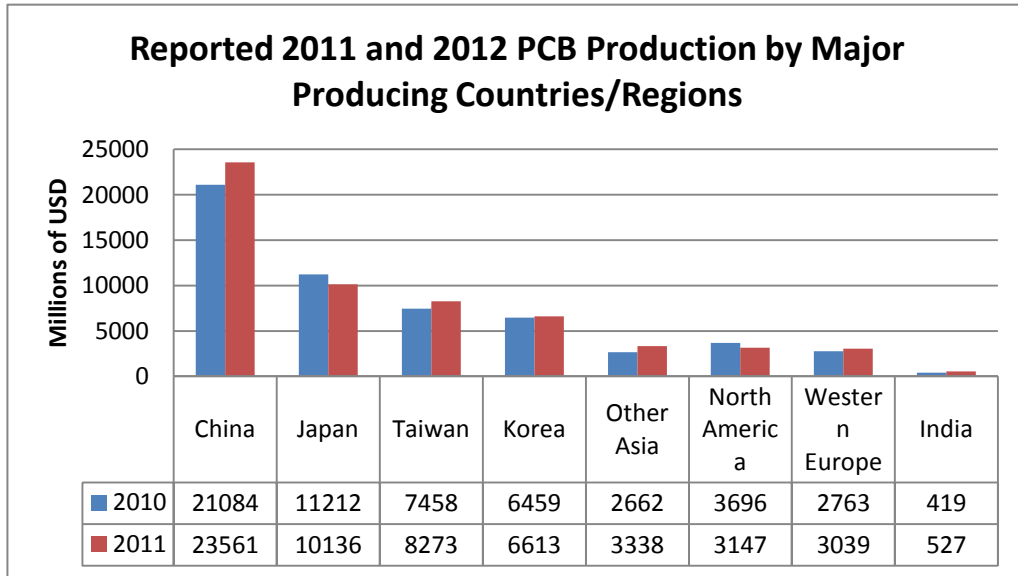
The manufacture of components such as PCBs, batteries, screens, cabling, enclosures and microchips can all create large amounts of pollution during their manufacture if not managed correctly. Out of all these components, PCBs are at the heart of IT products and are increasingly used in all manner of smart phones and tablets. Therefore, the pollution created and water resources used during their manufacture is a problem that deserves serious attention.

In 2012, by working with suppliers and environmental NGOs, Apple started to push a number of PCB manufacturers to improve their environmental performance.

1.3.1 China - the Global Center for PCB Manufacturing

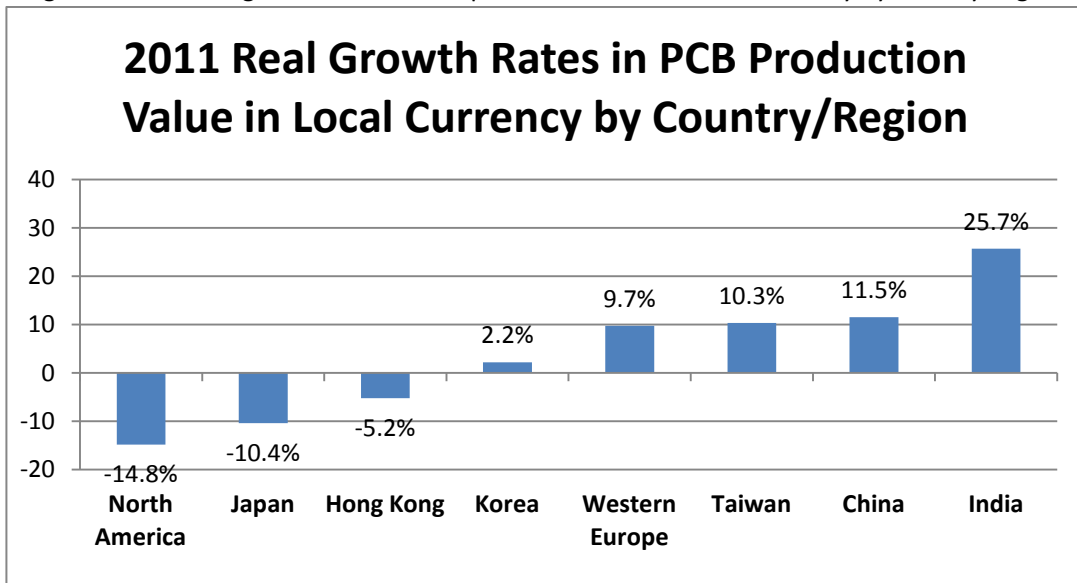
The PCB is a component that is found in almost all electrical equipment. China is the largest producer of PCBs in the world, producing PCBs with an estimated production value over USD 23.5 billion in 2011.¹

Figure 3: Reported 2011 and 2012 PCB production by major producing regions



Whilst PCB production declined in North America and Japan between 2010 and 2011, down 14.8% and 10.4% respectively, the production of PCBs in China continued to increase, with estimated production value rising by 11.5% between 2010 and 2011.²

Figure 4: 2011 real growth rates in PCB production value in local currency by country/region



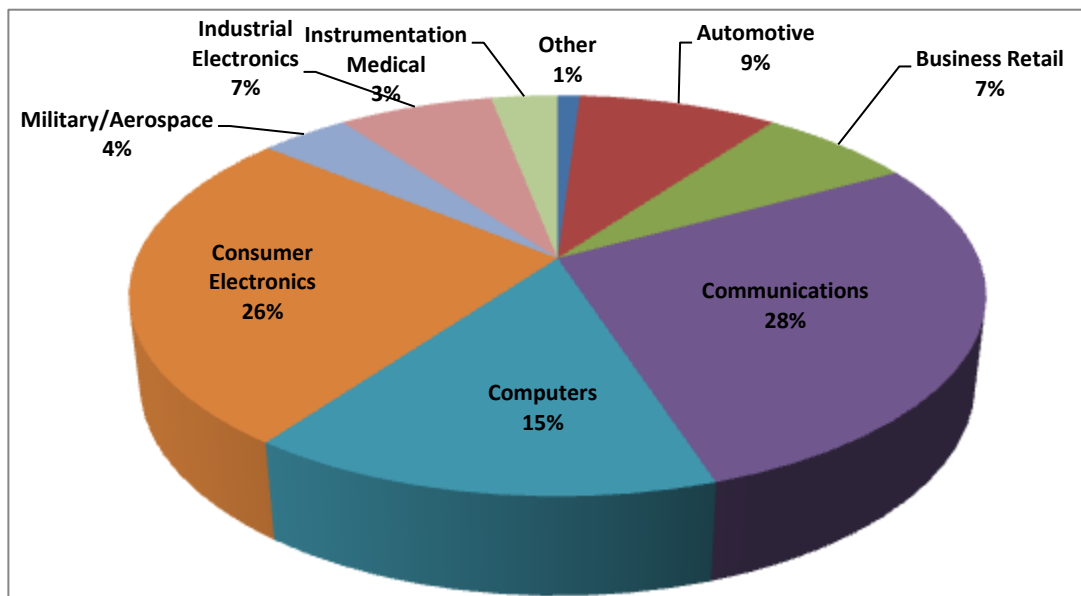
¹WECC Global PCB Production Report for 2011, World Electronic Circuits Council, September 2012.

[http://www.globalwecc.org/download.aspx?dlfn=2011+WECC+PCB+Statistical+Report+\(Sep+2012\)_868753454.pdf](http://www.globalwecc.org/download.aspx?dlfn=2011+WECC+PCB+Statistical+Report+(Sep+2012)_868753454.pdf)

²ibid

Consumer electronics, computers and communications equipment account for nearly 70% of the end market for PCBs in China.³

Figure 5: 2011 end-markets for PCBs in China



1.3.2 Major Environmental Impacts from PCB Manufacturing Processes

The manufacture of PCBs can bring about the following challenges:

Due to the mix of heavy metals and chemicals used in the manufacture of PCBs, its wastewater may contain complex pollutants like copper, nickel, mercury, hexavalent chromium, zinc and persistent organic pollutants (POPs),⁴ which are toxic at even low levels and difficult to treat. If such pollutants are not managed properly and are released into the environment, they can persist for long periods of time contaminating drinking water and soil and harming aquatic life.⁵

- PCB production requires a combination of heavy metals, chemicals and acid solutions⁶ that create hazardous solid waste. Due to the large scale of many PCB manufacturers operating in China, the volume of hazardous waste being generated can be massive, posing a major potential risk to public health and environmental safety.

³ibid

⁴<http://www.epa.gov/international/toxics/pop.html>

⁵Institute of Public & Environmental Affairs. 2010. [The IT industry has a critical duty to prevent heavy metal pollution.](#)

⁶Both the European Parliament's Restriction of Hazardous Substances (RoHS) ([DIRECTIVE 2002/95/EC](#)) and [China's Measures for Administration of the Pollution Control of Electronic Information Products](#) (China RoHS) sets limits on the amount of cadmium and other hazardous substances allowed in electrical and electronic products. The [Batteries Directive 2006/66/EC](#) also highlights proper disposal practices for NiCd batteries.

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- The production of PCBs can be extremely water intensive. This means that in a country like China where clean water is scarce, a high volume of water consumption can pose a huge threat to not just the environment but to the sustainability of the industry.

1.3.3 Management of PCB Suppliers is Highly Challenging

The management of PCB suppliers is highly challenging for a number of reasons:

- PCB suppliers are upstream in a company's supply chain. This makes it harder for a company to manage the supplier as they may not have systems in place to extend management beyond their first tier suppliers.
- Fixing environmental problems and installing pollution prevention measures at PCB manufacturers can be expensive, which may require high levels of investment that a supplier may be reluctant to carry out.
- Environmental problems that exist at PCB suppliers can be highly complex, and if the stakes for a supplier are very high, they may try to disguise any environmental problems that they have.

1.3.4 Good Practices Identified through a Transparent and Participatory Process

Based on the common understanding that PCB manufacturing can have a huge affect on the environment, Apple and the environmental NGOs came to an agreement that special third party audits overseen by the environmental NGOs and based on the normal GCA auditing protocol would be carried out. The special audits were not just carried out to confirm that previous environmental problems had been corrected but were targeted at specific problems and also looked for examples of good practice.

Through Green Choice Alliance (GCA) third party audits under the supervision of local NGOs, the corrective actions of several major PCB suppliers have been validated and some good practice from the industry has been identified.

1.3.4.1 Management of Complex Wastewater containing Metals and Chemicals

Due to the mix of heavy metals and chemicals used in the manufacture of PCBs, its wastewater may contain complex pollutants such as copper, nickel, mercury, hexavalent chromium and zinc and persistent organic pollutants (POPs)⁷ which are often difficult to treat.

During our investigations we found that a large number of PCB manufacturers were not able to consistently meet discharge standards. Some of these manufacturers, despite repeated censure from the authorities, were secretly discharging pollutants, directly discharging pollutants, or discharging pollutants in breach of regulatory standards and volumes limits. Instances of factories falsifying discharge concentrations to meet regulatory standards were also observed. PCB factories illegally discharging pollutants in breach of the regulatory requirements in this way have seriously polluted the aquatic environment in a number of regions.

In the report titled “The Other Side of Apple II,” the environmental NGOs highlighted a number of pollution problems at Apple’s PCB suppliers. After commissioning a third party organization to confirm that the problems existed, Apple then pushed the suppliers to formulate and implement a corrective action plan. They also pushed the suppliers to go through a third party audit, overseen by environmental NGOs, to provide proof to the public that corrective actions and improvements had been carried out. One such company that has made major changes after going through the audit process is Meiko Electronics (Wuhan) Co., Ltd.

- **Case Study 1 – Meiko Electronics (Wuhan) Co., Ltd.⁸**

Meiko Electronics (Wuhan) Co., Ltd. (hereafter referred to as Meiko Electronics) is located in the Wuhan Economic and Technological Development Area in Hubei Province. It was established in August 2005 and is the largest production base for the Japanese listed Meiko Corporation. It mainly produces multi-layer PCBs and high density interconnect circuit boards.

Between April and June 2011, with the help of a local fish farmer, the Wuhan Branch of Friends of Nature and the IPE carried out an investigation at Meiko electronics and found that the factory’s storm water discharge channel and nearby Nantaizi Lake were both seriously polluted. The sediment in the discharge channel was found to have high levels of copper and the sediment at the point where the discharge channel met Nantaizi Lake had extremely high levels of copper. On August 31st, 2011, the report titled “The Other Side of Apple II” featured the wastewater pollution problems at Meiko Electronics.

⁷<http://www.epa.gov/international/toxics/pop.html>

⁸ For the GCA audit report please see:

<http://www.ipe.org.cn/Upload/file/Notices/Audits/Audit-Meiko-Electronics-Wuhan-Co-Ltd-EN.pdf>

Figure 6: Meiko electronics, the discharge channel, Nantaizi Lake and the Dongfeng Sluice Gate



In September 2011, Meiko Electronics, in order to fulfill the requirements of their clients and the Japanese Embassy, held several rounds of discussions with the Wuhan Branch of Friends of Nature and the IPE. On September 23rd and 24th, 2011, Apple commissioned Golder⁹ to carry out an environmental audit on Meiko electronics. A follow up audit was then carried out by Golder to confirm the status of corrective actions.

On January 27th 2012, one of Meiko Electronics' clients, Apple, held a video conference call with the IPE and NRDC in which the parties came to an agreement to carry out a pilot Green Choice Alliance audit under the supervision of environmental NGOs. On April 26 2012, Meiko Electronics formally agreed to the third party environmental audit.

Through a document review and onsite audit it was possible to identify the environmental problems at Meiko electronics as well the causes of those problems. At the same time, the audit also confirmed the status of improvement works being carried out. The following three problems were singled out from the previous audit for particular attention:

- Wastewater being discharged through storm water drains.
- Wastewater containing heavy metals being discharged in breach of concentration and total volume standards.
- Contaminated sediment in Nantaizi Lake.

⁹One of the auditing companies approved by the GCA.

The following gives a summary of the audit findings and corrective actions:

1. Wastewater being discharged through storm water drains

a. Audit Findings

According to the first audit conducted by Golder, the problems with the collection of wastewater for discharge were as follows (text in italics is taken directly from the Golder audit report):

- *RO water, daily volume estimated at 1,000 tons, which was indicated from the diagrams to be connected to the WWTF, was discharged to the storm water system;*
- *Boiler blowdown which with high temperature and salinity was directed to the storm water system; its daily volume was unknown during the site visit;*
- *Several storm water manholes along the eastern boundary of the Plant 2 were noted with mauve water. During the time of the Audit, the mauve water noted in the storm water system was pumped back to the industrial wastewater collection tank; and*
- *Two steel pipes came from the direction of Plant 2 were noted leading into one storm water manhole which was located to the southeast of the Plant 2. No water was flowing out via the two pipes at the time of the Audit but mauve water was noted in the manhole.*

The audit findings also confirmed that Meiko Electronics had a problem with the management of the storm water and wastewater pipe network. RO condensate water and boiler blowdown were not treated effectively and were being discharged into Nantaizi Lake through the storm water system.

b. Rectification Status

The audit confirmed that in order to target the problem of industrial wastewater being discharged through the storm water outlet Meiko electronics adopted the following measures:

- *The factory installed valves at the two storm-water final discharge outlets to cut off their ability to directly discharge. At the same time, before the two final storm-water discharge outlets, a 400m³ storage tank has been added to store initial rainwater which can then be pumped back to the WWTF for treatment. The factory has also installed a new on-line monitoring system at the final storm-water discharge outlet to monitor copper and nickel concentrations so as to ensure there are no instances of discharge breaching the authorized standards.*
- *At present the factory has a 1000m³ storm water collection tank. Approximately half of this volume is used for RO concentrate water collection. During the audit, a factory representative stated that transformations to the current storm water collection system meant that it can now*

support the collection of rain water during a period of torrential rain as well as its emergency functions.

- *The processing wastewater pipe originally went underground to the wastewater discharge unit. It is now transported in a pipe above ground.*
 - *The RO re-cycling system has been built and put into operation. Using the system can save 20-30% of production water and also reduces wastewater discharge. Water is then transported from the newly built boiler condensate water collection pool to the WWTF for treatment.*
 - *The factory has carried out preliminary investigations on all the storm-water inspection drains in the factory area and has confirmed that they have removed and blocked all the pipes except the PVC rainwater pipes to prevent wastewater from industrial processes being discharged through the storm water system.*



Figure 7: To avoid the mixing of wastewater and storm water, the pipes that carry industrial wastewater that were previously underground have been moved above ground.



Figure 8: Storm Water Outlet with Tamper Proof Seal

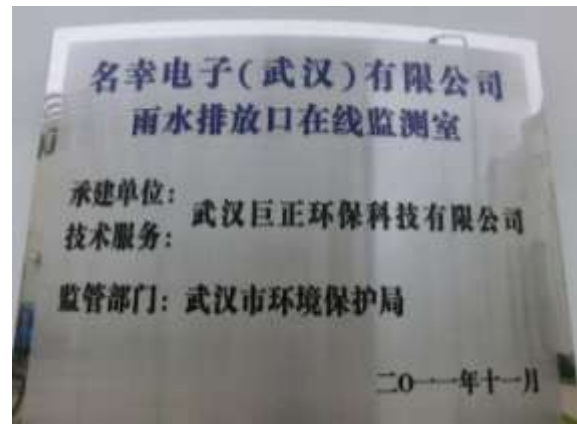


Figure 9: Online Monitoring Facilities for the Storm Water Outlet



Figure 10: RO recycling wastewater was previously being discharged to the storm water system. However, the RO water recycling system has now been completed and was in use when the audit took place.

2. Heavy metal wastewater pollutants and total discharge amounts in breach of standards.

a. Audit Findings

According to the first audit conducted by Golder, they referred to the Stage I EIA report from August 2008 and the EIA Approval issued on August 29th, 2005 by the Wuhan EPB. The following breaches of the authorized standards were found:

- *The environmental monitoring results of 2010 cited in the 2011- version EIA revealed the discharged total amount of total cyanide (0.021t/a), Cu (1.16t/a), effluent volume (12,694t/d), and COD (in domestic wastewater discharge, 70.44t/a) exceeded the relevant required control limits. In addition, the concentration of Cu (0.5mg/L) also exceeded the specifically required limit (0.24mg/L).*

The findings from the audit showed that Wuhan Meiko Electronics had problems with heavy metal wastewater pollutants in breach of the authorized standards and also total discharge amounts in breach of the authorized standards. These problems have polluted the Yangtze River, the water body into which the wastewater flows.

b. Status of Rectifications

The audit confirmed that to target the problems of heavy metal wastewater pollutants in breach of the authorized standards and total discharge amounts in breach of the authorized standards, Meiko Electronics adopted the following measures:

- Concentrations in breach of the authorized standards
 - a) *With regards to copper discharge concentrations they have confirmed that they need to abide by the local standard, which is 0.24mg/l. In line with this, the factory has adjusted the dosage of coagulant to control copper concentration. After the adjustments were made, self-monitoring results showed that the copper discharge concentrations met the relevant discharge standards. Furthermore, the factory adopted water saving measures for industrial processes which has reduced total wastewater volumes. The factory also formulated "General Wastewater Treatment Procedures" to target times when discharge volumes are in breach of the authorized standards. According to these procedures, if the concentrations are too high then the wastewater is sent back through the emergency channel and treated again.*
 - b) *When monitoring of the copper concentration takes place in the final combined treatment system pool, if there is a breach of the designed treatment values, a heavy metal capturing agent is immediately added (this would be a highly effective heavy metal precipitating agent which can precipitate and settle heavy metals in a very short space of time). This is to ensure that the copper concentration remains within the standard range. At the same time, the final discharge results are monitored.*
 - c) *In May 2012, after testing and de-bugging the online monitoring system for cyanide, total copper and total nickel discharge was be put into use. Discharges from each separate treatment system are monitored. If there is an exceedance in the designed value then the wastewater is returned directly for further treatment.*

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- d) *From looking at the January-March 2012 records it can be seen that each pollutant concentration is within the authorized standards. The factory has carried out their own collection and updating of rules and regulations but have also considered hiring a qualified consultant firm to provide assistance.*
 - e) *The factory provided information that shows that the micro-etching solution can now be treated by the factory's WWTF.*

- **Total volumes in breach of standards**

- a) *The factory has already established calculation and monitoring systems for the total discharge of each type of main pollutant, including COD, BOD, copper and nickel. The RO water recycling system has also been put into use and saves 20-30% of production water while also reducing wastewater discharge.*
- b) *Under the current output (up-to 20-30% of design capacity) statistics for total discharge amounts for each pollutant show that they can satisfy total quarterly pollutant discharge limits (converted from annual discharge amounts).*



Figure 11: Final Discharge Outlet for Production Wastewater



Figure 12: On-line monitoring for the production wastewater final discharge outlet

3. Nantaizi Lake Sediment Pollution

a. Audit Findings

In the first audit that they conducted at Meiko, Golder did not do an in-depth investigation into the Nantaizi Lake sediment contamination problems. However, they were later commissioned by Meiko Electronics to carry out an investigation to determine the extent of the pollution.

Golder conducted an investigation into the extent of contamination within a section of the lake with a radius of 300m. This was done so as to understand the horizontal and vertical distribution of sediment containing copper. Different sampling points were set up, five in the upper area, nine in the middle area and 20 in the lower areas. Three sediment samples were taken at different depths at each of the sampling points and all of the samples were then sent to a third-party laboratory to analyze their copper content. The results showed that the most severely contaminated area was that near the discharge outlet. Contamination was concentrated in the top 10cm layer of the sediment and most of the contamination was within a 100m radius of the drainage channel.

b. Rectification Status

The audit confirmed that Meiko Electronics commissioned Golder to formulate a pollution control plan to target the problem of contaminated sediment in Nantaizi Lake. A local Wuhan dredging company was then hired to carry out the work.

In accordance with the project plans, six sedimentation tanks were set up onsite (Please see the image below). Each had a capacity of 500 cubic meters and was laid with geo-membrane liners. The plan was for four to be used every day, with the remaining two left on standby. A discharge pool with a capacity of 1000m³ was also set up on-site and another pool with a capacity of 800 m³ was set up for the treatment of surplus water from the centrifuges.



Figure 13: Sedimentation pools and centrifuges at the Nantaizi Lake site

Three centrifuge water extracting units were set-up on site in accordance with the design plan (please see the image above). Each unit was designed to treat 240 cubic meters per day. Two units were used and one was kept on standby.



Figure 14: On-site dredging

The dredging company designed and constructed a simple dredging boat and suction pump to carry out the remediation project (Please see the image above).The suction pump is used to suck up the sediment and draw it to another pump where the pressure is increased and the sediment is transported to the sedimentation pools.



Figure 15: Nantaizi Lake

The centrifuge units are used to extract silt from the bottom of the sedimentation pool and remove the water from it. The extracted sediment is directly placed into woven bags and these bags are then removed to a temporary storage area by fork lift truck. The bagged sediment is then regularly removed by a qualified third party hazardous waste treatment company.



Figure 16: Nantaizi Lake Site Works



Figure 17: Nantaizi Lake Site Works

Due to the complex nature of the project and the fact that there was no domestic or international precedent for this kind of remediation work, it has taken some time to devise a satisfactory dredging and treatment process. Some changes have now been made to the original processes as they were not delivering the results that were required. Work is now being carried out round the clock and we hope to see good results from the dredging and treatment processes.

Meiko Electronics - Good Practice

- To target the problem of total pollutant volumes breaching the authorized standards, Meiko carried out the following:
 - They now monitor copper concentrations in the final combined treatment system pool. If there are any breaches of the planned treatment values, a heavy metal capturing agent is immediately added.
 - They set up an online monitoring system to monitor total copper and total nickel discharge.
 - They set up monitoring for each of the wastewater discharge systems. If any exceedances are found, the wastewater is immediately returned for further treatment.
- To target the problem of discharge from the stormwater outlet, Meiko carried out the following:
 - Moved pipes that were originally underground to above ground so as to avoid the mixing of stormwater and wastewater in the pipe network.
 - Installed valves on the two storm water final discharge outlets to prevent direct discharge.
 - Added a 400m³ storage tank before the two final storm-water discharge outlets to store initial rainwater, which can then be pumped back to the WWTF for treatment.
 - Installed a new on-line monitoring system at the final stormwater discharge outlet to

monitor copper and nickel concentrations to ensure there are no instances of discharge breaching the authorized standards.

- To target the problem of contaminated sediment in Nantaizi Lake, Meiko carried out the following:
 - Commissioned a professional organization to formulate a remediation plan and carry out a comprehensive restoration project.

1.3.4.2 Substantial Reduction of Hazardous Waste

Hazardous waste is a serious problem in China with over 10 million tons generated from industrial sources per year.¹⁰ The storage, transportation and treatment of hazardous waste all pose massive environmental and health risks. The Ministry of Environmental Protection recognizes this and has made tackling the problem of hazardous waste a major priority for 2013. Some of the sources of industrial hazardous waste from the PCB industry include PCB dust, waste acid and alkaline etching liquid, waste electroplating liquid, waste liquor containing nickel and sludge containing copper. Heavy metal wastewater is also treated with an acid solution that forms hazardous waste sludge, which can then cause serious soil and underground heavy metal contamination if not disposed of correctly.

- **Case Study 2 –Tripod (Wuxi) Electronic Co., Ltd.**¹¹

In 2010 Tripod Wuxi generated over 112,000 tons of hazardous waste.¹² For this reason it was listed on the IPE website and also featured in “The Other Side of Apple II” report. Apple then commissioned an audit that identified a number of problems and confirmed the extremely large volumes of hazardous waste that were being generated. Tripod was then required to remediate the problems.

In order to confirm that the problems identified in the first audit had been corrected, and to see how the hazardous waste reduction plan was being implemented, on October 16th and 17th, 2012, a GCA audit was carried out by Golder under the supervision of environmental NGOs. Golder then produced an audit report which gave details on Tripod Wuxi’s hazardous waste reduction plan and the status of the planned reductions.

The auditing company first of all identified the sources of hazardous waste. The largest volumes were coming from waste acid and alkaline etching liquid, sludge containing copper and electroplating waste liquid.

The auditing company then confirmed the baseline annual rate of hazardous waste generation plus the reduction target. Using the type and volume of hazardous waste generated in 2011, as well as the

¹⁰http://www.chinadaily.com.cn/china/2012-11/02/content_15867364.htm

¹¹ For the GCA audit report please see:

<http://www.ipe.org.cn/Upload/file/Notices/Audits/Audit-Tripod-Wuxi-Electronic-Co-Ltd-EN.pdf>

¹²<http://www.ipe.org.cn/Upload/Report-IT-V-Apple-II-EN.pdf>

annual production volume, the total volume of hazardous waste generated per m² of PCBs produced was confirmed as 21.93kg/m². The factory planned to reduce the amount of hazardous waste produced per m² of PCBs produced by 32% in 2011.

The auditing company confirmed that Tripod Wuxi implemented four main measures to reduce the quantity of hazardous waste they were generating. They carried out the following:

- 1.) Reduced the ratio of water in the sludge containing copper - The average ratio of water in the sludge containing copper in 2011 was 82%. For the months of January to September 2012 this was reduced to an average of 70%.
- 2.) In 2012, the facility started converting copper sulfate solution into copper sulfate, which they then sold.
- 3.) Started the removal of waste acid etching liquid - The factory used a series of processes to turn the acidic liquid into copper oxide, which is then shipped off-site.
- 4.) Removal of waste liquor containing phosphorus - In 2012 the facility started using a low phosphorus solvent to replace the phosphorus detergent. The waste solvent was then directly discharged to the WWTF.

Two of the measures that provided the most outstanding hazardous waste reduction results included the removal of waste acid etching liquid and the conversion of copper sulfate pentahydrate into copper sulfate. These two processes both benefitted greatly from the construction of the recycling center at their two factory sites in 2012.



Figure 18: Resources Recycling Center

In order to check the results of the hazardous waste reduction program, the audit report summarized hazardous waste volumes produced by the factory from January 2012 to August 2012. The summary showed that the total amount of hazardous waste generated had been reduced. By looking at the production volume for this time period it was confirmed that the amount of hazardous waste generated per m² of PCB production was significantly reduced from 21.93kg/m² in 2011 to 12.03 kg/m² in 2012.

| | 2011 | 2012 (up to August 31st) |
|--|-----------|--------------------------|
| Total PCB Production (m ²) | 5380000 | 5230000 |
| Total volume of Hazardous waste generated (tons) | 117982.02 | 62941.52 |
| Hazardous waste per unit area (kg/m ²) | 21.93 | 12.03 |

The company had set a target of reducing hazardous waste by 32% per m² of PCB production in 2012. However, using data from January to September 2012, the facility has actually managed to reduce the amount of hazardous waste generated per m² of PCBs produced by 45%, which was well in excess of the their target. The fact that this company managed to greatly reduce the amount of hazardous waste generated in a short period of time, shows what a huge potential for waste reduction there is within the industry.

Extended Environmental Checks to Hazardous Waste Treatment Vendors

As part of this special hazardous waste management GCA audit, Tripod Wuxi selected four hazardous waste treatment contractors to be interviewed about their environmental practices, environmental responsibilities and how well they had conformed with government regulations.

By looking at the Pollution Map Database whilst on site at the facility, it was found that each of the hazardous waste treatment companies that were interviewed, had at some point been handed an administrative penalty from the local Environmental Protection Bureau (EPB). During the interviews, representatives from the hazardous waste treatment companies provided initial explanations for the reasons they were given the administrative penalties. They also explained what measures and plans they had put in place to correct those problems. Since the audit was completed, some of the treatment companies have provided written explanations and supporting documents to Tripod Wuxi.

During past GCA audits on IT companies, checks have been made on their hazardous waste treatment vendors to see if they were qualified, however, their true environmental performance has not been tracked before. In October 2012, four ministries, including the Ministry of Environmental Protection, released the “‘Twelfth Five Year Plan’ Hazardous Waste Pollution Prevention and Control Plan’ which stated that, “Hazardous waste treatment and utilization facilities have very low technological levels and are not managed to a good standard. This means there are many cases where standards are not

adhered to, and cases where heavy metals hazardous waste causes pollution are particularly numerous.”

Hazardous waste has many dangerous characteristics, meaning that if it is improperly disposed of, it can not only causedamage to the ecological environment that is difficult to repair, but also causes serious harm to public health. The face to face interviews carried out with hazardous waste treatment vendors during the audit made special use of existing supervision records so as to follow up on treatment vendors’ violations. This was the first time that supply chain environmental management had been actively extended to hazardous waste treatment vendors.

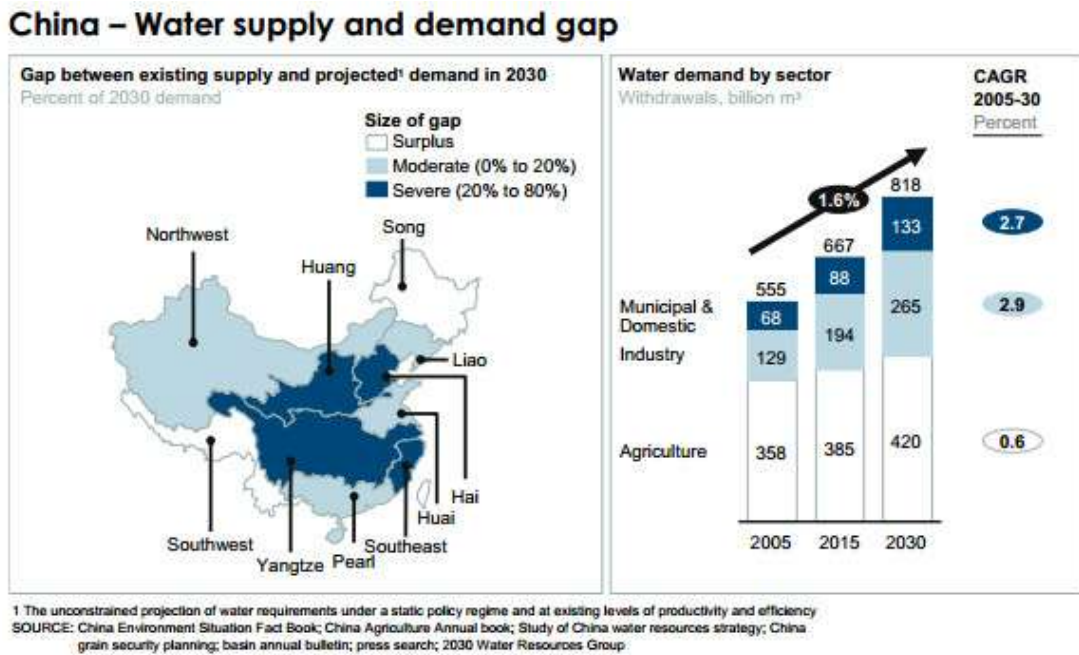
Tripod Wuxi – Best Practice

- Targeted the huge amounts of hazardous waste being generated;
- Identified the sources of pollution;
- Formulated a number of hazardous waste reduction measures, improved facilities and management and recycled heavy metal resources;
- Through a special audit, they confirmed the results of their hazardous waste reduction program;
- For the first time in the IT industry they made use of publically disclosed supervision records to follow up on hazardous waste treatment vendors with violation records.

1.3.4.3 Sustainable Use of Water Resources

Water scarcity is a huge problem in China, exacerbated by extensive pollution and inefficient industrial processes, it is predicted that by 2030 existing water supply will not be able to meet projected demands.¹³ Demand from the industrial sector is predicted to increase at the fastest rate, growing on average 3% per annum.

Figure 2.1: China – Water supply and demand gap¹⁴



Faced with such a grim environmental situation, particularly with regards to water, in 2011, the *No.1 Document of the Central Committee of the Communist Party of China* and the Central Conservancy Working Conference explicitly required the implementation of strict water resources management systems. In 2012, The State Council issued a guidance document which formulated the “Three Red Lines” water resources management goals, which were:¹⁵

- The Red Line for the control of development and utilization of water resources: The target being to control the level of total water consumption nationwide to below 700 billion m³ by 2030;
- The Red Line for the control of water use efficiency: The target being to attain or nearly attain an advanced global level of water use efficiency, to reduce water consumption per RMB10,000 of industrial production to below 40 m³, and to raise effective water use efficiency of farmland irrigation to above 0.6 by 2030;

¹³ http://www.2030waterresourcesgroup.com/water_full/Charting_Our_Water_Future_Final.pdf

¹⁴ http://www.2030waterresourcesgroup.com/water_full/Charting_Our_Water_Future_Final.pdf

¹⁵ State Council on the implementation of strict water resources management systems, Guofa (2012)No.3 January 12, 2012.

- The Red Line for restriction of pollutants in water function areas: The target being to control the total quantity of major pollutants discharged into rivers and lakes within the pollutant absorption capacity of the water function areas, as well as raising water quality compliance rate in such areas to more than 95%.¹⁶

As of 2010, China's PCB industry was producing more than 180 million m² of PCBs per annum with a production value in excess of USD 18 billion, making China the biggest producer of PCBs in the world, and of course the biggest consumer of resources.¹⁷ The PCB industry is one of the biggest water consuming industries in China. The following table gives more details:

Quantity of water used to produce different PCB products¹⁸

| PCB Type | Single Layer Board | Double Layer Board | 4 Layer Board | 6 Layer Board | 8 Layer Board | Every 2 layers added |
|---------------------------------------|--------------------|--------------------|---------------|---------------|---------------|----------------------|
| Water Consumption (t/m ²) | 0.6~1.2 | 1.2~1.8 | 1.8~2.4 | 2.4~3.6 | 3.6~5.4 | Increase by 50% |

Therefore, it is vital that companies recognize the challenges that water scarcity and pollution bring to their industry and the wider environment and start to implement ways in which to reduce their water consumption. Reducing water consumption through product or industrial processes innovation or by increasing the use of recycled or reclaimed water can also provide economic benefits to a company in the form of reduced water bills.

▪ **Case Study 3 - Ibiden Electronics (Beijing) Co., Ltd.¹⁹**

PCB manufacturing facility recycled water and used reclaimed wastewater

The Japanese electronics company Ibiden Co., Ltd. is one of the largest developers and manufacturers of printed circuit boards (PCBs) in the world. Established in 2000, Ibiden Electronics (Beijing) Co. Ltd. (hereafter referred to as "Ibiden") is Ibiden Co., Ltd's product manufacturing base in China. Ibiden's Beijing base comprises of two factory buildings located at their factory site in the Beijing Economic and Technological Development area at No. 15 Rongchang Dongjie.

In June 2010, Ibiden was reported during an environmental inspection for having an irregular heavy metals hazardous waste transport manifest and also because its sludge containing heavy metals had "gone missing."

¹⁶ http://www.china.org.cn/china/2012-02/17/content_24664293.htm

¹⁷ China's PCB Industry' Facing "four big challenges" (2) – "reduction law" the technical resource consumption challenges" Linjin, Printed Circuit Board information, March, 2012.

¹⁸ China's PCB Industry' Facing "four big challenges" (2) – "reduction law" the technical resource consumption challenges" Linjin, Printed Circuit Board information, March, 2012.

¹⁹ For the GCA audit report please see:

<http://www.ipe.org.cn/Upload/file/Notices/Audits/Audit-Ibiden-Electronics-Beijing-Co-Ltd-EN.pdf>

On August 25, 2011, environmental NGOs sent a letter to Ibiden in order to verify their record in the *Pollution Map Database*. However, no response was received.

On August 31, 2011, Friends of Nature, IPE, Green Beagle, Envirofriends, and Nanjing Green Stone jointly released “The Other Side of Apple II” report. In the report, the environmental organizations highlighted Ibiden’s violation problems.

On September 7, 2011, Ibiden and the IPE first spoke over the phone and then in a face to face meeting. Ibiden explained the situation regarding their hazardous waste. At the same time they also explained the efforts that the factory had been making to conserve water.

On January 27, 2012, one of Ibiden’s clients, Apple, held a conference call with the IPE and the Natural Resources Defense Council (NRDC). In the call, the parties came to an agreement to carry out a pilot Green Choice Alliance audit under the supervision of environmental organizations. Ibiden was provisionally selected for the pilot audit.

In October 2012 Apple and IPE held discussions and agreed that Ibiden would be a good candidate for a third party compliance audit. At this time, the IPE proposed that Ibiden undergo a specialized audit looking at their water resources management (including the effectiveness of their water reduction program). Apple also agreed with IPE’s suggestions.

Water Shortage Situation in Beijing

The annual average water resources available in Beijing for the years 1956-2000 was 3.74 billion m³ per year. However, in recent years, the amount of precipitation in the drainage area has declined and the volume of water entering the area has reduced by a large margin. At the same time, rapid urbanization has led to severe water shortages. In 2011, Beijing’s total water consumption was 3.52 billion m³; even though Beijing’s total water resources were 2.681 billion m³. According to the 2011 end of year census, there were 20.19 million people living in Beijing, plus a transient population of 2.4 million people. This means a per capita water resource of 119 m³, well below the international standard indicating severe water resource shortage of 1000 m³ per capita.²⁰

These water shortages have led Beijing to have no option but to extract a large amount of groundwater, causing groundwater levels to continuously decline meaning that in recent years Beijing has had to rely on transferring water from Hebei to maintain its water supply. However, Hebei is also faced with very serious water resource shortages.

Because the PCB industry uses a huge amount of water, and Beijing is a particularly water stressed city, the environmental NGOs decided to pay particular attention to Ibiden’s water resources management. On November 13 and 14, 2012 a Green Choice on-site audit was conducted at Ibiden to look in detail at how Ibiden’s plan to use reclaimed water and implement water saving measures had been put into practice.

²⁰ Beijing Water Resources Bulletin, 2011, Beijing Water Authority.

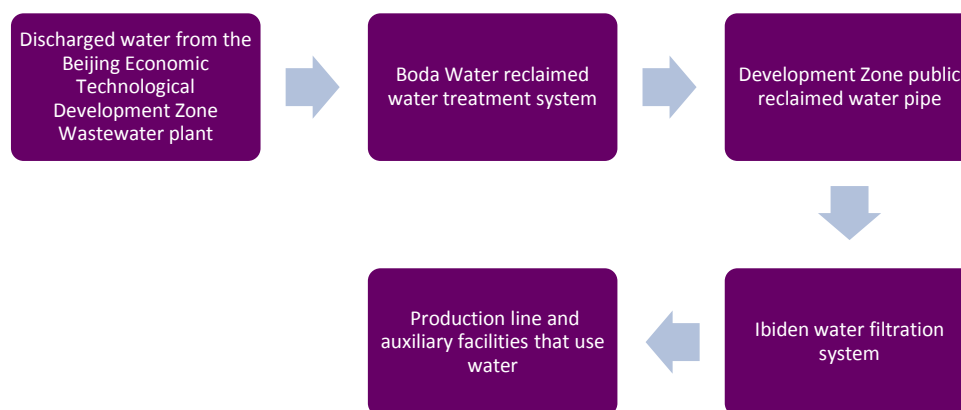
During the audit it was discovered that Ibsiden had implemented two major water saving measures:

1. Using reclaimed water
2. Increased their water efficiency

- Regarding their use of reclaimed water:

The Beijing Economic and Technological Development Area (BDA) built a centralized reclaimed water plant which is operated by Beijing Boda Water Co., Ltd. During the audit it was discovered that Ibsiden's Plant 2 had been using reclaimed water since May 2010, and Plant 1 had been using it since December 2011.

Figure 21: Flow chart showing reclaimed water use



During the audit, the auditors and environmental NGOs visited the reclaimed water plant to check its treatment capacity. According to the representative from the reclaimed water plant, the plant can supply 20,000 m³ /day, but the actual amount supplied was 13,000 m³ /day.

During the audit it was noted that reclaimed water was treated by two water purification systems in Plant 1 and 2 before it was used for production purposes. All of the production lines in the factory now use reclaimed water and auxiliary equipment (air conditioning system, boilers etc.) are being transformed so that they can use it. Reclaimed water is also used for gardening and flushing toilets and tap water is used for domestic purposes (kitchens and hand washing).

The bills of the usage of the reclaimed water issued by Beijing Boda Water Co., Ltd. were also provided for review. According to the bills, the Facility's reclaimed water consumption from December 2011 to October 2012 was:

Table 5: Reclaimed Water Consumption in 2012

| Date | Reclaimed water consumption (m³) for Plant 1 | Reclaimed water consumption (m³) for Plant 2 |
|--|--|--|
| December 2011 to February 2012 | 37,179 | 107,213 |
| March 1, 2012 to March 29, 2012 | 28,964 | 43,947 |
| March 30, 2012 to April 26, 2012 | 26,657 | 38,014 |
| April 27, 2012 to May 31, 2012 | 35,555 | 53,238 |
| June 1, 2012 to July 2, 2012 | 36,602 | 52,608 |
| July 3, 2012 to July 26, 2012 | 20,956 | 35,066 |
| July 27, 2012 to August 30, 2012 | 32,507 | 58,466 |
| August 31, 2012 to September 28, 2012 | 35,458 | 45,673 |
| September 29, 2012 to October 25, 2012 | 33,234 | 43,975 |

- Increased their water use efficiency

Based on the feedback from a factory representative, both plants at the Facility implemented water reduction plans in 2012, which are listed as below:

Table 7: Water Recycling Plans in 2012

| | Water recycling plan |
|---------|---|
| Plant 1 | <ul style="list-style-type: none"> ■ Using the reclaimed water for the pure water system, and increasing retention time of the reclaimed water in the resin tower to reduce the consumption of the reclaimed water. ■ Using the reclaimed water instead of tap water for the boilers. ■ Fixing the water inlet of the grinding machine to reduce the water consumption. ■ Using the reclaimed water instead of tap water for air conditioner system. |
| Plant 2 | <ul style="list-style-type: none"> ■ Stop using the last resin tower of the pure water system to reduce the consumption of the reclaimed water. ■ Reducing the usage of the solid calcium hydroxide in the WWTF to lower the consumption of the water for prepare the solution. ■ Using the reclaimed water instead of tap water for the boilers. ■ Using the reclaimed water instead of tap water for air conditioner system. ■ Using the reclaimed water instead of tap water for clearing the sludge tank and wastewater sludge drying machine in the WWTP. ■ Using the acid-containing wasteliquid for the pH treatment. ■ Using the squeezing rollers to reduce the PCB boards take water out from the partially etching bath. ■ Recycling the back washing water from the sand filter tower. ■ Recycling the clearing water from the grinding process. |

During the audit, calculations were made from monthly water consumption values to give the following results:

| | Total water consumption (t) | Tap water (t) | Recycled water (t) | Reclaimed water (t) | Quantity of PCB production (m ²) |
|----------------------|-----------------------------|---------------|--------------------|---------------------|--|
| Plant 1 | | | | | |
| 2011 total (Apr-Dec) | 677,777 | 299,939 | 377,640 | 198 | 167,000 |
| 2012 total (Jan-Sep) | 689,905 | 47,226 | 385,017 | 257,662 | 164,000 |
| Plant 2 | | | | | |
| 2011 total (Apr-Dec) | 742,512 | 18,089 | 316,602 | 407,821 | 244,000 |
| 2012 total (Jan-Sep) | 836,981 | 20,085 | 402,863 | 414,033 | 265,000 |

Based on a review of documentation, the consumption ratio of the tap water, recycling water and reclaimed water were as follows:

| % | Plant 1 | | Plant 2 | |
|---|---------|------|---------|-------|
| | 2011 | 2012 | 2011 | 2012 |
| Tap water consumption / Total water consumption | 44% | 7% | 2% | 2.4% |
| Recycling water consumption / Total water consumption | 56% | 56% | 43% | 48.1% |
| Reclaimed water consumption / Total water consumption | 0% | 37% | 55% | 49.5% |

The audit confirmed that Ibiden had made important progress with their plans to use reclaimed water and also their implementation of water saving measures:

- Confirmed the status of Ibiden's reclaimed water use, and water for industrial processes in both plants were already using reclaimed water provided by Beijing Boda Water Co., Ltd.
- Through an on-site visit, it was confirmed that in order to meet their water saving targets, Ibiden implemented specific measures separately in both Plant 1 and Plant 2.
- Plant 1's tap water consumption was reduced from 44% in 2011 to 7% in 2012, benefiting from the plant's use of reclaimed water which started in 2012.
- Plant 2 took advantage of the fact that it started using reclaimed water in 2010, and in 2011 and 2012 their use of tap water was 2% and 2.4% of their total water use.
- Plant 2's use of recycled water increased from 43% of total water use in 2011 to 48.1% in 2012. Part of this increase was thanks to the four measures included in the water saving plan which was completed in June 2012 (using the acid-containing waste liquid for the pH treatment, using the squeezing rollers to reduce the PCB board takes water out from the partially etching bath,

recycling the back washing water from the sand filter tower, recycling the clearing water from the grinding process).

Ibiden - Best Practice

- Ibiden have replaced the use of tap water for industrial processes with high quality reclaimed water, which has substantially reduced their effect on local water resources.
- Formulated and implemented a water saving plan to increase water use efficiency.

Recommendations:

- Considering the seriousness of the water shortage situation in Beijing, as well as the high quality of the reclaimed water in the development area, the reclaimed water could have a number of other uses. The environmental NGOs hope that Ibiden will increase their water efficiency in line with international best practice, and in doing so reduce their use of high quality reclaimed water.
- The audit showed that Apple followed up on the supplier environmental violation problems that were raised by the NGOs. They proactively pushed the supplier to take action and required the supplier to go through a third party audit overseen by the environmental NGOs to provide proof to the general public of compliance. The IPE expresses their appreciation for this and hopes that Apple will take the example of Ibiden's use of reclaimed water and recycled water and bring this into their supply chain management system.
- The huge amount of water used by the PCB industry, which is an integral sector of the IT industry, poses a significant environmental challenge. The IPE recommends that PCB manufacturers and IT brands jointly push for a reduction in the use of fresh water (tap water) in order to promote the sustainable development of the PCB industry.
- Because of the large volumes of water used by the PCB industry it is recommended that when PCB factories are sited they should rely on reclaimed water sources.

2. What should Apple do next?

Figure 22: Chart showing steps completed by Apple

| Company Name | Replied to NGO Letter | Checked the Purpose of the Study | Checks on Supplier Violation Cases | | Use of Public Information to Enhance Supply Chain Management | Push for Suppliers to Make Corrective Action & Disclose Information | | Further Extension of Environmental Management into the Supply Chain | | |
|--------------|-----------------------|----------------------------------|------------------------------------|---------------------------|--|---|---|---|--------------------------------------|---|
| | | | Performed Initial Checks | Performed In-depth Checks | | Considered Establishing a Search Mechanism | Decided to Establish a Search Mechanism | Corrective Action & Explanation | Regular Disclosure of Discharge Data | Directly Extended to Main Materials Suppliers |
| Apple Inc. | ✓ | ✓ | ✓ | ✓ | ✓ | X | ✓ | X | ✓ | X |

From the table above it is possible to see the steps that Apple has taken so far; however, there are still many areas in which they could do more. We make the following suggestions to Apple to make greater improvements to transparency and accountability:

1. **Perform in-depth checks.** Apple has reviewed and checked cases of suppliers with environmental violations that were raised in the Phase IV IT industry report. However, to date no suppliers with violation records have made *public* explanations except those that have gone through a Green Choice 3rd Party Audit. We suggest that Apple encourage all suppliers with pollution records to provide public explanations in a timely and comprehensive manner. Amongst these suppliers, local communities are still making serious complaints about a number of the companies. Through follow-up investigations, many case studies were found to have been resolved. However, there are still a number of companies that local communities are not satisfied with. Problems at these companies were mainly related to air emissions. Considering that air emissions include toxic substances like sulfuric acid mist, volatile organic compounds and benzenes they do not only affect the local community but can also be a source of urban PM2.5. We recommend that Apple pushes its suppliers to improve their air emissions management.
2. **Establish a search mechanism.** Apple should establish a regular search mechanism for existing and prospective suppliers to check for environmental violation records against the *Pollution Map Database*. Apple began to build a search mechanism using the *Pollution Map Database* but the interval between searches can be as long as 18 months, which is too long to identify problems in a timely fashion. Also, none of the suppliers identified by Apple have been in direct contact with the NGOs, which makes it difficult to verify and assess the effectiveness of the searches they have carried out. We suggest that Apple learn from other brands and conduct more frequent

checks.

3. **Explanations and Corrective Actions.** Following supplier checks, companies should be encouraged to communicate directly with NGOs to provide explanations on violations. This kind of exposure will help them develop a sense of accountability. It is also more efficient to include NGOs throughout the process of identifying and correcting problems, rather than only engaging with NGOs once supplier problems have been resolved. This will reduce the burden on suppliers of having to complete repeated audits. During the audit and the drafting of the audit report, Apple representatives need to make sure that they do not interfere in the audit procedure or impose their views during the drafting of the report.
4. **Push suppliers to regularly disclose discharge data.** We suggest that Apple encourages suppliers to regularly disclose discharge data to the public. This could be done on an annual basis with data uploaded onto a publically accessible platform such as the IPE website. This is a very important step because management starts with measurement. Suppliers need to measure, document and validate discharge levels before they can properly report the data.
5. **Directly extend management to main materials suppliers.** We suggest that in order to continue its best practice of extending management to material suppliers with the highest environmental footprints, Apple could conduct more special GCA audits. We also suggest Apple encourage other PCB suppliers to adopt those good practices identified through GCA audits.
6. **Push tier one suppliers to manage tier two suppliers.** Cascading environmental monitoring by encouraging first tier suppliers to make checks on their own suppliers is vital, especially in the IT industry where the most heavy pollution occurs further upstream in the supply chain.

In addition to these points we hope that Apple will also:

Promote proper recycling and disposal of end-of-life products. Apple has a continuous stream of updated products; this fast disposal rate contributes to the rapidly growing problem of e-waste. Discarded products contain toxins and heavy metals that are released when improperly disposed of. In China these toxins are also often released when products are recycled by informal workers using dangerous methods. It is Apple's responsibility to inform their consumers of the hazardous nature of e-waste and launch programs to ensure safe recycling, such as easy take-back schemes.

3. Assessment of 33 IT brands

In 2010, a number of Chinese environmental NGOs launched the Green Choice IT Industry Supply Chain Investigation based on a combination of data collection, as well as desk and onsite investigations. So far contact has been made with 32 IT brands and five investigative reports have been released. The reports highlighted environmental problems at Chinese suppliers to major global IT brands and have brought these problems to wider attention.

| Company Name | Replied to NGO Letter | Checked the Purpose of the Study | Checks on Supplier Violation Cases | | Use of Public Information to Enhance Supply Chain Management | | Push for Suppliers to make Corrective Actions and Disclose Information | | Further Extension of Environmental Management into the Supply Chain | |
|-----------------|-----------------------|----------------------------------|------------------------------------|---------------------------|--|---|--|--------------------------------------|---|---|
| | | | Performed Initial Checks | Performed In-depth Checks | Considered Establishing a Search Mechanism | Decided to Establish a Search Mechanism | Corrective Action & Explanation | Regular Disclosure of Discharge Data | Directly Extended to Main Materials Suppliers | Pushing Tier 1 Suppliers to Manage Tier 2 |
| | | | Siemens | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Panasonic | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | X | X | X |
| Nokia | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | X | ✓ | X |
| Vodafone | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | X | X | ✓ |
| Philips | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | X | ✓ | X |
| Apple Inc. | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | X | ✓ | X |
| Alcatel-Lucent | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | X | X | X |
| Sony | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | X | X | X |
| Microsoft | ✓ | ✓ | ✓ | ✓ | ✓ | X | ✓ | X | X | X |
| HP | ✓ | ✓ | ✓ | ✓ | ✓ | X | ✓ | X | X | X |
| BT | ✓ | ✓ | ✓ | ✓ | ✓ | X | X | X | X | ✓ |
| Foxconn | ✓ | ✓ | ✓ | ✓ | ✓ | X | ✓ | X | X | X |
| Sanyo | ✓ | ✓ | ✓ | ✓ | ✓ | X | ✓ | X | X | X |
| Dell | ✓ | ✓ | ✓ | ✓ | ✓ | X | ✓ | X | X | X |
| Lenovo | ✓ | ✓ | ✓ | ✓ | ✓ | X | X | X | X | X |
| Toshiba | ✓ | ✓ | ✓ | ✓ | ✓ | X | X | X | X | X |
| Cisco | ✓ | X | ✓ | ✓ | ✓ | X | ✓ | X | X | X |
| Sharp | ✓ | ✓ | ✓ | X | ✓ | X | X | X | X | X |
| Motorola | ✓ | ✓ | ✓ | ✓ | ✓ | X | X | X | X | X |
| Intel | ✓ | ✓ | ✓ | X | ✓ | X | X | X | X | X |
| Seiko Epson | ✓ | X | ✓ | ✓ | ✓ | X | X | X | X | X |
| Hitachi | ✓ | ✓ | ✓ | ✓ | X | X | X | X | X | X |
| Samsung | ✓ | ✓ | ✓ | ✓ | X | X | X | X | X | X |
| Canon | ✓ | X | ✓ | ✓ | X | X | X | X | X | X |
| Haier | ✓ | ✓ | ✓ | X | X | X | X | X | X | X |
| BYD | ✓ | ✓ | ✓ | X | X | X | X | X | X | X |
| TCL | ✓ | ✓ | ✓ | X | X | X | X | X | X | X |
| SingTel | ✓ | ✓ | ✓ | X | X | X | X | X | X | X |
| IBM | ✓ | X | ✓ | X | X | X | X | X | X | X |
| LG | ✓ | X | ✓ | X | X | X | X | X | X | X |
| Ericsson | ✓ | X | ✓ | X | X | X | X | X | X | X |
| BlackBerry- Rim | ✓ | X | ✓ | X | X | X | X | X | X | X |
| HTC | X | X | X | X | X | X | X | X | X | X |

Under pressure from many different parties, 32 IT brands have now given varying responses. The majority of them have responded to questions raised by the NGOs and looked into problem suppliers. Some of the brands have started to establish a search mechanism, and through comparing their records with publically available data, they have systematically identified problem suppliers and then pushed them to take corrective actions. Vodafone and Philips have started to extend their supply chain management further upstream. However the performance of several large scale international brands such as Canon and LG has been poor and HTC has not responded at all.

3.1 Performance of Positively Ranked Brands

Siemens

Since the Phase IV IT industry heavy metal investigation report was released in January 2011, Siemens has made significant improvements:

1. Incorporated government released information on company environmental supervision records into its environmental supply chain management. Because they have a large number of suppliers, Siemens has created its own mechanism that can automatically check and compare their supplier list with all of the company supervision records in the Pollution Map Database.
2. Required suppliers with violations to disclose corrective measures carried out or ones that they plan to carry out. Siemens also recently stated that they will encourage suppliers to conduct third party GCA audits and also push suppliers to regularly disclose discharge data.

Panasonic

On April 15th, 2010, 34 environmental NGOs jointly sent a letter to Panasonic to confirm if company's listed in the Pollution Map for having a violation record were their suppliers, if they had other suppliers that had environmental violation problems, and whether or not they had established a supplier environmental management system.

Panasonic and the IPE communicated over the phone on several occasions. On April 30th, 2010, after conducting more in depth investigations, Panasonic provided a written statement. The statement gave an explanation for each of the companies that the NGOs had raised questions about and also explained that they were using the China Pollution Map Database to manage first tier suppliers and that they were considering going a step further to establish it as a supervision mechanism.

In 2012, Panasonic started to use the China Pollution Map Database to carry out supplier management and also established a supervision mechanism. Panasonic has pushed 27 supplier companies to make improvements and make public explanations on the status of those improvements. The environmental groups believe these are positive developments.

Microsoft

In January 2012 the environmental groups jointly sent a letter to Microsoft. After several rounds of discussions Microsoft confirmed that they are seriously considering establishing a high quality supply chain management system. During discussions with Microsoft suppliers, we learned that before Microsoft signs a purchasing order they use the China Water Pollution Map to screen suppliers. If the supplier is found to have a violation record the supplier is required to go through a NGO supervised third party audit.

3.2 Performance of Negatively Ranked Brands

HTC

HTC has so far failed to respond to questions from the environmental NGOs about their supply chain. The environmental NGOs believe that client companies have a responsibility to respond to questions about their suppliers. We call upon HTC to face up to these questions, respond positively, and start the work of managing their supply chain.

Canon

On April 15th, 2010, 34 environmental NGOs jointly sent a letter to Canon to confirm if company's listed in the Pollution Map for having a violation record were their suppliers, if they had other suppliers that had environmental violation problems, and whether or not they had established a supplier environmental management system.

After a long period of silence, Canon began to communicate with the environmental NGO. However, the results of the conversations were far from satisfactory. As of January 2013, no response has been received from Canon about how they were going to establish a search mechanism to search for suppliers with violation problems. The environmental NGOs believe that if after receiving the follow-up questions from the NGOs, Canon once again sinks into silence, there can be no bright future for their environmental supply chain management.

LG

On April 19th, 2010 the NGOs sent a letter to LG for the first time. After a long period of silence, LG started to communicate with the NGOs. LG does not want to really follow-up on status of their suppliers who have violation records. The NGOs believe that LG should talk to those suppliers listed in the previous investigative reports for having violations, as well as any other suppliers that have violation records, and ask them to provide proof and evidence of corrective action plans and measures that have already been taken. Information transparency will prove to the community that there are no more environmental issues. The environmental NGOs hope that LG will use their suppliers' environmental violations as a lesson and take the opportunity to investigate the gaps in their environmental supply chain management systems. Through using open government information, LG can manage their supply chain.

4. Conclusion

- Apple has increased their level of transparency and started green procurement to push a number of suppliers to substantially improve their environmental performance.
- The environmental NGOs hope that Apple can take this good practice and extend it to more suppliers. The NGOs also hope that more brands and suppliers will adopt these good practices and help to clean up the highly polluting IT materials production processes.

| Green Choice Alliance (GCA) NGO Member Organizations | |
|--|--|
| 1 | Friends of Nature |
| 2 | Global Village Beijing |
| 3 | Green Earth Volunteers |
| 4 | Global Environmental Institute |
| 5 | Huaihe River Guardians |
| 6 | Gansu Green Camel Bell |
| 7 | Friends of Green in Tianjin |
| 8 | Beijing Association of Sustainable Development |
| 9 | Center for Legal Assistance to Pollution Victims |
| 10 | Chongqing Green Volunteer Federation |
| 11 | Nanjing Green Stone Environmental Action Network |
| 12 | Nature Watcher Volunteer |
| 13 | Hubei Green Hanjiang |
| 14 | Environmental Protection Commonwealth Association |
| 15 | Xinjiang Conservation Funds |
| 16 | Hebei Green Friend Association |
| 17 | Yunnan Green Watershed |
| 18 | Wenzhou Green Eyes |
| 19 | Wild China |
| 20 | Green Island |
| 21 | Green Beagle |
| 22 | Shanghai Oasis Ecological Conservation & Communication Center |
| 23 | Shaanxi Women's Federation "Red Phoenix Project" |
| 24 | Friends of Green Environment |
| 25 | Green Longjiang |
| 26 | Green Anhui |
| 27 | Green Zhujiang |
| 28 | Green River |
| 29 | Dalian Environmental Resource Center |
| 30 | Center for Rural Development & Biodiversity Protection of Lanzhou University |
| 31 | South China Nature Society |
| 32 | Green Kunming |
| 33 | Chongqing Liangjiang Voluntary Service Center |
| 34 | Institute for Environment & Development |
| 35 | Fujian Green Home Environmentally Friendly Center |
| 36 | Green Hunan |
| 37 | Green Zhejiang |
| 38 | Green Panjin |
| 39 | Gull Protection Association of Panjin City |
| 40 | Xiamen Green Cross Association |
| 41. | Lv Se Jiang Nan Public Environmental |
| 42. | Nature University |
| 43. | Dalian Environmental Protection Volunteers Association |
| 44 | Wuhu Ecology Center |
| 45. | Wuling Mountains Conservation Federation |
| 46. | Institute of Public and Environmental Affairs |