



Green Beagle

China chemical safety case study: Pollution from glyphosate production in Pengshan, Sichuan Province

In the frame of the EU-funded project: Strengthening the capacity of pollution victims and civil society organizations to increase chemical safety in China (China Chemical Safety Project)

IPEN and Green Beagle

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Introduction

Glyphosate is the world's best selling pesticide with a sales value more than all other herbicides combined.^{1 2} Monsanto patented the pesticide in the 1970s and has retained about half of global production despite expiration of their patents in 1991 (outside the US) and 2000 (in the US).³ Glyphosate is well-known as the active ingredient of Monsanto's profitable pesticide formulation, Roundup. The company has marketed the pesticide in combination with seeds for crops that are genetically engineered to be resistant to it.

Despite the prominence of US-based Monsanto, the top country for glyphosate manufacturing is China, not the US. In 2011, China's glyphosate production capacity reached 700,000 tonnes per year.⁴ Glyphosate manufacturing produces large volumes of highly toxic waste – a topic that gets much less attention than glyphosate use. This case study focuses on how faulty environmental impact assessment documents provided a permit for a glyphosate production facility in a village whose residents once used river water, but now have to travel 10 km for potable drinking water.



Sichuan Dimeite Biological Science and Technology plant is very close to the Min River (photo by Mao Da)

Glyphosate and genetically modified organisms (GMOs)

Glyphosate use soared when Monsanto combined its sale with seeds for crops genetically engineered to be resistant to it (GMO crops). The method allows farmers to spray the herbicide to kill weeds after the crops are already growing. The glyphosate resistance protects the GMO crops, which survive.

The technique has become widely adopted in certain countries. In the US, more than 70% of the corn, soybeans and cotton are genetically engineered to be glyphosate-resistant, representing 1.37 billion acres (0.55 billion hectares) planted between 1996 and 2011.^{5 6}

China allows some GMO imports, but only for animal feed. Instead of welcoming Monsanto, China has pursued a more national approach. As Minister of Agriculture Han Changfu noted, *“The government will pursue its own research and development of genetically modified food, though it remains “cautious” on the distribution of GMO products... We can’t have such techniques monopolized by others.”*⁷

Glyphosate increases pesticide use

The corporate marketing concept promoted by Monsanto and others claimed that the use of genetically modified organisms (GMOs) would reduce pesticide use. However, a recent study calculated that in the US, GMO crop technology has increased pesticide use by 239 million kg between 1996 and 2011.⁸ Part of the reason for the increased use of glyphosate has been the appearance of glyphosate-resistant weeds.⁹ In 2011, an estimated 11 million acres of US farmland was infested with glyphosate-resistant “super weeds”.¹⁰ In 2012, 49% of US farmers surveyed said they have a problem with glyphosate-resistant weeds – up from 34% in 2011.¹¹ Glyphosate resistance results in higher pesticide use to try to control weeds. This is profitable for Monsanto and other pesticide companies, but in 2011 cost US farmers approximately \$1 billion USD a year with a projected 70% increase in pesticide use by 2015.¹² Glyphosate resistance is not only a problem for US farmers. *“Glyphosate-resistant weeds have now been found in 18 countries worldwide, with significant impacts in the US, Brazil, Australia, Argentina and Paraguay.”*¹³

Manufacturing glyphosate

The pesticide industry is highly profitable in China with a total profit in 2013 of 22.93 billion yuan – an increase of 31% over the previous year.¹⁴ Sichuan Beier Group was ranked number 53 among the top 100 pesticide companies in China with sales of 642 million yuan.^{15 16 17} In 2014, the company signed an agreement with Orgsyntes Group for glyphosate manufacturing in Russia and has plans to build another plant in South America.¹⁸ The company’s glyphosate products are registered in Brazil, Malaysia, and Paraguay.¹⁹

One subsidiary of Sichuan Beier Group is the topic of this case study – Sichuan Dimeite Biological Sci-Tech Co. Sichuan Dimeite is jointly held by Sichuan Beier Group, Chengdu Industrial Investment Group, and Taiwan Simbon Technology Group.²⁰ The main focus of the company is production of glyphosate and an intermediate used to synthesize glyphosate, PMIDA (N-(phosphonomethyl) Iminodiacetic Acid).²¹ According to the company, they were the first to receive certification from the Chinese Ministry of Agriculture for glyphosate production.²² The

company currently produces 20,000 tonnes of glyphosate annually, but plans production capacity of 50,000 tonnes of glyphosate and 100,000 tonnes of PMIDA within five years.²³

There are three main commercial production methods for making glyphosate in China: HCN, DEA, and glycine.²⁴ All three use a variety of toxic chemicals. For example, the HCN process uses hydrogen cyanide and formaldehyde; the DEA process starts with ethylene oxide; and the glycine process uses paraformaldehyde. Of the three processes, the glycine process is most widely used in China, occupying 60% of glyphosate production.²⁵ According to their Environmental Impact Assessment, Sichuan Dimeite uses the glycine process – however, company materials suggest a change to the HCN process.

The glycine process reaction occurs in organic solvent and produces chloromethane as a byproduct – a substance that causes neurotoxicity and reproductive damage.²⁶ The glycine process also uses toxic phosphorous trichloride, along with paraformaldehyde, which can release formaldehyde – a known human carcinogen.²⁷

Company materials suggest that Sichuan Dimeite has shifted to using a proprietary glyphosate manufacturing process using HCN and an iminodiacetic acid pathway – sometimes called the IDAN process. This process uses hydrogen cyanide to produce IDAN, which is then used to make iminodiacetic acid and subsequently PMIDA (N - phosphonomethyliminodiacetic acid) and glyphosate.²⁸ This allows the company to sell PMIDA to other companies that want to make glyphosate as well as sell the glyphosate itself. Other toxic components of the process include phosphorous trichloride and formaldehyde.

Glyphosate production generates large amounts of waste. Recently, Chinese researchers estimated that manufacturing 250,000 tonnes of glyphosate generates 20,000 tonnes of chemical oxygen demand along with toxic byproducts.²⁹ In addition, the HCN process generates large amounts of highly toxic cyanide wastewater.³⁰ An analysis of the “greenness” of the three glyphosate processes by Chinese researchers concluded that the DEA process was most green, followed by glycine and HCN.³¹ The researchers note that it is the HCN process that is growing most rapidly in China despite being the least environmentally friendly, likely due to lower costs of manufacturing.³² In June 2013, news reports emerged of two glyphosate manufacturers in Zhejiang Province, Wynca and Jinfanda, dumping glyphosate pollutants into the Beijing-Hangzhou Grand Canal through a third company.³³ The signal for environmental authorities turned out to be excessive levels of phosphorous that were traced back to the factories.

To provide some examples of pollutants released by glyphosate manufacturing, publically available estimates of company pollution are available through the US Toxics Release Inventory. Monsanto uses the DEA process – the one found to be “greenest” among the three commonly-used processes. However, data for Monsanto’s production facility in Luling, Louisiana provides insights into how toxic glyphosate production can be. In 2013, the top chemical release from the plant was formaldehyde at 4,735,591 kg released.³⁴ Other pollutants released by the plant include formic acid (3,501,700 kg) and chloromethane (35,063 kg), among many others. The data also provides some clues about potential waste production from glyphosate manufacturing. In 2013, chemicals released into wastes at the Monsanto Luling facility included 5,508,366 kg formaldehyde, 5,274,442 kg formic acid, 2,080,518 kg chloromethane, and 1,684,956 kg

hydrochloric acid, among many others. The report notes that the majority of releases (99%) were to land and underground via underground injection and that about half of the waste that was generated was released and half was treated.³⁵

A village connects to the world's most popular pesticide

Baimiao village is located in the Guanyin Town of Pengshan County in Sichuan Province. On its eastern border, the Min River has been flowing for thousands of years. Historically, the villagers have relied on the river for many aspects of their livelihood, such as drinking water, washing water, fish and transport. However, in the last 20 years, as many industries emerged along the river banks, the Min River has become more and more polluted. As a result, people turned to other water sources, particularly for drinking water. Digging a deep well was one of the solutions for safe water, and almost every household of Baimiao Village owns a well. However, since 2008, villagers found that water from wells was not potable either. This posed a big problem. Villagers either went to the county center to buy bottled water and transported it back, or went to a spring 10 km away. Both the sources are expensive, time consuming and labor intensive.

Villagers also started to wonder what caused the groundwater quality degradation. They suspected Sichuan Dimeite Biological Science and Technology Co., Ltd. – a glyphosate production facility located between the village and the Min River. Local suspicions began by matching the odor of their contaminated water with the illegal waste water discharge from the plant to Min River. In 2012, some villagers started to file a lawsuit against the plant and the relevant governmental environmental protection departments.

Villagers question Provincial regulators in court

Because it was hard to judge what caused water quality degradation in Baimiao village, the villagers looked to possible flaws in the EIA process. In 2012, with the help of the Center for Legal Assistance to Pollution Victims, villagers launched administrative litigation against Sichuan Provincial Environmental Protection Department (EPD), the body that approved the plant's EIA statement.

The first hearing took place in April 2012. Villagers questioned the validity of the EIA from three angles. First, the plant is 300 meters away from the nearest residential houses. According to relevant regulation, 500 meters is the minimum distance. The EIA failed to address this problem. Second, through the whole EIA process, there was no public notification, which also violates relevant laws and policies. Third, villagers hired Chengdu Sub-Center of the Center for Water Environment Monitoring of Sichuan Province to sample the ground water pumped from their homes, and found several pollutants higher than the standard limit. EPD rejected all charges and insisted that the EIA process was legal, water quality was good, and, even if there was some contamination, it had no relation with the protection distance of the plant. By the end of 2012, both the first and second trials rejected villagers' claims.



Sichuan Dimeite wastewater outlet on the river bank (photo by Mao Da)

Investigation confirms poor water quality

In May 2013, Project personnel visited Baimiao village to investigate the situation. The first obvious observation was that near the waste water outlet of Sichuan Dimeite plant, there was visible orange and oily pollution in the Min River. In addition, some suspected hazardous waste was dumped outside the wall of Sichuan Dimeite plant, very near to the Min River bank.



Orange and oily pollutants in the river near the bank (photo by Mao Da)

There were also several other pollution sources nearby, including a rubber plant north of the facility and cattle farm south of it. In terms of water quality, Project personnel found a government report admitting that the Min River cannot be regarded as a back-up drinking water source anymore. An investigation of well water in the village indicated that it was also not suitable for drinking. The testing report issued by Chengdu Sub-Center of the Center for Water Environment Monitoring of Sichuan Province not only shows the high hardness of the groundwater, but also records that levels of “three nitrogens”, sulfate and manganese are higher than standard limits (Please see Annex 1). Many villagers drive cars or ride motorcycles to the spring 10 km away from Baimiao for water and they are very worried that one day the spring will also be polluted.



Photo of Baimiao well water during boiling showing oily residue (photo by Wang Hui)

Voluntary regulation does not work

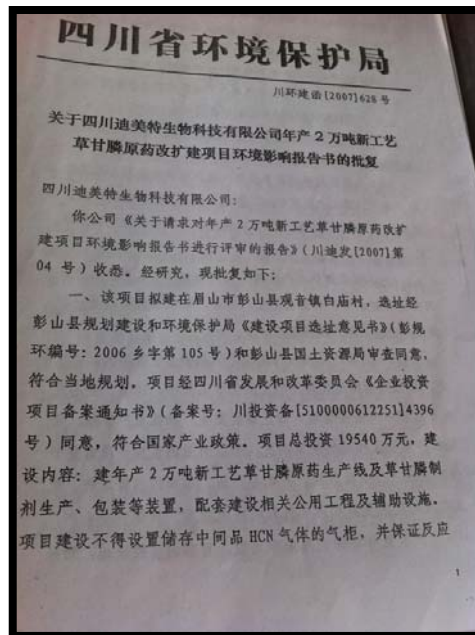
In May 2013, in response to rising concern, the Ministry of Environmental Protection (MEP) issued a special measure targeting glyphosate producers and formulators to be implemented during 2013 – 2015. The measure asks producers to voluntarily provide information and samples to provincial authorities and agree to onsite inspection.³⁶ To encourage participation, MEP would include the company on the list of compliant enterprises if its data passed review by provincial authorities and MEP. However, the company would be subject to periodic investigation and violations could result in removal from the “compliant list”.³⁷ According to the Chinese pesticide industry, there are approximately 130 glyphosate companies in China, but in 2013, only about 12 (9.2%) of them had completed the application for verification. Sichuan Dimeite was not one of the companies that applied for verification. As the news report rightly states, “*The voluntary nature of these environmental measures has provided little incentive for companies to comply.*”³⁸



Odorous waste dumped outside the Sichuan Dimeite plant (photo by Mao Da)

Getting the EIA

Villagers used their courage and wisdom to get the EIA statement. On 8 February 2012, about 20 Baimiao villagers went together to the Pengshan County Environmental Protection Bureau (EPB) to apply for the EIA statement of Sichuan Dimeite plant. Although the EPB official refused at the beginning, the villagers insisted and stayed there for a whole day. Finally, they used their mobile phones to take photos of every page of the statement. The villagers understood that without this document, no further action could be taken.



The EPA approval of the Sichuan Dimeite EIA statement, which contains a faked public participation section (photo by Wang Hui)

According to the EIA, Sichuan Dimeite and the EIA agent had conducted a public participation activity required by law and obtained 25 signatures on questionnaires, proving 100% village support for the plant. Through some communication with Project personnel and other experts, the villagers decided to investigate the authenticity of these signatures. After a door-to-door investigation, the Baimiao villagers found that many of the 25 questionnaires were in fact filled by workers hired by the Dimeite plant. In addition, villager Wang Hui found that villagers who did exist claimed they had not ever seen the questionnaires or been asked about the plant. In March 2014, a journalist from Sichuan Legal News interviewed two villagers whose names were on the questionnaires and found that they had never seen it. In other words, it appeared that the company and EIA agent had faked the public participation portion of the EIA. The finding triggered collaboration between Project personnel and the villagers to prepare a petition to the relevant government department to withdraw the EIA approval of the Sichuan Dimeite plant.

EIA and information disclosure

This case demonstrates once again that public participation is one of the weakest parts of the EIA process in China. Instead of organizing public hearings and experts' discussion seminars, the project developer and EIA agent turn to questionnaires to fulfill their legal obligation for public participation. However, once the questionnaires are not required by the government to be accessed by citizens, it is highly likely that they will be faked by the developer or EIA agent rather than being filled out by authentic residents. Public access provides a watchdog over the process to ensure that public participation is real. To the surprise of the developers and EIA agents, pollution victims nowadays will first turn to the authenticity of the public participation process-particularly the questionnaires- in order to challenge EIA approval. This may result in a crisis of legitimacy for many EIAs, which makes the environmental protection department more reluctant to disclose EIA documents. The only way to get out of this vicious circle is to open questionnaires for public access. This should be done for both EIAs in process and after permitting of a facility.



Villagers have to go to a spring to carry drinking water 10 km away (photo by Mao Da)



“If this water is polluted, what can we do?” sentence printed near the spring (photo by Mao Da)

Monitoring

This case study shows another common problem faced by pollution victims: the inability to prove a causal relationship between a suspected pollution source and actual pollution. In many cases, the refusal of government environmental protection departments to provide data results to victims that already live in severe poverty means victims have to spend their own money to pay for sampling and testing. Environmental protection departments should monitor and honestly publicize the results of the basic situation of the environment and polluters, and provide analysis on the possible reasons for the pollution, or provide enough data for experts to evaluate.

Conclusion

The Pengshan case study provides opportunities for improvements in several areas:

EIA needs correct implementation and enforcement

The central government has an important role to play to ensure that Chinese law is effectively implemented and enforced. This case study illustrates two apparent problems in the EIA statement of Dimeite’s herbicide plant: 1) the minimum distance between the plant and residential houses violates the law; and 2) the required public opinion and approval section is fake. These are two common problems with EIA in China, and demonstrate that frequently project developers and EIA agencies do not respect the relevant law and local people’s basic rights. In this case, the victims have already launched litigation against the provincial environmental protection department’s wrongful approval of the EIA statement, but unfortunately the provincial government has refused to take responsibility. This highlights the importance of the intervention of the central government on the duties of provincial and local environmental protection departments or bureaus to conduct necessary investigations on the

content of EIA statements and enforce violations when they occur. As a first step, a guideline on checking some common errors in EIA statements should be provided by the Ministry of Environmental Protection. In the meantime, the Supreme Court should also give some guidance to provincial or local courts on how to judge the controversy.

Information disclosure

Public right to know is a key principle of chemical safety and this needs significant improvement, as this case illustrates. In this case, the Pengshan EPB made a vigorous effort to block access to the EIA, even though villagers were merely acting within Chinese law. As noted above, environmental protection departments should monitor and honestly publicize the results of the basic situation of the environment and polluters, and provide analysis on the possible reasons for the pollution, or provide enough data for experts to evaluate. Additionally, communities can demand better, more informative websites of the local government Environmental Protection Bureaus. However, ultimately, Chinese law should be obeyed and the information disclosure requirements need to be enforced at appropriate governmental levels.

Clean water

Access to clean water is a basic human right – but in this case an entire village is traveling 10 km to access water. The government has the responsibility to provide this basic human right. More fundamentally, the government needs to do a prompt, comprehensive survey to identify the pollution source(s) for the ground and surface water, find out who should be responsible, and develop measures to tackle the pollution and clean it up.

Ecological agriculture

The Sichuan Dimeite plant and others like it exist due to an agricultural system that relies on deliberate release of toxic chemicals to cultivate crops. Pesticides are designed to kill biota and are deliberately released into the environment, mostly in a broad-scale approach that results in only a small proportion of the chemical reaching its intended target organism.³⁹⁴⁰ The system is quite profitable for pesticide manufacturers but ultimately harmful for human health and the environment – particularly under conditions of use in developing and transition countries. The ecosystem-based approach to pest management, including agroecology, is now well established at the UN level.⁴¹ Ecosystem-based approaches to pest management are the clearly the way forward for replacing glyphosate and the GMO system (which results in higher pesticide use) with a more sustainable approach that protects communities where food is produced and eliminates the pollution faced by communities where pesticides are manufactured.

Legal reform

Fines for pollution are generally low so companies often calculate a cost – benefit of polluting vs. paying to properly operate factories and that calculation often results in a “pay to pollute” situation. This problem is compounded by the fact that revenues obtained from pollution fines often go into the general funds of local governments instead of being separately earmarked for environmental regulation. Local governments do not like to give up this money and begin to view local factories as economic partners. Taken together the motivation to reduce pollution gets sharply reduced. The situation will never be resolved without a newly revitalized set of institutions that can impartially address these types of pollution and subsequent harms. This case,

like many others, illustrates the urgent need for effective legal reform that creates truly impartial administrative and legal institutions to regulate pollution.

Media reports

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Annex 1. Ground water sampling testing results from the well of villager Wang Wenshu

Data sampled, measured and reported by Chengdu Sub-Center of the Center for Water Environment Monitoring of Sichuan Province, 24 February, 2012.

Measured	Result	Standard limit (Class III, Ground water quality national standard, GB/T 14848-93)
pH	7.01	6.5-8.5
Chloride (mg/L)	64.2	250
Sulfate (mg/L)	257	250
Total hardness (mg/L)	803	450
Permanganate index (mg/L)	9.3	3
Ammonia nitrogen (mg/L)	13.3	0.2
Nitrite nitrogen (mg/L)	0.037	0.02
Nitrate nitrogen (mg/L)	16	20
Mn (mg/L)	0.85	0.10
Fe (mg/L)	0.03	0.30
Cu (mg/L)	0.00662	1
Zn (mg/L)	0.0032	1
Volatile phenol (mg/L)	ND	0.002
Cyanide (mg/L)	ND	0.05

About the China Chemical Safety Project

This is an EU-funded project of IPEN with partner Green Beagle that aims to strengthen the capacity of civil society organizations and communities impacted by pollution to increase chemical safety in China. The Project (also known as the China Chemical Safety Project) is being implemented in China over two years with total EU funding of €344,580 and EU contribution of 77.84% of the total cost.

The Project includes:

- Improving capacities of impacted communities and civil society organizations for involvement in policy making
- Training on public participation in environmental impact assessment
- Generating new publicly available data about pollution and impacted communities that contribute to increased implementation of local and national chemical safety policies
- Raising awareness on emissions-related pollution



European Union

Strengthening the capacity of pollution victims and civil society organizations to increase chemical safety in China (China Chemical Safety Project) is funded by the European Union. The contents of this report are the sole responsibility of the IPEN and Green Beagle and can in no way be taken to reflect the views of the European Union.

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⁴¹For example, at the Conference of the Parties to the Stockholm Convention in May 2013, Parties agreed unanimously to give priority to ecosystem-based approaches to pest control to replace the insecticide endosulfan listed under the Convention for global phase out. FAO promotes a paradigm of sustainable crop production intensification (SCPI) that conserves and enhances natural resources, and develops a healthy agroecosystem as the first line of defence against crop pests. It is based on an ecosystem approach: inputs of land, water, seed and fertiliser complement natural processes that support plant growth, pollination, natural predation for pest control, and soil biota that enhance plant access to nutrients. The UN Special Rapporteur on the right to food, Oliver de Schutter, delivered a report to the 16th Session of the UN Human Rights Council in 2011, based on an extensive review of recent scientific literature. The report demonstrated that, if sufficiently supported, agroecology could double food production in entire regions within 10 years, at the same time mitigating climate change and alleviating rural poverty.