

Jiangsu Deqiao "4.22 " Fire Accident Investigation Report

On 9:13 22 April 2016, a fire occurred at Transfer Pit 2 of Jiangsu Deqiao Storage Co. Ltd.

As a result of this accident, one member of the fire fighting crew suffered severe burn and passed away. The direct loss attributable to the accident is RMB25.3 million.

According to Safety Production Law and Safety Accident Reporting, Investigating and Handling regulations (Decree of the State Council 493), an accident Investigation team was set up by the local government and started its investigation on 23 April 2016. The team members included the relevant government authorities and 5 industry experts. Following are the recommendations and the report from investigation team:

1. Basic information of the accident company

a. Jiangsu Deqiao Storage Co., Ltd. ("Deqiao")

Deqiao obtained the approval for Liquid Chemical storage and jetty on May 2005 and obtained its land use rights in December 2006. The project construction was approved in August 2009. The project was constructed in two separate phases. Phase 1 includes 42 tanks with a capacity of 126,000m³ and construction starts in November 2007 and completed in November 2009. Phase 2 includes 103 tanks with a capacity of 457,000m³ and project starts in January 2012 and completed in November 2015.

Tank layout:

The Tank Farm includes two sections: namely, South tank farm and North tank farm. The Deqiao terminal has a total storage capacity of 547,500 m³ with 139 Tanks that are grouped into 11 sub group and these sub groups are numbered accordingly.

The Transfer Pit 1, Transfer Pit 2 and Waste water treatment pool are also located in this tank Farm area.

Transfer Pit 2

The Transfer Pit 2 is located at the north of tank group 24 and the shed was constructed of opened sided steel frame. Transfer Pit 2 is connected to the tank farm, jetty and Truck loading bay. There are 36 Truck loading pumps and 6 shipping pumps located in this Transfer Pit.

The jetty is connected to the Transfer pit with 12 fixed steel pipe lines and 58 fixed steel pipes to the tank farm group 13, 14, 15, 23, 24 and 25.

The truck loading bay is connected with 36 dedicated fixed steel pipes to the tanks. The interconnection at the transfer Pit is serves by 24 hoses to perform the operation among the tank farm, truck loading bay and jetty.

There is a trench under the pipe lines and around the transfer Pit, the trench serves to collect the percolated cargo and the water used to clean the pipe lines. The waste in the trench will be collected into the waste water well located in the southeast corner before it will be pumped to the waste water treatment station.

b. Huadong Construction & Installation Co. Ltd. ("Huadong")

Huadong Construction & Installation Co. Ltd. ("Huadong") was established on 7 November 2014 in Nantong, Jiangsu province. Huadong is qualified to carry out Chemical storage construction and pipe line installation. Huadong had agreed to provide 7 workers, led by Gu Yankun to undertake the construction and installation operations with an agreed fee for the operations.

2. Transactions between Deqiao and Huadong

In 2014, Gu Yankun, under the name of Huadong, undertook and finished the tanks insulation work of Deqiao Phase 2 project. In 2015, Gu Yankun handed over the business to his son, Gu Wei. They hired Huang Dequan, who was responsible for the construction projects with Deqiao on-site for multiple times.

3. Rectification project at accident site before 22 April 2016

8 of the Methanol tanks in group 13 were not connected to the Truck loading bay and it will required to be transferred to other tanks before it can be pump to the Truck loading bay. In order to minimized the transfers, Mr. Zhu Jing , Vice GM of Deqiao, and Shao Jianwei, Vice manager of Storage department decided to rectify the pipelines at Transfer Pit 2 so that the 8 tanks in group 13 can be linked directly to the pumps and loading bay. On 19 April 2016, Zhu Jingen contacted Mr. Huang Dequan for him to undertake the rectification job. After getting the approval of Gu Wei, Huang Dequan arranged for Xu Lei (installation), Shen Jinhua (Welding) and Lu Jun (grinding) to carry out the rectification work on 21st April 2016.

4. Goods stored in Deqiao before the accident

At the time of accident, there were 25 different grades of Petrochemicals with a total quantity of 212,000 metric Tons of cargo in Deqiao Terminal, These includes Gasoline, naphtha, methanol, aromatics, glacial acetic acid, ethyl acetate, butyl acetate, ethylene dichloride and liquid hydrocarbon. Amongst the range of products, there were 140,000 metric ton of petroleum products, 70,000 metric tons of liquid chemicals: and 1420 metric tons of Liquefied Petroleum Gas.

5. Operations in Transfer Pit 2 station before the accident

There were four operations at Transfer Pit 2 prior to the accident

- a. Ship unloading: from 3:13 am, 22 April 2016, Gan Hua Qiang Hua 016 (ship name) unloading 600 tons of acetic ether to Tank 2307; from 6:34 am, 22 April 2016, Haiyou 318 (ship name) unloading 500 tons of Gasoline to Tank 2411. The operation lasted until the accident occurred.
- b. Inter Tank Transfer: from 21:00 of 21 April 2016, 760 tons of Gasoline was transferred from the tank 2409 to the tank 2405 and the operation lasted until the accident occurred.

- c. Pipeline Cleaning: according to Shao Jianwei's arrangement, Chen Qiping, Cao Xuxin and Wang Long, operator of storage department cleaned the pipeline no 2507 in preparation for the transfer of BTX aromatics. During the process of cleaning, waste water flowed into the trench. From 8:30, Chen Qiping and 3 other people started to collect the waste oil in the trench and the well.
- d. Pipeline rectification operation: According to Shao Jianwei's arrangement, Xu Lei and the two other people started to reform the pipeline in Transfer Pit 2 from 12:30, 21 April. They finished the preparation to cut the pipe line to be rectified that afternoon. They obtained approval for "hot work permit" from the Fire and safety department for on-site work that day and Cao Xuxin, Deqiao's employee, monitored the operation.

On 22 April 2016, Xu Lei's job was to weld the pipe flange to connect Tank 1302 to the pipe 2301 so that it can link to the truck loading bay directly.

There were 8 people working at the Transfer Pit at the time of the accident.

Accident and Rescue

Accident:

At 16:00, 21 April 2016, Xu Lei sought permission from Shao Jianwei for the following day's Hot Work Permit. Shao Jianwei signed the permit without the acknowledgement of the safety inspector's, who should have inspected the operation site first. Shao Jianwei submitted the permit to Zhu Jingen for safety approval. At 18:00 that day, Xu Lei sent the permit to Security Department Liu Dongliang, site inspector, who acknowledged the permit without site inspection and submit the permit to He Jianming, Vice manager of Security department. Mr. He Jianming signed the Security permit without further inspection.

At commenced work on 22 April 2016, 0800 hrs, Xu Lei arrived at the Security department to obtain the Hot Work permit approved on the day before; however this was without the signature at the "Monitor" field. At 8:10, Shen Jinhua started to weld the flange on pipe 2301. Xu Lei and Lu Jun stayed outside the pump station and fabricated the pipe to be used for the operation. Xia Shuangli, Security operator, monitored the site operation. Shao Jianwei checked the site operation one time during the operation.

At 8:30, Chen Liang and Lu Yin, security inspectors came to Transfer Pit 2 for checking. Lu Yin replaced Xia Shuangli to monitor the operation. Chen Liang continued his site inspection.

At 9:13 22 April 2016, when Xu Lei opened the orifice on pipe No 1302, Sparks from the cutting ignited the flammable liquid in the trench and caught fire. The fire spread in the trench and burned down the pipe close to the trench and the flammable liquid in the pipeline flowed out and the fire spread to the whole Transfer Pit. At 10:30, the pipeline at Transfer Pit 2 caught fire. At 10:40, more pipe line ruptured and large amount of Gasoline gash out and started burning and spreading towards the surrounding area of the Transfer Pit. At 12:30, the overhead pipelines at Transfer Pit 2 collapsed and the fire became larger.

Rescue:

When the accident occurred, 3 Deqiao's operator's onsite used the fire extinguisher to fight the fire.

At 9:15, the on-site operator called for help via radio, however they evacuated the transfer pit as the trenches were on fire.

At 9:16, site rescuers activated the fire hydrant, fire monitor and spray system. They called Central Control office to close the valves of tank group 24, 22, 23, 21 and 25. Two operators went into tank group 24, trying to close the valves manually at tank 2401 and 2402 but it was not completely successful as the fire were too big.

At 9:16, Central Control office tried to close the tank valves of tank 2401, 2402 and 2403, by automatic control; however the system showed the valves were unable to fully closed.

At 9:17, Central control office closed all the valves of all tank groups and jetty via automatic control system. At 9:18, all Central control PLC signals were down.

At 9:20, as more lines ruptured and the fire gets bigger, the rescuers evacuated the tank Farm area. Central control office called the fire police.

At 9:34, Jingjiang Xingang fire brigade arrived at Deqiao terminal.

Fire Administration, Ministry of Public Security, Jiangsu Fire Brigade, Taizhou Fire Control Center assembled 290 fire engines and 1768 firemen from Jiangsu, Shanghai and Zhejiang. They divided the fire area into four parts and tried to extinguish the fire separately.

State Administration of Work safety set up a work team and assembled 5 professional Chemical Rescue team to provide on-site support

At 14:00, Deqiao arranged for the professional personnel to enter the tank area and manually closed the valves of tank group 11, 12, 13, 14, 15, 21 and 22.

At 18:00, the first general firefighting movement suppressed the flow of fire on both sides in the area.

At 00:30, 23 April 2016, the second firefighting movement significantly weakened the fire.

At 01:00, together with the firemen, the Deqiao operators successfully closed the valves of tank 2401, 2403, 2404 in group 23. The fire weakened.

At 02:04, 23 April 2016, after 17 hours, the fire was extinguished.

Cause of the accident

Direct cause:

The construction company did not thoroughly clean the waste oil in the trench, did not analyze the combustible gas of the air on site and did not take precaution measures to separate the trench and the point of combustion (such as covering trench below), before they commenced the cutting and welding work. The sparks generated from the cutting works ignited the flammable liquid in the trench. This was the direct cause of this accident.

Root causes

Deqiao Company did not follow the safety procedures to make the necessary inspection on-site and did not implement the appropriate Emergency response procedure at the beginning of the accident.

1. Inappropriate special operation management: the personnel responsible for the hot work permit, Zhu Jingen, Shao Jianwei, He Jianming and L Dongliang did not conduct the necessary risk assessment, did not confirm the safety protection action and did not follow Deqiao's "Hot Work" approval procedure. They have allowed the hot work operation to continue even though the Hot Work Permit is invalid.
2. Inappropriate emergency response at the beginning of the accident: when the accident occurred, Deqiao personnel on-site did not close the related tank valves at the first instance and did not inform the central control office to close the valves to shut down the source of fire immediately. Deqiao did conduct its fire and rescue exercises on an annual basis but the practice did not focus on effectiveness of the plans. Deqiao did not concentrate on the Emergency responsibility of each individual on-site.
3. Inappropriate management of supplier: Deqiao did not check the qualification of the construction suppliers thoroughly, did not find that Gu Yankun undertook to carry out the project under the name of Huadong, did not provide enough safety training to the third party workers, Gu Dong, Deqiao inspector, and did not provide the appropriate training to the third party workers. Shao Jianwei and Chen Liang checked the site operation twice. Xia Shuangli and Lu Yin was also on site to monitor the operation, however none of them stopped faulty hot work operation or notice the invalid Hot work permit.

Appendix – unofficial translation in relation to the sections of the Report that are relevant to the Group

4. Incomplete Risk assessment: Deqiao did not follow the government's policy and take appropriate actions to mitigate the risks of all operations. Deqiao was instructed by relevant to conduct risk assessment on all operations and to improve the work safety procedures. Deqiao and was fined several times by the government due to the failure in the hot work permit system.
5. The management of Deqiao, Mr. Wang Wei Zhong, General Manager, did not carry out his role well in work safety management and did not take the appropriate actions to implement the risk assessment review following government's policy, did not review and implement the “new” Hot work permit procedures in time, did not provide adequate training to all the departments of the company in work safety and did not take the actions to reduce the risks of the working condition.

Huadong Company did not have the appropriate site operation management.

Huadong accepted Gu Yankun to operates its business under its name and charged them the administration fee, but did not arrange for any personnel to monitor on-site operations, did not check the safety protection of the working condition, did not train the operators and did not stop the operation which is against the regulations.

Jingjiang Economic Development District did not implement the country's policy appropriately.

Jingjiang Economic Development District is the national level development district and should have not less than 9 people to monitor the work safety of the district according to the government policy. However, there were only 5 people provided with 3 inexperience staff in safety operations for the whole district.

The nature of the accident

After the investigation, Jiangsu Deqiao 4.22 accident was identified as a “Big” production safety accident.

Responsibilities and recommendations

Jingjiang Public Security Bureau has taken the actions: (7 people)

1. Zhu Jingen, Deputy General Manager of Deqiao, in charge of safety department, as the suspect of the crime of major accident, was detained with criminal charges on 23 April 2016 and arrested on 6 May 2016
2. He Jianming, Deputy Manager of Deqiao security department, as the suspect of the crime of major accident, was detained with criminal charges on 23 April 2016 and was arrested on 6 May 2016.

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3. Shao Jianwei, Deputy Manager of Deqiao logistics department, as the suspect of the Crime of major accident, was detained with criminal charges on 23 April 2016 and was arrested on 6 May 2016
4. Liu Dongliang, Site inspector of Deqiao security department, as the suspect of the crime of major accident, was detained with criminal charges on 23 April 2016 and was arrested on 6 May 2016.
5. Xu Lei, Site operator of Huadong Company, as the suspect of the crime of major accident, was detained with criminal charges on 23 April 2016 and arrested on 6 May 2016.
6. Lu Yin, Site inspector of Deqiao security department, as the suspect of the crime of major accident, was detained with criminal charges on 23 April 2016 and posted bail, awaiting trial on 6 May 2016
7. Chen Liang, Site inspector of Deqiao Security department, as the suspect of the crime of major accident, was detained with criminal charges on 23 April 2016 and posted bail, awaiting trial on 6 May 2016

Advised the Jingjiang Public Security Bureau to take the actions: (2 people)

1. Gu Yankun, Construction Company, who assumed the construction project under the name of Huadong, did not arrange for the safety personnel to manage the site operation, should bear the major responsibility of the accident. It was proposed that the judicial authority take over the case.
2. Wang Weizhong, General Manager of Deqiao, as the first responsible person of the company safety work, should bear the major responsibility of the accident. It was proposed that the judicial authority take over the case.

Administrative penalty advice

1. Gu Wenlong, Board Chairman of Deqiao, did not check the work safety and reduce the hidden danger of accident, and should bear the lead responsibility of the accident. It was recommended that an administrative fine be imposed on Mr Gu Wenlong, Chairman of Jiangsu Deqiao, amounting to 40% of his 2015 annual income.
2. Wang Guoxiang, Board chairman of Huadong, permitted other people to deal with the business under his company's name and did not arrange the people to manage the site operation, should bear the lead responsibility of the accident. It was recommended that an administrative fine be imposed on Mr Wang Guoxiang, amounting to 40% of his 2015 annual income.
3. Gu Dong, Site inspector of Deqiao security department, in charge of safety Inspection and safety work training, did not provide the appropriate safety training for the operators. It is proposed that Jingjiang Administration of work safety to revoke his qualification of Safety officer.

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4. Jiangsu Deqiao Storage Co. Ltd. was found responsible for this accident. It was proposed that an administrative fine of RMB1 million be imposed on Jiangsu Deqiao and to temporarily withhold the "Operating License for Hazardous Chemicals" of Jiangsu Deqiao for six months.
5. Huadong Company agreed for other people to deal with the business under its name and did not arrange the people to manage the site operation, is found responsible for the accident. It was proposed to that a fine of RMB1 million be imposed on Huadong Company.