



PORT OF TIANJIN EXPLOSIONS

12th August 2015

CAT-VIEWSM EVENT BRIEFING

Contents

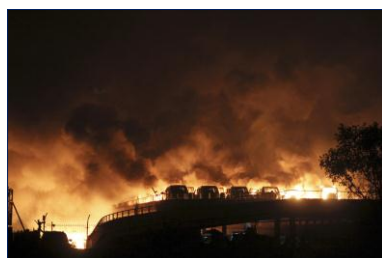
Introduction.....	3
Event Description	4
Estimated Total Insured Losses	5
Satellite Imagery Site Survey	6
Impact Assessment	8
Containers	10
Vehicles	10
Property including Residential, Industrial Premises and Warehouses.....	12
Transportation Infrastructure	14
General Aviation	14
Marine Cargo Losses in Focus.....	15
Non-Marine Losses in Focus.....	17
Property Exposure Assessment.....	17
Property Damage Assessment	19
Reported Insured Losses	20
Liability	21
Reinsurance	21
A Final Word.....	22
References	23

Front cover

Source: Reuters.

Acknowledgements

Guy Carpenter acknowledges, with thanks, the contribution to this report made by Paul Fearn and Dave Fox from Geospatial Insight and Gerry McEnroe. Satellite imagery used in this analysis was provided by Pleiades/SPOT-7 Airbus Defense & Space, and Skybox/Google.



(Images: VOA, CNN, CNES, Reuters, Airbus Defense & Space)

Introduction

The explosions that occurred in Tianjin, China, 170 km southeast of Beijing on 12th August are likely to constitute one of the largest insured man-made losses to date in Asia and will certainly be considered one of the most complex insurance and reinsurance losses in recent history. As the claims process begins, Guy Carpenter presents this report as a framework for understanding the number of complicated issues involving a lengthy evaluation and inspection timeframe.

The largest of the explosions had the greatest impact to Tianjin Port, the fourth largest port globally (by throughput) as well as Tianjin Port Logistics Center, a large industrial park, which is home to both Chinese and international interests. In addition, local government sources indicated that 700 tonnes of sodium cyanide and other toxic substances were present at the time of the explosion. However, no conclusive information about resultant effects is available.

We estimate that (re)insurance companies from approximately 15 countries will be involved as well as a wide variety of insurance coverages across the marine, property, liability and aviation markets. It has also been reported that a number of the international policies will include complex Contingent Business Interruption (CBI) and Business Interruption (BI) exposures. As a result, it is likely that the loss guidance provided in this preliminary report will change as updated information becomes available.

To inform our analysis, we have utilized proprietary data and high resolution pre- and post-event satellite imagery. Our initial analysis indicates that the two explosions will generate insured losses of between USD 1.6 billion and USD 3.3 billion. The methodology used to support these estimates is explained in detail in this report.

Reinsurance claims emanating from both Chinese and international programmes are likely. This will have an impact on both marine and non-marine coverages and will affect many classes of reinsurance including proportional, per risk as well as catastrophe covers. Similar to other losses affecting port areas, the extent of loss, number of (re)insurers from multiple countries, numerous lines of business and various types of coverage will make for a very complex and drawn out process.

Guy Carpenter will continue to evaluate the situation and, as additional data becomes available, will update the market on our findings.

Event Description

Two massive explosions at a warehouse in the port of Tianjin on 12th August 2015 occurred at around 23:30 (15:30GMT), about 30 minutes after firefighters responded to a fire at the location.

The China Earthquake Networks Center reported that the first explosion was equivalent to three tonnes of TNT, while the second was the equivalent of 21 tonnes of TNT and registered as a magnitude 2.9 earthquake. As of 28th August, the official death toll from the blasts stood at 146, with 27 people declared missing.

The blasts emanated from unknown materials at a plant warehouse owned by Ruihai International Logistics in the Beijiang Port Area. This is one of three core port areas: Beijiang; Nanjiang; and Dongjiang (Figure 1).

Tianjin Port located 170km southeast of Beijing, is the world's fourth largest port by throughput tonnage and the 9th in container throughput (both 2013 figures). Capacity has been increasing at a high rate, with 550-600 million tonnes of throughput expected in 2015.



Figure 1 - Site map

According to news sources, authorities declared that the area held approximately 2,500 tonnes of toxic substances, including at least 700 tonnes of sodium cyanide and unknown quantities of toluene diisocyanate (TDI) and calcium carbide. It is unclear to what extent these substances were involved.

Aside from the obvious destruction of surrounding buildings, the blast caused widespread damage to infrastructure, a large industrial park that housed the operations of Ruihai Logistics and many other firms, and stored goods including tens of thousands of shipping containers and new vehicles. Surrounding residential areas were also impacted, and there were potential concerns over chemical contamination.

A 3km exclusion zone around the blast site is reportedly in place as authorities inspect the area and remove hazardous materials. Several smaller explosions occurred and fires broke out in the area, some as late as 11 days after the largest explosion according to news reports.

Estimated Total Insured Losses

Initial estimates have been issued by several market observers: on 17th August Credit Suisse estimated the loss at USD 1.0-1.5 billion based on media reports; on 18th August Fitch Ratings suggested it would be over USD 1.0-1.5 billion with the event being “one of the most costly catastrophe claims for the Chinese insurance sector in recent years”. On 24th August JP Morgan posted a lower figure of up to USD 1.0 billion net loss, excluding business interruption.

As more information becomes available, it is increasingly apparent that the Tianjin loss will become one of the most complex insurance and reinsurance losses in recent history. It is reported that 285 of the Fortune Global 500 companies are known to have an office in the vicinity of Tianjin with the United States, Japan and South Korea being the top origins/destinations of imports and exports.

In addition to potential loss in multiple geographies, there is likely complexity with regard to the wide range of policies impacted by loss and in the interpretation of coverage between classes, including the potential for CBI, BI and supply chain disruption.

Given these conditions, we are likely to be several weeks or even months away from having a clear indication of the aggregate insured and reinsured losses. However, in order to provide some preliminary guidance Guy Carpenter has leveraged technology, proprietary data and experience to produce estimated (re)insured losses.

Our loss estimates in Table 1 have the following exclusions: CBI and BI; likely impact to public works; losses outside of the immediate area, such as glass damage that reportedly extended up to 10km away; clean up and contamination losses. These estimates also assume that property and cargo within the exclusion zone of 3km will not be confiscated or declared a total loss.

Subsequent sections on marine and non-marine losses describe our methodology and assumptions, which draw upon the best available data including high-resolution satellite imagery and Guy Carpenter’s International Trade Database (ITDB) of monthly customs returns and Guy Carpenter’s Industrial Park Database.

Table 1 - Guy Carpenter's estimated insured losses in USD million

	Count	Low estimate (USD million)	High estimate (USD million)	Methodology overview
1. Containers	20,000	20	60	Media + Satellite analysis
2. Cargo in containers	-	206	528	GC International Customs Database + Satellite analysis
3. Property including residential, industrial premises & warehouses	Various	614	1,228	Satellite + blast scenario + GC Industrial Park Database
4. Vehicles (Cargo and Property)	over 22,700	790	1,429	Media + Satellite analysis
5. General Aviation	4	Less than 7.5 million		Media + Satellite analysis
TOTAL		1,638	3,253	

Satellite Imagery Site Survey

To help our clients understand and analyze the impact of this event, Guy Carpenter's CAT-VIEWSM response service¹ was activated. A timeline of satellite imagery was acquired for the Tianjin blast impact zone (Figure 2).

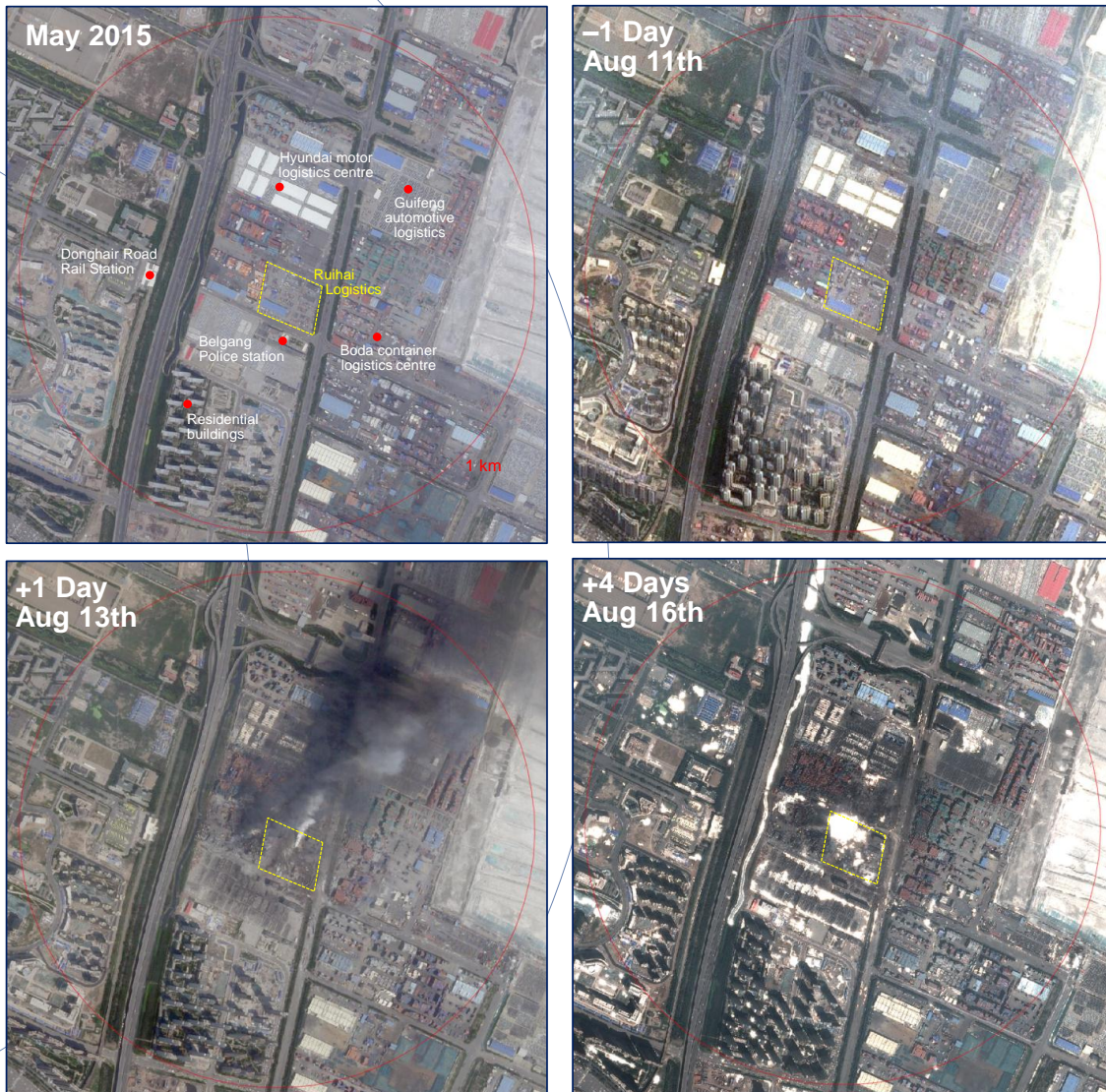


Figure 2 - Satellite imagery timeline (Images: Pleiades/SPOT-7 Airbus Defense & Space, Skybox/Google)

Pre-event imagery is available for May 2015 and -1 Day before the blast. This accurately captures the pre-event land use and inventory of cargo at the affected area of Tianjin Port. Post-event images were captured +1 Day after, when the blast zone was partially obscured by smoke. The +4 Day image is smoke free and clearly shows the impact area. Bright white areas of the image are due to the sun reflecting off residue water from firefighting efforts and fallen glass/debris.

¹ GC-CAT-VIEWSM is Guy Carpenter's satellite-based catastrophe evaluation service, which provides clients with information about the event impact and damage to inform estimates of insured losses.

Figure 3 provides a bird's-eye view of the blast zone and map for the Ruihai Logistics site.



Figure 3a - Blast epicenter north view

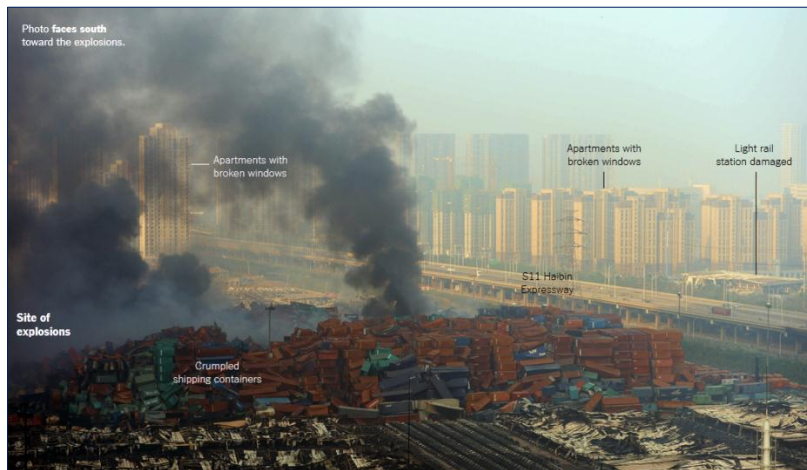


Figure 3b - Blast epicenter south view



Figure 3c - Ruihai International Logistics (Images: The New York Times)

Impact Assessment

The fireball and shockwave from the explosions blasted shipping containers; incinerated vehicles in the port and on an adjacent highway overpass; destroyed warehouses, production facilities, dormitories; impacted the nearby Donghai Road light rail station; and blew out windows within residential structures for several kilometers.

To understand what exposures were present at the time of the blast and therefore could contribute to the loss, satellite imagery was used to map the land use throughout the entire port area. As shown in Figure 4, our analysis is divided into 9 categories aligned with the loss estimation calculations in Table 1.

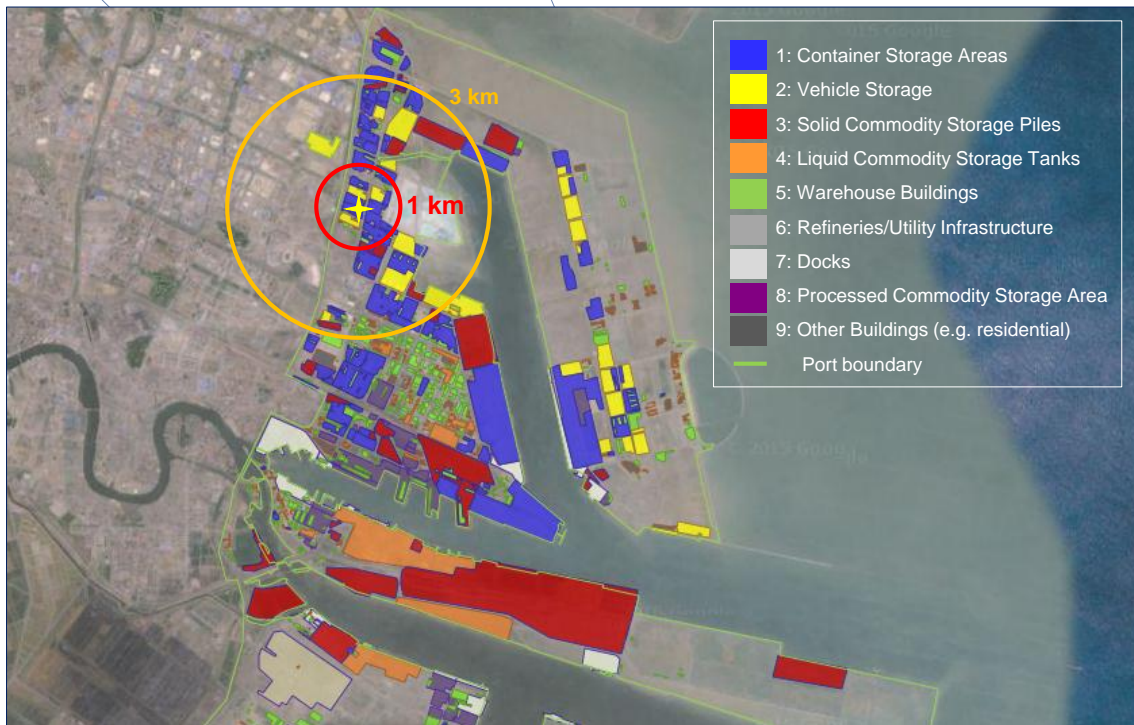











Figure 4 – Land use map for Tianjin Port, used to compute % contribution to the total insured loss
(Images: Google/Skybox with Guy Carpenter analysis)

Table 2 shows the percentage breakdown by land use category for the Tianjin Port area. During the mapping process, boundaries were delineated around discrete land uses. In some instances (e.g. solid commodity) this boundary was a true representation of the land use extent. However, in other cases where the footprint contained a mixture of land covers, a scaling factor was applied to the area.

For example, it was not feasible to digitize each and every container, so the ‘container’ boundary in this instance included both open space and containers (in some cases stacked on top of each other). A density factor was applied to reflect the container component required for the calculation.

Table 2 – Land use area breakdown in sq. m based on satellite imagery captured in May 2015 and on 11th August 2015. Damage in the 1km and 3km zones expressed as a % of the port-wide total
(Images: Airbus Defense & Space)

Port Land use		Total Area (sq m)	<1km damage as % port total	<3km damage as % port total
1: Container Storage Areas		4,363,059	16%	41%
2: Vehicle Storage		1,855,610	11%	54%
3: Solid Commodity Storage Piles		3,185,550	2%	16%
4: Liquid Commodity Storage Tanks		4,536,287	0%	2%
5: Warehouse Buildings		6,186,790	2%	12%
6: Refineries/Utility Infrastructure		4,937,090	0%	0%
7: Docks		3,247,385	0%	0%
8: Processed Commodity Storage Area		1,395,429	0%	0%
9: Other Buildings		1,326,876	2%	9%

The following sections provide further information about key insurable categories that were impacted close to the Ruihai blast epicenter, including: containers; property; and vehicles. It also considers transportation infrastructure and aviation. The former does not feature in the loss estimation but is attracting considerable attention in the media.

Containers

Tianjin authorities initially stated that approximately 18,000 containers may be affected and, based on our satellite imagery analysis, we believe there is a possibility this figure could exceed 20,000 (Table 1). Of the total area of containers within the port, 16% were within the 1km blast zone, and 41% were within 3km (Table 2).

Given that the immediate area around Ruihai Logistics included long-term storage, many of these containers could have been empty. However, the loss from containerized cargo may be substantial, potentially reaching USD 528 million, according to our estimation based on the Guy Carpenter International Trade Database.



Figure 5a - Containers impacted by the explosion – ground and satellite view (Images: Wall Street Journal, Reuters)

Vehicles

Thousands of new vehicles were incinerated or otherwise damaged (Figure 5b). Many of these vehicles will be classified as cargo, but others are covered under property insurance policies. At this time, the split is unclear.



Figure 5b - Vehicles impacted by the explosion – ground and satellite view (Images: Reuters, Reuters)

From analysis of the satellite imagery, the vehicles were concentrated in 11 areas surrounding the blast zone. Figure 6 shows these locations, of which three fall within the 1km zone. An estimated vehicle count based upon the satellite imagery, suggests 54,065 vehicles within these 11 sites.


Vehicle count from image
0-1 km impact zone

1	4,100
2	2,900
3	3,600
Total	10,600

1-3km impact zone

4	3,469
5	2,451
6	10,572
7	1,722
8	6,993
9	10,880
10	4,413
11	2,965
Total	43,465

Grand Total 54,065

Figure 6 - Satellite imagery analysis of the vehicle storage and production areas within Tianjin Port, showing vehicle counts. (Image: Google/Skybox with Guy Carpenter analysis)

Media sources, as of 2nd September, indicate possible damage to more than 22,700 vehicles from a range of auto companies (see Table 3). The discrepancy between the satellite inventory and manufacturers' reports may be because a number of companies have been unable to access their facilities to provide a count. Also, it remains unclear if vehicles within the 3km zone that did not sustain significant blast damage will be written off. As more information becomes available, it will be possible to match the 11 sites to the car manufacturers and reconcile the numbers.

Toyota reportedly suspended its two final assembly lines near Tianjin Port, partly to assess damage and partly due to the evacuation zone. Toyota reportedly made 432,340 cars at the plants in 2014, and may lose production of 2,200 vehicles per day due to the blasts, according to researcher IHS Automotive. The automaker has another line in a different part of the city which was unaffected and reportedly partially restarted operations near the port on 27th August, two weeks after the explosion.

Notably, farm equipment maker John Deere suspended its operations in the Tianjin Economic Development Area, which is about three kilometers from the blast site, and reported minor damage to some of the buildings at its USD 50 million factory, including broken windows and water pipes.

Table 3 – Publicly reported affected vehicles (as of 2nd September)

Manufacturer	Vehicles reported in media	Location in Figure 6
Audi	100	TBC
BMW	Two distribution centers within 3km of epicenter	TBC
Chrysler	3,000	Area 3
Ford	Potential impact	TBC
Fuji Heavy (Subaru)	100	TBC
GM	Potential impact	TBC
Hyundai and Kia	4,100	Area 1
Mazda	50	TBC
Mitsubishi	600	TBC
Renault	1,500	TBC
Tata (Land Rover/Jaguar)	5,800	Tata notes that not all of these vehicles were within the 3km zone; locations TBC
Toyota	4,700	Area 4 (two other Toyota premises reported in media but no vehicles visible on imagery)
VW	2,750	Area 2

Property including Residential, Industrial Premises and Warehouses

There were injuries and broken windows in apartment buildings around the blast site. Online footage of damage to high-rise residential property less than 2.0km from the blast epicenter (see, for example, Figure 7) shows damage to glass and other non-structural elements as well as damage to contents.

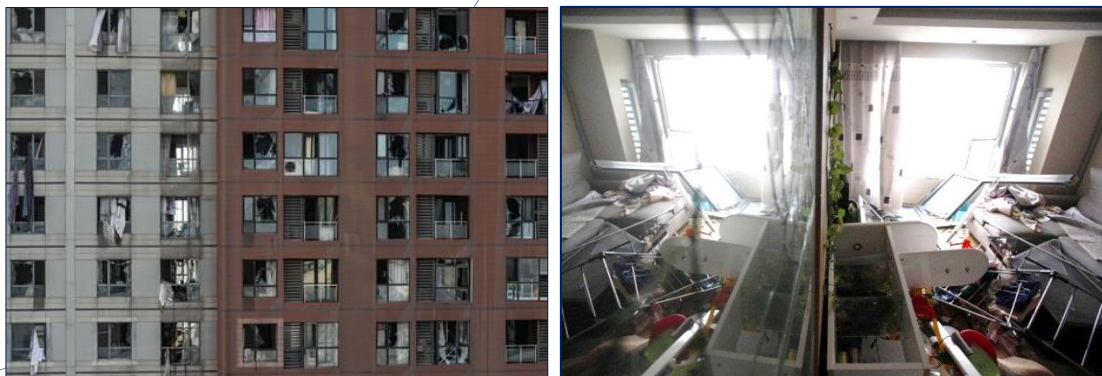


Figure 7 - Residential building damage within the 3km blast zone (Images: South China Morning Post)

As with marine cargo losses, insured property losses will be split between domestic and international insurers and reinsurers. Warehouses and industrial premises surrounding the blast sustained a range of damage levels from complete destruction, to moderate damage that may be repairable, to straightforward repairable cosmetic damage (Figure 8).

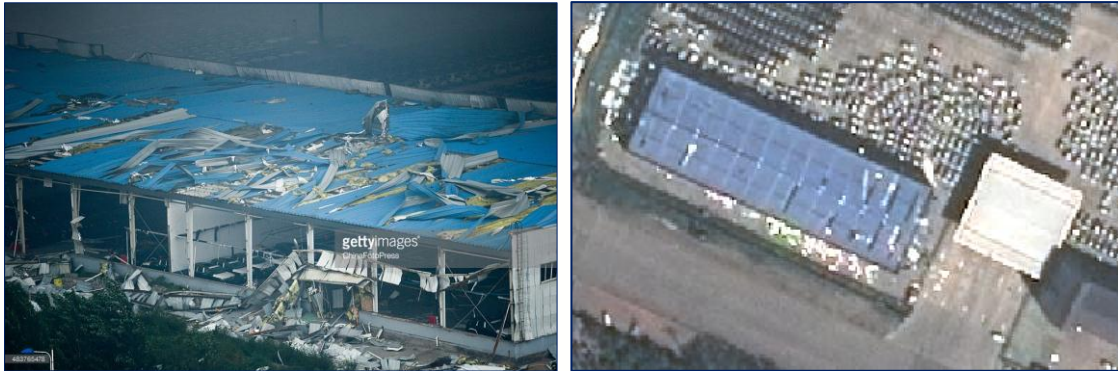


Figure 8 - Warehouse damage within the 3km blast zone. Lesser damage further from the epicenter could potentially be repairable. (Images: Getty, Airbus Defense & Space)

It is possible to identify four broad damage classes from the satellite imagery. Figure 9 maps damage severity for residential buildings and warehouses within the 3km blast zone which, as described later in this report, was used to compute losses. The look angle of the +4 Day image assisted with this process, as the sun glint caused shattered glass and debris to give a highly reflective white signal which could easily be detected on the images.



Figure 9 - Damage to property, analyzed using post-event satellite imagery. (Image: Google/skybox with Guy Carpenter analysis)

Transportation Infrastructure

Transportation infrastructure has also been impacted. Figure 10 shows damage to the Donghai Road light rail station, which is approximately 650m away from the main blast site. A highway overpass (the S11 Binhai Highway) adjacent to the port and approximately 500m away from the epicenter also sustained damage.



Figure 10 - Donghai Road light rail station, which sustained severe damage in the blast (Images: Getty, Airbus Defense & Space):

General Aviation

The Tianjin Binhai Heliport (Figure 11) is approximately 1.2km from the blast epicenter. At the time of the blast three helicopters were stationary outside adjacent to the hangar complex. The fourth helicopter can clearly be seen within the damaged hangar.

Four helicopters of Eastern General Aviation Co., Ltd. are reported to have sustained damage. Initial reports indicate that the helicopters received varying degrees of damage from the shock wave and from parts of the hangar door/wall that buckled. The estimated 100% value for all four helicopters is up to USD 40 million.



Figure 11 - Location of Binhai airport, where four helicopters sustained unknown levels of damage by the shock wave and the hangar door buckling (Images: Panorama/Google, General Flight of China)

Marine Cargo Losses in Focus

The cargo interests affected by the Tianjin incident are unclear at present and it is likely to be some time before there is clarity. Using Guy Carpenter's exclusive International Trade Database² (ITDB) we have made an assessment of the total cargo exposure at risk within the entire port area. The value of the exposure is based on customs values rather than insured values and is predicated on our assumption of the port lag time (i.e. the time cargo is held in port either prior to loading aboard or after discharge from overseas vessels).

Based on the following assumptions, the estimated total cargo exposure, excluding oil and bulk commodities, within the port was USD 3.9 billion (Table 4).

- The database comprises every type of cargo from bulk oil and ore, to cars, to consumer goods and everything in between.
- Data is based upon customs' valuations, which are likely to be lower than insured values.
- Data received was as at the end of June. We have compared the trend with 12 months ago and taken into account the subsequent decline in China's trade volume.
- Data is for Tianjin, which we assume is representative given the majority of the municipality's shoreline comprises the Port of Tianjin.
- The analysis takes into account the amount of days per month the port is working and an estimate of how long cargo remains in the port area, either before loading or after discharge. We assume the port works every day non-stop including public holidays.
- In consultation with industry experts, we use an average time in the port area of 4 days for commodities, while for vehicles we use an average lag time of 35 days.
- The estimate is a mathematical average and the values could vary from this on a daily basis. For example, the estimate would not reflect the presence of a shipment of particularly highly-valued project cargoes in the port on the day of the blast.

Table 4 – Total cargo exposure, excluding oil and bulk commodities, USD millions. (Source: Guy Carpenter's ITDB)

All cargo (projected for Aug 2015)	All commodities ex Vehicles, Ore and Bulk Oil	Vehicles only	Total
Exports	876	633	1,509
Imports	406	2,014	2,420
Total	1,282	2,647	3,929

Cargo losses are likely to impact both the domestic Chinese market and the wider international market. From the ITDB we can see cargo exposures emanating from the countries in Figure 12 and can expect losses being largely retained there.

² Guy Carpenter's International Trade Database is made up of Customs' returns from authorities all over the world. Goods in the database are broken down by HS code (Harmonised System coding is a standardised multi-functional system to classify goods, universally applied by governments of all countries) and port/province/country of origin or destination. The database is updated monthly, usually a month or two in arrears. As we have years of historical data, we can determine seasonality of port throughput as well as trends both in overall activity as well as product mix. Consequently, we can determine with a tolerable degree of accuracy the declared customs' value of the goods going through Tianjin on 12th August.

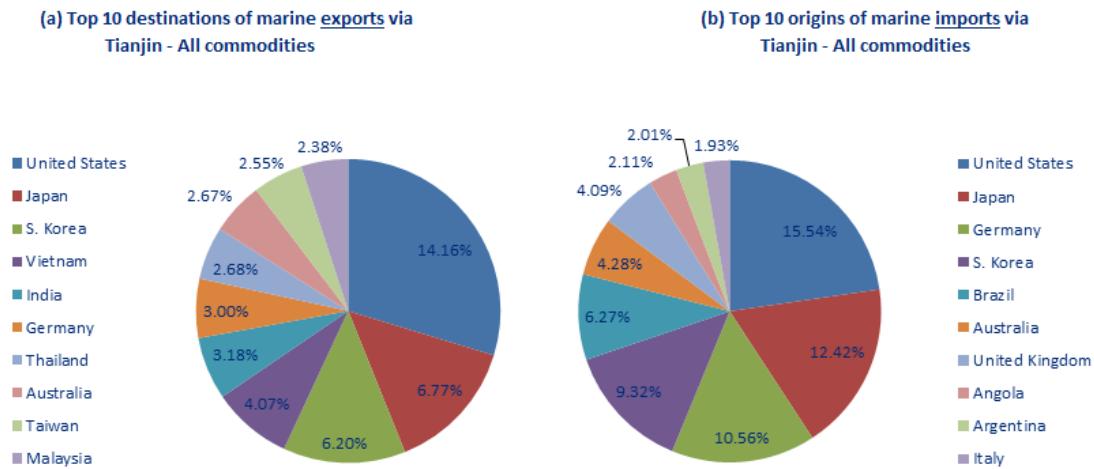


Figure 12 - Top 10 destinations of marine exports and imports via Tianjin - All commodities (Data: Guy Carpenter's ITDB)

Given the land use estimates in Table 2 of this report and based on the exposure estimates in Table 4, we estimate the insured losses to containerized cargo and vehicles as noted in Table 1:

- Containerized cargo: between USD 206 million and USD 528 million
- Vehicles (cargo and property coverage): between USD 790 million and USD 1.4 billion

Our analysis takes an average cost approach to estimate cargo exposures. However, there is market speculation that there were some high value project cargo exposures within the vicinity at the time of loss, which may have a material impact on the quantum.

Similar to Superstorm Sandy in the U.S. (2012), the vehicle exposures will be a significant part of the overall loss in Tianjin, with losses split between marine and non-marine insurance policies and reinsurance coverage.³

Cargo insurance specialists note that many of the shipping containers in the immediate blast site were empty. Post-event images of the most severely damaged containers support this observation. Our estimate of insured losses to the actual containers is derived by taking an average insured value per container of USD 1,000 to USD 3,000.

Due to the existence of 'brands clauses' in many international cargo policies, even though cargo may not appear superficially damaged nor have been in the exclusion zone, Assureds may be able to claim that their brand will suffer if they offer goods for sale which had been in Tianjin at the time of the blast.⁴

³ There is inconsistency in the way autos are insured in the various stages of transit. Motor manufacturers often use port areas for long-term storage, in which case autos may be transferred from a marine cargo policy to a property policy after discharge from the vessel. Autos in transit and intended to move out of port upon clearing customs, on the other hand, will usually remain on the cargo policy until they are delivered. Differences in sales terms add to the complexity of determining insurance coverage: imported vehicles are sold on either Free on Board (FOB) terms, under which ownership and risk passes to the buyer when the autos are loaded onto the ship, or Cost, Insurance and Freight (CIF) terms, under which the seller retains risk for the vehicles until they are delivered to the buyer.

⁴ A typical 'brands clause' reads as follows: In case of damage to property bearing a brand or the sale of which in any way carries or implies a guarantee of the Supplier or Assured, the salvage value of such damaged property shall be determined after removal of all brands and any trade marks (on containers on which brand cannot be removed, contents to be transferred to plain bulk containers) which might be taken to indicate that the guarantee or brand of the manufacturer or Assured attached to said property. The Underwriters waive

Non-Marine Losses in Focus

The Tianjin blast affected commercial, government, residential and industrial property in and around the area, including districts outside but adjacent to the port. Guy Carpenter's analysis of the damage relied heavily on satellite imagery and visible identification of damage, as well as a specific blast case scenario.

Property Exposure Assessment

The assumptions in Table 5 underlie our analysis of property exposures in the blast scenario. Given the limited 2%-9% area affected relative to the total area of the port (Table 2), the analysis assumes that any demand surge (increased usage costs for other areas of the port) is limited.

Table 5 - Assumptions underlying insured property loss estimates. (Unit costs are derived from Turner & Townsend, 2012)

Class	Unit Cost (\$/sq m)	Share of Insured Value			Insurance Penetration
		Building	Contents	Business Interruption	
Residential	630	80%	20%	0%	5%
Low cost residential	315	90%	10%	0%	LOW ~0%
Commercial	734	35%	60%	5%	90%
Building sheds	78	100%	0%	0%	100%
Warehousing	477	10%	80%	10%	100%

At the heart of the blast zone was a large industrial park and surrounding area housing operations and facilities for registered companies. Much of the non-marine property loss may be borne by these firms. Using Guy Carpenter's Industrial Park Database⁵ (Figure 13) we can extract details about the firms operating here, which are summarized in Table 6.

their right to take over any merchandise or containers from which it is impractical to destroy all evidence of the Assured's connection therewith, such merchandise or containers to be destroyed.

⁵ Guy Carpenter has developed an exhaustive database of industrial estates in China, Hong Kong, India, Indonesia, Japan, Malaysia, Philippines, Singapore, South Korea, Taiwan, Thailand and Vietnam. The database was launched in 2012 with extensive updates in 2014.

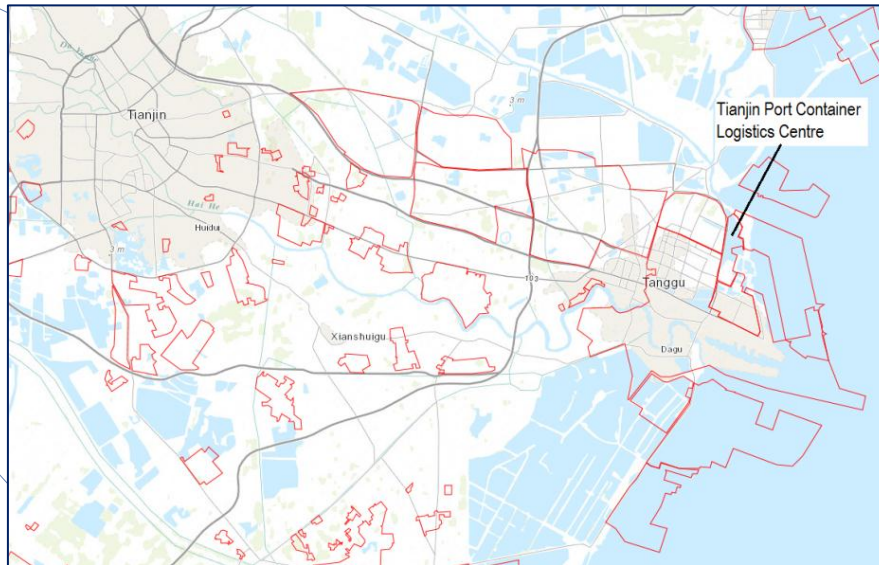


Figure 13- Guy Carpenter’s Industrial Parks Database used to identify businesses in Tianjin (Image: Guy Carpenter)

Table 6 – Registered businesses in Tianjin Port Logistics Center and surrounding areas

SI No.	Company	SI No.	Company
1	Binhai Beijiang Container Logistics	23	Jinshi Minmetal Intl Logistics
2	Boda Container Logistics Center	24	Kaitai Intl Logistics
3	Changhua Intl Logistics	25	Keyun Intl Logistics
4	China Marine Shipping Agency (Tianjin Sinoagent)	26	Malun Logistics 2nd Station
5	CIMC Container Factory	27	Minmetal Logistics
6	CIMC Zhenghua Logistics	28	Nine Dragons Paper Packing Materials
7	Construction Materials Yard	29	Penavico Jinfei Logistics (Tianjin Penavico)
8	Container Clearing Center	30	Ruihai Logistics
9	Cosco Container Logistics	31	Shengshi Container
10	CWT Warehousing and Distribution	32	Tanggu Intl Container
11	Dangerous Goods Logistics Center	33	Tianjin Binhai TEDA Logistics
12	Daya Logistics	34	Tianjin Customs
13	First Harbor Engineering	35	Tianjin Hualong Logistics
14	Fujia Logistics	36	Tianjin Ocean Shipping
15	Gangqiang Logistics	37	Tianjin Port Group
16	Guifeng Automotive Logistics	38	Tianyu Transport
17	Haijing Zhenhua Logistics Center (TJCIQ)	39	Vehicle Distribution Center
18	Hongbao Logistics	40	Yongkang Logistics
19	Huaxi Container Logistics	41	Zhenhua Logistics
20	Hyundai Motor Logistics Center	42	Zhongchu Holdings
21	Intl Logistics Development	43	Zhongdian Logistics
22	Intl Logistics Development Company	44	Zhonglian Jiantong Logistics

Property Damage Assessment

For our property analysis, structures within three kilometers of the epicenter were assigned a damage state according to four categories detectable from the satellite coverage (Figure 9):

- Level 4** = No visible damage to the building
- Level 3** = Structure and roof looks intact, but visible debris around the building
- Level 2** = Visible roof damage and debris around the building
- Level 1** = Building completely destroyed or has major structural damage

The distance of the property from the blast epicenter was also computed. Figure 14 illustrates a clear correlation with proximity to the blast site and visible damage, which is consistent with the blast scenario.

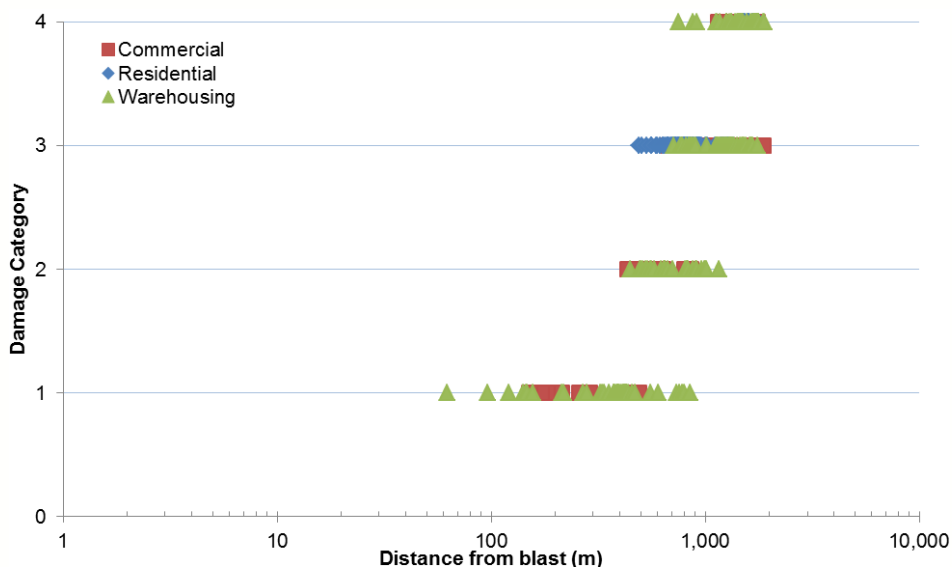


Figure 14 - Correlation between damage state and distance (log scale) from the blast epicenter

Combining our land use analysis and exposure assessment, observed damage from our satellite analysis and the blast scenario, we have developed an overall property insured loss estimate of USD 614 million to USD 1.2 billion (see Table 1).

It is informative to compare this event to historical fire losses. Table 7 lists the ten largest insured fire losses from 1993 through 2014. Many of these involved oil and gas. The September 2001 explosion at the Azote Fertilisant (AZF) fertilizer plant in Toulouse, France involved chemicals, in that case ammonium nitrate.

This AZF explosion and loss provides a useful reference point and comparison to the Tianjin explosion. That blast was larger than the Tianjin explosion, reportedly equivalent to 20-40 tonnes of TNT, measuring 3.4 on the Richter scale. Ultimate damages paid by insurance exceeded EUR 1.5 billion (in 2001 values), including liability for deaths, injuries and the

approximately 4,000 residential properties in the surrounding area that were damaged or destroyed.

Table 7 - Major fire losses from 1993, worldwide. The 2001 AZF event in France (highlighted) involved chemicals and is a useful point of reference for the Tianjin blast; Loss figures not adjusted for inflation

Accident year	Insured loss (USD million)	Country	Event
2008	2,000	UAE	Fire at Port Khalid
2001	1,700	France	Explosion at fertilizer plant, residential area
2008	1,639	Australia	Gas explosion
2008	1,400	UK	Oil storage terminal fire
2011	1,177	Canada	Fire and explosion at energy plant
1996	1,168	Mexico	Explosion at oil refinery
2005	1,078	Canada	Explosion, fire at oil facility
2010	1,060	USA	Explosion and fire at offshore oil rig
2011	1,000	Singapore	Fire and explosion at oil refinery
2013	900	China	Fire at semiconductor factory

Reported Insured Losses

For comparison with our loss estimates, some insurance companies in China have started reporting losses arising from the blast. Table 8 shows aggregated loss reserve by class of business notified by clients as of 2nd September 2015.

Table 8 - Aggregated losses reported by Guy Carpenter clients as of 2nd September. Note: FX rate as at 27th August 2015: USD 1 = CNY 6.41. Hyundai, Volkswagen, Chrysler Jeep, Subaru, General Motor and Renault car losses, reported and estimated, are included in the market loss table

Class	100% Gross Loss (CNY million)	100% Gross Loss (USD million)
Property/Motor	6,114	954
Cargo	223	35
Aviation	41	6.4
Motor	12.5	1.95
Total	6.39billion	997million

At the time of writing this report, market information suggests that the majority of the claims may fall into the property category, including building, contents and vehicle losses at or near the blast zone. For marine cargo insurance, it is still too early to quantify losses and will take longer

for claims to be reported and inspected. In all cases, the claims assessment will be further complicated by ongoing site clearance.

In addition to the above mentioned main cover, market information also suggests that liability losses could be limited at this stage, and insured losses from life and personal accident may not be as significant as that of the non-life sector. Pollution damage to cargo and losses from CBI and BI remain a large part of the uncertainty for the global insurance industry.

Liability

At present it is unclear what type of liability insurance, if any, was purchased and it is too early to make any calculation of expected claims.

We understand that Ruihai International Logistics Co. Ltd may well face substantial losses, together with the owners of the cargo stored in the warehouse. State and international media have reported that a number of executives from Ruihai International Logistics and senior Tianjin port officials have been detained as a result of alleged neglect of duties. Tianjin Port Development who owned the land where the warehouse was located may also face questions about Ruihai's compliance with health and safety and lease/licensing obligations.

It is unclear what types of chemicals have leaked, which may threaten the water supply. It is possible adjacent industrial facilities may become unsafe as a result of contamination, and basic utilities in the area will be affected. Other potential health issues which may manifest themselves as a result of direct contact or ingestion of the chemicals are unknown. However, local press have indicated that abatement measures are underway as authorities in Tianjin are building a 20,000-square meter 'leak-proof' tank to store contaminated soil from the scene.

Whilst the extent of property damage is evident, the proliferation of bodily injury, exposure to air, soil and water contamination and where the liabilities for these rest - along with any associated insurance penetration - will take much longer to develop and assess.

Reinsurance

Given the expected wide geographic distribution of insured losses, it is difficult to estimate a global reinsured loss. In particular, some territories, such as Japan, have high levels of deductibles on cargo and property treaties and will therefore recover a smaller overall percentage of the insured loss from the global reinsurance market. The bespoke nature of reinsurance coverage prevents direct calibration of reinsured losses with our insured loss estimates.

Based on preliminary loss advices received to date it would appear that the major portion of the reinsured loss will emanate from the Chinese market and affect non-marine and marine proportional and excess of loss programmes. Owing to the unique nature of the loss, claims will not be distributed evenly across the market.

A Final Word

The existence of toxic substances and the exclusion zone have made access to the impacted area extremely difficult. This has naturally contributed to high levels of conjecture in the market surrounding loss levels. Guy Carpenter's aim in producing this report has been to provide the reader with an independent overview of the loss, together with some plausible outcomes based upon various analytical approaches.

It may be some time before the true quantum of the loss becomes clear and we learn which exposures have actually been affected. Whatever the final numbers, this tragic event will be far-reaching and should provide a catalyst to insureds and (re)insurers alike seeking to prevent costly losses and manage risk.

We believe that this report shines a light on some of the technologies and tools such as satellite imagery, Guy Carpenter's International Park Database and the International Trade Database that are available to help insureds, insurers and reinsurers assess, measure, control and monitor complex risk exposures in even opaque and rapidly-developing situations.

References

- A.M. Best places ratings of Hyundai Insurance (China) Co., Ltd. Under review. (2015, August 20). *AMBest.com*
- BMW says vehicle distribution center damaged in Tianjin blasts. (2015, August 18). *Bloomberg News*.
- Bodeen, Christopher (2015, August 17). Families of Chinese firefighters seek answers in port blasts. *Associated Press*.
- Bracken, Len (2015, August 18). Tianjin blast could impact trade flows. *Bloomberg News*.
- Companies feel effect of Tianjin blasts as \$625m of cars wrecked. (2015, August 17). *Financial Times*.
- Damage from Tianjin blasts keeps John Deere factory closed. (2015, August 16). *Reuters.com*.
- Death toll rises to 112 from Tianjin blasts, with 95 missing. (2015, August 16). *Bloomberg News*.
- Explosion in the AZF fertilizer plant, September 21st, 2001. (2013, July). http://www.aria.developpement-durable.gouv.fr/wp-content/files_mf/FD_21329_TOULOUSE_DP_JLC_GB_29072013.pdf
- Ford sustained minimal damages from China Tianjin blasts. (2015, August 14). *Bloomberg News*.
- Gan, Nectar (2015, August 16). '700 tonnes' of sodium cyanide reportedly in warehouse during deadly Tianjin blasts. *South China Morning Post*.
- GM says use of Tianjin port is limited; no impact from blasts. (2015, August 14). *Bloomberg News*.
- Grigg, Angus (2015, August 17). Rain the big fear in Tianjin. *Financial Review*.
- Hagiwara, Yuki and Huang, Grace (2015, August 27). Toyota poised to restart output at China plant shut in blast. (2015, August 27). *Bloomberg*.
- Holman Fenwick Willan briefing:- <http://www.hfw.com/Tianjin-Port-explosion-August-2015>
- Industry assesses blast fallout. (2015, August 18). *Financial Times*.
- Jeep sustained some vehicle damages from China Tianjin blasts. (2015, August 14). *Bloomberg News*.
- Kinetz, Erica and the Associated Press (2015, August 18). Decimated Toyota cars, mangled cargo containers: Tianjin blast forces companies to suspend operations. *National Post*.
- Rain stokes pollution fears at Tianjin blasts site. (2015, August 17). *Xinhua*.
- Tata Motors says many JLR vehicles damaged in Tianjin explosion. (2015, August 21). *Bloomberg*.
- Tatlow, Kirsten Didi (2015, August 19). Sinosphere: One week after the Tianjin blasts: What we know. *New York Times*
- The dangers housed at ports worldwide. (2015, August 18). *Washington Post*.
- Tianjin, China, explosions: At least 44 dead, hundreds injured after multiple blasts. (2015, August 13). *CBC News*.
- Toyota confirms it restarted operations in Tianjin, China. (2015, August 28). *Bloomberg*.
- Trudell, Craig (2015, August 20). Toyota widens China production shutdowns on Tianjin explosions. *Bloomberg*
- Turner & Townsend plc (2012). International construction cost survey 2012. *Turnerandtowntsend.com*
- Volkswagen says 2,700 cars were damaged by Tianjin explosions. (2015, August 17). *Bloomberg*.
- Ying, Moxy (2015, August 14). Tianjin blast roundup: P&C insurers, Renault may be affected. *Bloomberg*.
- Yu, Xie (2015, August 18). 10b Yuan in claims seen over Tianjin explosions. *South China Morning Post*.

Contact your Guy Carpenter Team for further information:

James Nash

Regional CEO, Asia Pacific

+81 3 5308 2121

James.Nash@guycarp.com

James Summers

CEO Guy Carpenter Global Marine & Energy Specialty

+44 20 7357 1924

James.Summers@guycarp.com

Ian Wrigglesworth

Global Head of Aviation and Aerospace Specialty

+44 20 7357 5225

Ian.Wrigglesworth@guycarp.com

Dr. Beverley Adams

Head of CAT Planning & Response

+44 20 7357 2992

Beverley.Adams@guycarp.com

Vienna Cheung

Managing Director, China Operations

+852 2582 3524

Vienna.Cheung@guycarp.com

Hemant Nagpal

Head of CAT Model development, Asia Pacific

+65 6922 1948

Hemant.Nagpal@guycarp.com

Disclaimer: Guy Carpenter & Company, LLC provides this report for general information only. The information contained herein is based on sources we believe reliable, but we do not guarantee its accuracy, and it should be understood to be general insurance/reinsurance information only. Guy Carpenter & Company, LLC makes no representations or warranties, express or implied. The information is not intended to be taken as advice with respect to any individual situation and cannot be relied upon as such. Please consult your insurance/reinsurance advisors with respect to individual coverage issues. Statements concerning tax, accounting, legal or regulatory matters should be understood to be general observations based solely on our experience as reinsurance brokers and risk consultants, and may not be relied upon as tax, accounting, legal or regulatory advice, which we are not authorized to provide. All such matters should be reviewed with your own qualified advisors in these areas. Readers are cautioned not to place undue reliance on any historical, current or forward-looking statements. Guy Carpenter & Company, LLC undertakes no obligation to update or revise publicly any historical, current or forward-looking statements, whether as a result of new information, research, future events or otherwise. This document or any portion of the information it contains may not be copied or reproduced in any form without the permission of Guy Carpenter & Company, LLC, except that clients of Guy Carpenter & Company, LLC need not obtain such permission when using this report for their internal purposes. The trademarks and service marks contained herein are the property of their respective owners.