

HAZARD LOG

Project Title: Harbour Area Treatment Scheme Stage 2A Environmental Impact Assessment Study – Investigation (HATS2A)

Subject: Hazard and Operability (HAZOP) Study for Identification of Hazards associated with Construction, Operation and Maintenance Activities of upgraded PTW within the Consultation Zone of PHI No. H5 at Ap Lei Chau

Date / Time: 11 June 2007, 2:30pm – 4:45pm

Venue: Conference Rm B, 11/F, Tower 2, Grand Central Plaza, Shatin

Participants:

	Name	Department / Company
1	Matthew Ko	ENSR Asia
2	Benita Kung	ENSR Asia
3	Laura Ho	ENSR Asia
4	Lawrence Ho	DSD
5	Andrew Yuen	DSD
6	Peter Leung	DSD
7	S L Lun	Shell
8	Christine Yuen	M&E (PTW Design Team)
9	Ivan Tsang	MEMA (Tunnel Design Team)

The following issues were discussed during the HAZOP Study.

1. Presentation from Shell's representatives

- Shell's representative pointed out the LPG compound and LPG transit depot are operated by 2 different departments.
- Detailed account on the site layout, daily operation, onsite LPG storage etc was presented.
 - Main units of LPG transit depot: LPG storage shed; jetty (connecting Tsing Yi LPG supply); LPG storage platform
 - Main units of LPG compound: Two (2) 20-ton LPG mounded vessels; Five (5) hot water heated type vaporisers; Two (2) electrically heated type vaporisers
- Gas detector was installed at LPG storage shed but none in LPG compound. Monitoring duties of LPG compound e.g. check pressure, amount of gas etc rely on contractors
- Shell's major concern on construction works of the nearby PTW include:
 - No alarm for detecting gas leakage. Particular concern for leakage in night-time
 - Excessive vibration causing shut-down of vaporiser regulators
 - Excavation causing ground settlement and leading to pipelines / tank rupture

2. Discussion on PTW upgrading works

- Existing and upgraded layout of Ap Lei Chau PTW was presented
- Potential hazards were identified and mitigation measures were recommended

3. Discussion on tunnel construction works

- Construction details of Tunnel Q were presented
- Potential hazards were identified and mitigation measures were recommended

4. Discussion on Operation and Maintenance Activities in upgraded PTW

- PTW operators confirmed future operation of upgraded PTW and onsite staff number would remain practically the same as current operation.
- No. of staff (operators & administrators) was further confirmed by PTW Operator to remain the same

5. Discussion on Dangerous Goods (DGs)

- Only small amount of DGs would be stored during both construction and operational stage. No significant impacts anticipated.

Ref No.	Major Activity	Potential Hazards / Hazardous Scenarios	Mitigation Measures ¹
PTW Upgrading			
1	Excavation at PTW site about 11m deep near Shell LPG transit depot/ LPG Compound (bulk domestic supply)	<ul style="list-style-type: none"> ▪ Unexpected drawing down of groundwater table during excavation at PTW site, causing ground settlement and subsequent structural damage of LPG facility 	<ul style="list-style-type: none"> ▪ Foundation details of LPG tanks to be provided by Shell <u>Drawing down of groundwater</u> ▪ Sheet piling would be adopted as retention system for earth retention and excavation support to avoid groundwater draw down². ▪ Monitor the excavation activity to avoid excavation to the wrong depth (too much excavation) ▪ Inspection and supervision to ensure operation of equipment properly ▪ Provide recharge well to restore groundwater table if necessary <p><u>Ground settlement</u></p> <ul style="list-style-type: none"> ▪ Conduct condition survey (as a standard procedure) and monitoring programme regularly throughout the entire construction period ▪ Monitor and record signs of ground settlement by means of construction surveys even after completion of all construction works ▪ Shell confirmed that no underground pipework located inside PTW site and thus the construction of the PTW will not affect gas supply.
		<ul style="list-style-type: none"> ▪ Damage of LPG pipework system affecting LPG supply to the residential flats and commercial complex in South Horizons ▪ Rock level too high for excavation by mechanical means 	<ul style="list-style-type: none"> ▪ SI data to be provided by GI Team to confirm underground rock level and the feasibility of mechanical excavation ▪ Alternative excavation method will be proposed in case of high rock level ▪ Use of explosives will not be considered <p>[Post Meeting Note: According to GI records at Aberdeen PTW, the rockhead level is about -20mPD. As the Aberdeen PTW ground level is 5mPD, hence the rock layer is 25m below ground. Seems that the deepest excavation at this PTW should not be required to reach 25m below ground. Hence, blasting to break the rock for PTW upgrading works can be eliminated.]</p>

¹ The mitigation measures shall be further reviewed and implemented in construction stage if applicable.

² Sheet piling is a form of driven piling using thin interlocking sheets of steel to obtain a continuous barrier/ wall in the ground. They have an important advantage in that they can be driven to depths below the excavation bottom and so provide a control to heaving in soft clays or piping in saturated sands if sufficient embedment is provided. In addition, a well constructed sheetpile wall with tight interlocking could provide a better water tightness than soldier pile wall and pipe pile wall. In sensitive area where necessary, recharge well could be provided to help limiting the groundwater drawdown during dewatering within the excavation

Ref No.	Major Activity	Potential Hazards / Hazardous Scenarios	Mitigation Measures ¹
2	Piling Works	<ul style="list-style-type: none"> ▪ Excessive ground vibration leading to structural damage of LPG facility ▪ Trigger shut-down system of vibration-sensitive regulators that leads to closure of valves or results in air-logged gas pipes in South Horizons 	<ul style="list-style-type: none"> ▪ Use pre-bored H-Piles, which is non-percussive ▪ Standard and guidelines given in <i>Gas Production & Supply: Code of Practice for Avoiding Danger from Gas Pipes</i> shall be followed <p><u>Vibration</u></p> <ul style="list-style-type: none"> ▪ Monitor vibration resulted from construction works to ensure the velocity and amplitude of vibration will not threaten stability of Shell's LPG facilities. Vibration limits of LPG compound to be provided by Shell ▪ Given no device installed in PHI facility, it is recommended to install vibration sensor. ▪ The safeguards for this potential impact shall be further confirmed in detailed design stage.
3	Demolition of existing PTW structures (and substructures)	<ul style="list-style-type: none"> ▪ Inappropriate method of demolition may cause damage (e.g., due to excessive vibrations) to LPG installations and pipelines 	<ul style="list-style-type: none"> ▪ It is expected that all demolition of substructures within the PTW area will not damage Shell's structures ▪ For safety sake, additional hoarding at existing boundary wall is recommended. ▪ Conduct monitoring to ensure the stability of Shell's LPG facilities
4	Installation of electrical and mechanical equipment	<ul style="list-style-type: none"> ▪ Accidents initiated by electricity supply facilities installed close to the LPG facility or pipework system could cause damage to Shell's installation/pipe network ▪ Accidents associated with welding 	<ul style="list-style-type: none"> ▪ Given the E&M works will be limited within the PTW works site boundary, impacts to the nearby LPG facilities is negligible.
5	Mobilising and usage of construction equipment (e.g. backhoe, bulldozer, dump truck, site vehicle etc)	<ul style="list-style-type: none"> ▪ Mobile crane overturn/ crashes into the Shell LPG facility may causing structural damage 	<ul style="list-style-type: none"> ▪ The stability of the equipment should be ensured. ▪ Given LPG compound is protected by sheltering structure and boundary wall, hazard of structural damage is significantly reduced. ▪ It is recommended to use tower crane and crane lorry for construction material delivery. Tower crane is preferred over mobile crane for its greater stability. Contractors shall set a safety zone for crane operation to ensure the crane arm would not reach the PHI boundary in all directions.
6	Welding / Hot works	<ul style="list-style-type: none"> ▪ Accidents involving fuels used in welding and sparks produced during welding, causing fire hazard to the neighbouring LPG facility 	<ul style="list-style-type: none"> ▪ Welding restricted zone to be coordinated with Shell ▪ No serious concern regarding welding activities being inflicted on the PHI during construction as no projectile motion is expected. ▪ Standard procedures for avoiding danger from gas pipes shall be followed to address welding carried out in vicinity of exposed gas pipes. ▪ Provide supervision by safety officers

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Tunnel Construction			
7	Drop shaft construction (inside Ap Lei Chau PTW) by mechanical boring	<ul style="list-style-type: none"> ▪ Unexpected drawing down of groundwater table during shaft excavation, causing ground settlement at LPG site or gas pipelines, and subsequent structural damage 	<ul style="list-style-type: none"> ▪ Drop shaft is located far from the LPG facility to reduce the potential hazards to the LPG facility ▪ Drop shaft is located a fair distance away from the seawall such that drawing down of groundwater is not likely. ▪ Inspection and supervision to ensure operation of equipment properly ▪ Conduct monitoring to ensure stability of the LPG facility and pipelines during construction phase ▪ Expansion agent will be used for rock boring. No explosives will be used.
8	Tunnel Q construction by horizontal directional drilling (HDD)	<ul style="list-style-type: none"> ▪ Construction of Tunnel Q strayed from actual alignment to cause unexpected damage to the nearby LPG facility 	<p><u>Straying from actual alignment</u></p> <ul style="list-style-type: none"> ▪ Tunnel Q will be constructed without intruding into Shell's LPG site ▪ Directional drilling: Pilot hole drilling under close surveyor supervision to avoid deviation from actual alignment during tunnel construction ▪ Periodic checking: Closely monitor and check alignment every 25 meters ▪ Reliability of monitoring system demonstrated in overseas experiences ▪ Inspection and supervision to ensure operation of equipment properly ▪ Conduct monitoring to ensure stability of the LPG facility and LPG pipelines during construction phase ▪ HDD profile set off to avoid clashing with the Rubble Mound of seawall ▪ Minor demolition works only
9	Demolition of aboveground structure	<ul style="list-style-type: none"> ▪ Inappropriate method of demolition may lead to damage (e.g., due to excessive vibrations) to LPG installations and pipelines 	<ul style="list-style-type: none"> ▪ Implementation of DG storage and management procedures, in accordance with requirements stipulated in Dangerous Goods Ordinance and its subsidiary regulations
10	Temporary storage of construction plant, equipment, and materials in PTW (during Construction Stage)	<ul style="list-style-type: none"> ▪ Additional hazard associated with storage of DGs and possible hot works 	<ul style="list-style-type: none"> ▪ Implementation of DG storage and management procedures, in accordance with requirements stipulated in Dangerous Goods Ordinance and its subsidiary regulations
Operation			

Ref No.	Major Activity	Potential Hazards / Hazardous Scenarios	Mitigation Measures ¹
11	Upgraded PTW operation	<ul style="list-style-type: none"> ▪ Additional hazard resulted from the upgraded PTW operation on PHI 	<ul style="list-style-type: none"> ▪ As confirmed by PTW operator, the operation of upgraded PTW will remain similar to the current practice. No significant adverse impact on the PHI is anticipated during operational stage.
Use and storage of DGs			
12	DGs storage in construction stage	Limited quantity of DG on site.	<ul style="list-style-type: none"> ▪ Fire safety precautionary measure to be in place.
13	DGs storage in operational stage	Limited quantity of DG store in PTW.	<ul style="list-style-type: none"> ▪ Fire safety precautionary measure to be in place
Others			
<ul style="list-style-type: none"> ▪ Establish sound communication channel between Shell and PTW operators in case of emergency evacuation initiated from either side ▪ Emergency plan to be developed and detailed in later stage. Close coordination with Shell operation staff. ▪ Install gas detector/ alarm for detecting gas leakage. The detection limit shall be lower than the shut-off sensitivity of valves ▪ Regular meetings with Shell ▪ Closer and more frequent supervision in early construction period from both Shell and construction team representatives 			