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 and tunnel construction within the Consultation Zone of PHI No. H4 at Aberdeen
Date / **Time**: 1 June 2007, 9:25am – 12:15pm
Venue: Conference Rm B, 11/F, Tower 2, Grand Central Plaza, Shatin
Participants:

	Name	**Department / Company**
1	Matthew Ko	ENSR Asia
2	Laura Ho	ENSR Asia
3	Benita Kung	ENSR Asia
4	Lawrence Ho	DSD
5	Andrew Yuen	DSD
6	Pun Kam Cuen	DSD
7	Leung Kam Wah	HKCG (Towngas)
8	Elscar Hau	HKCG (Towngas)
9	James Chan	M&E (PTW Design Team)
10	Ivan Tsang	MEMA (Tunnel Design Team)

The following issues were discussed during the HAZOP Study.

1. **Presentation from Towngas representatives**

   - Towngas' representatives from Production Department pointed out any impacts regarding pipeline network should be re-directed to the Network Department via government communication channel.
   - Detailed account on the structure of gas holder and its operation was presented.
   - On-site safety measures include:
     - compressor alarm installation
     - remote CCTV monitoring on holder level and depot
     - reporting system for Towngas staff to enter the depot
     - monthly inspection on holder integrity
   - Towngas' major concern on construction works of the nearby PTW include:
     - Excessive vibration
     - Crane operation
     - Drill and blast activities
     - Emergency Response Plan

2. **Discussion on PTW upgrading works**

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

3. **Discussion on tunnel construction works**
   - Construction details of Tunnel Q & P were presented
   - Production shaft outside CZ was still considered as relevant. Potential hazards associated with its drill and blast activities would be added to the Hazard Log.
   - 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 (ie 22 onsite staff)

5. **Discussion on Dangerous Goods (DGs)**
   - Only small amount of DGs would be stored in temporary works area during construction stage. No significant impacts anticipated.
   - DG store would be established in upgraded PTW. Referring to the DG inventory in Annex D, it has been assumed that on-site storage of these DGs would fall within the designated threshold levels.

Hazard Log

Ref No.	Major Activity	Potential Hazard / Hazardous Scenarios	Mitigation Measures[1]
PTW Upgrading			
1	Excavation near Gas Holder	▪ Unexpected drawing down of groundwater table during excavation at PTW site, causing ground settlement at Gas Holder site and subsequent structural damage	<u>Drawing down of groundwater</u> ▪ Shallow excavation at PTW site of only 3m to 5m, therefore significant groundwater draw down not likely ▪ Provide recharge well to restore groundwater table if necessary <u>Ground settlement</u> ▪ As discussed with the staff from Towngas in April 2007, the Gas Holder is on piled foundation. As such, hazard of ground settlement is unlikely. ▪ Provide lateral support (e.g. sheet-piling) to excavations in the PTW site ▪ Monitor and record signs of ground settlement by means of construction surveys even after completion of all construction works <u>Structural damage of Towngas facilities</u> ▪ As confirmed by Towngas, there is no gas pipe found within PTW site ▪ Monitor the excavation activity to avoid excavation to the wrong depth (too much excavation) in construction stage ▪ Conduct monitoring to ensure stability of the Gas Holder during construction phase
		▪ Gas pipe damage	▪ The location of the gas pipelines has been identified. Towngas confirmed no gas pipelines found within PTW site. ▪ Excavation running close and parallel to gas pipelines under road/ pavement will be avoided as far as possible. Indication/ sign for gas pipelines will also be provided. Liaison with Network Department of Towngas will be conducted if such excavation is required.
2	Piling Works	▪ Excessive ground vibration leading to damage of Gas Holder foundation and water seal which results in gas leakage	▪ Use pre-bored H-Piles, which is non-percussive ▪ Monitor vibration resulted from construction works to ensure the velocity and amplitude of vibration as recommended by HKCG will not be exceeded. As noted in General Requirements for Construction Work in the Vicinity of Gas Main, the velocity and amplitude of

[1] As consulted and advised by PTW Team, the anticipated mitigation measures shall be further considered and implemented in construction stage.

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			vibration acting on the gas pipe should be within 25mm/s peak particle velocity and 0.2mm respectively. As provided by Towngas, the velocity and amplitude of vibration acting on the gas holder by the construction works must not exceed 13 mm/s peak particle velocity and 0.1 mm respectively. ▪ Towngas recommended to follow Standard and guidelines given in *Gas Production & Supply: Code of Practice for Avoiding Danger from Gas Pipes* ▪ More supervision is recommended during peak construction period
3	Demolition of existing PTW structures (and substructures)	▪ Inappropriate method of demolition may cause damage (e.g., due to excessive vibrations) to Gas Holder installations and pipelines	▪ The location of the gas pipelines has been confirmed with Towngas. No gas pipelines found within the PTW area. ▪ Structures to be demolished within the PTW area are low-rise (~ 10 meter high). No excessive vibration is anticipated. ▪ Undertake regular monitoring to ensure the stability of the Gas Holder
4	Installation of electrical and mechanical equipment	▪ Accidents initiated by electricity supply facilities installed close to the Gas Holder could cause damage to the Gas Holder installation/ pipe network ▪ Accidents associated with welding	▪ Given the E&M works will be limited within the PTW works site boundary, impacts to the nearby Gas Holder is negligible.
5	Mobilising and usage of construction equipment (e.g. drill rig, backhoe, bulldozer, dump truck, site vehicle etc)	▪ Construction equipment overturn/ crashes into the Gas Holder site causing structural damage to the Gas Holder and pipelines ▪ Crane operation accidentally hitting gas holder	<u>Equipment overturn / crash</u> ▪ The stability of the equipment should be ensured. ▪ PHI owners shall be notified the location and design of any large-scale and/or high-elevated equipment during detailed design and construction stage. <u>Accidents associated with crane operation</u> ▪ 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. ▪ Inspection and supervision to ensure operation of equipment properly

Ref No.	Major Activity	Potential Hazard / Hazardous Scenarios	Mitigation Measures[1]
6	Welding / Hot works	▪ Accidents involving fuels used in welding and sparks produced during welding, causing fire hazard to the neighbouring Gas Holder	▪ No serious concern regarding welding activities being inflicted on the PHI during construction as no projectile motion is expected. ▪ Hazardous zone (welding –free area) of gas holder already in place according to overseas guidelines. Boundary wall is located beyond hazardous zone. All area within the gas holder depot boundary is subject to hazardous area control. ▪ 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
7	Reconstruction of a section of the existing seawall	▪ Sheet piling will be involved and resulted in excessive ground vibration leading to structural damage of Gas Holder.	▪ Monitor vibration resulted from construction works to ensure the velocity and amplitude of vibration as recommended by Towngas will not be exceeded
Tunnel Construction			
8	Drop shaft construction (inside Aberdeen PTW) by mechanical boring	▪ Unexpected drawing down of groundwater table during tunnel drilling, causing ground settlement at Gas Holder site or gas pipelines, and subsequent structural damage	▪ Drop shaft is located a fair distance away from the seawall such that drawing down of groundwater is not anticipated. ▪ Provide lateral support to excavation ▪ Inspection and supervision to ensure proper operation of equipment ▪ Undertake regular monitoring to ensure stability of the Gas Holder and gas pipelines during construction phase
9	Tunnel Q construction by horizontal directional drilling (HDD)	▪ Construction of Tunnel Q strayed from actual alignment to cause unexpected damage to the nearby Gas Holder	▪ Safer mechanical method adopted. No explosives will be used ▪ Stabilizing agent applied to secure structural stability of tunnel ▪ HDD profile set off to avoid clashing with the Rubble Mound of seawall ▪ Directional drilling: Pilot hole drilling under close surveyor supervision to avoid deviation from actual alignment during tunnel construction ▪ Periodic monitoring and checking of Tunnel Q construction every 25 meters ▪ Inspection and supervision to ensure proper operation of equipment ▪ Conduct monitoring to ensure stability of the Gas Holder and gas pipelines during construction phase

Ref No.	Major Activity	Potential Hazard / Hazardous Scenarios	Mitigation Measures[1]
10	Mobilising and using high-elevated drill rig	▪ Given drill rig is exposed and higher than boundary wall, its collapse may cause structural damage to the Gas Holder and pipelines	▪ Addition hoarding and fencing in boundary is recommended. The stability of the equipment should be ensured. ▪ PHI owners shall be notified the location and design of any large-scale and/or high-elevated equipment during detailed design and construction stage.
11	Groundwork excavation for Tunnel Q construction	▪ Unexpected drawing down of groundwater table during excavation at PTW site, causing ground settlement at Gas Holder site and subsequent structural damage	▪ Shallow excavation at PTW site, only up to 5m, therefore significant groundwater draw down is unlikely
12	Tunnel P construction by “drill and blast” or mechanical boring (tunnel boring machine)	▪ Unexpected drawing down of groundwater table during tunnel construction, causing ground settlement at Gas Holder site or gas pipelines, and subsequent structural damage ▪ Also, ground vibration and air overpressure, if blasting were involved	▪ Undertake regular monitoring to ensure stability of the Gas Holder and gas pipelines during construction phase ▪ Blasting would be carried out to a depth of about 70m below ground in solid bedrock and relevant issues to be addressed by a “Blasting Assessment ▪ No explosives will be stored, handled, or used at aboveground locations within the Gas Holder CZ
13	Production shaft construction (outside CZ of PHI)	▪ Drill and blast construction method will be adopted ▪ Explosives will be used ▪ Flyrocks hitting gas holder	▪ Location of production shaft shifted outside the CZ. ▪ Vibrations would be addressed by “Blasting assessment”. ▪ Delivery route of explosives by Mines Department would stay clear from the Gas Holder CZ ▪ Drill and blast adopted only in rock head level. It is anticipated that the soil depth at the production shaft would be in the range of 4 to 5 m. Two boreholes will be carried out at the production shaft to obtain SI information for detailed design purpose. Given standard precautionary measures implemented by contractor, no serious concern to ground level is envisaged regarding flyrocks ▪ Drill and blast to be conducted progressively at an excavation rate of 4 metre per day and subsequently 24m over 6 days of construction. Impacts to the neighbourhood is expected to be minimal ▪ Vibration control will be implemented e.g. restricted amount of

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			explosive ▪ More supervision and monitoring is recommended in early period of explosive operation
14	Temporary storage of construction plant, equipment, and materials in temporary works area opposite the Gas Holder/ PTW site	▪ Additional hazards associated with storage of DGs and possible hot works	▪ Given the temporary works area is located at opposite side of PHI and only minor maintenance is performed, no significant impact is envisaged. ▪ Implementation of DG storage and management procedures, in accordance with requirements stipulated in Dangerous Goods Ordinance and its subsidiary regulations
Operation			
15	Upgraded PTW operation	▪ Additional hazard resulted from the upgraded PTW operation on PHI	▪ As confirmed by PTW operator, the operation of upgraded PTW will remain similar to the current practice. No adverse impact on the PHI is anticipated during operational stage.
Use and storage of DGs			
16	DGs storage in construction stage	▪ Exceedance of threshold quantity.	▪ Implementation of DG storage and management procedures, in accordance with requirements stipulated in Dangerous Goods Ordinance and its subsidiary regulations ▪ Quantity of DGs will be limited within FSD threshold
17	DGs storage in operational stage	▪ Exceedance of threshold quantity.	▪ A DG store will be set up as a depot to support regional need. Fire safety requirements for DG store will be followed.
Others			
▪ Establish sound communication channel between Towngas and PTW operators in case of emergency evacuation initiated from either side ▪ Regular meeting with Towngas ▪ Closer and more frequent supervision in early construction period from both Towngas and construction team representatives			