

## Hong Kong Disneyland

### Trial Fireworks Display and associated Air Quality and Noise Monitoring

#### MONITORING REPORT – EXECUTIVE SUMMARY

#### INTRODUCTION

1. This executive summary presents the results of the air quality and noise monitoring conducted for the firework trial show. The trial firework display was conducted following the requirements stated in the Section 3.1 of the Further Environmental Permit (FEP-01/059/2000).

#### BACKGROUND

2. The Hong Kong Disneyland (HKDL) will provide a nightly firework show. Quantitative assessments of the likely environmental impacts have been previously undertaken as part of the Construction of an International Theme Park Environmental Impact Assessment <sup>(1)</sup> (approved Theme Park EIA report (February 2000)). The findings of the Theme Park EIA report (February 2000) was presented in the Advisory Council on the Environment Environmental Impact Assessment Subcommittee (ACE EIA Subcom) Meeting on 5 and 10 April 2000 and the ACE Meeting on 17 April 2000.

3. The Theme Park EIA report (February 2000) concluded that the fireworks show would not cause any significant impacts to the surrounding environment. The findings were confirmed by a Trial Test conducted in Orlando in 2000 which confirmed that no significant impact would occur in the air quality aspect and it would be feasible in designing a fireworks show which would meet the noise criterion of 55 dB(A)  $L_{eq\ 15\ minutes}$ .

4. Subsequently, findings from the EIA assessments, comments from the public and the recommendation from the ACE Members contributed to the approval of the EIA report and the granting of an Environmental Permit under the *Environmental Impact Assessment Ordinance* (EIAO) by the Environmental Protection Department (EPD) to the Civil Engineering Department on 6<sup>th</sup> May 2000 and a Further Environmental Permit (FEP-01/059/2000) was granted to Hong Kong International Theme Parks Ltd (HKITP) on 21<sup>st</sup> July 2000. It is stated in the Section 3.1 of the Further Environmental Permit (FEP-01/059/2000), the Permit Holder (HKITP) shall carry out trial fireworks displays and associated air and noise monitoring. The details of the trial and monitoring programme shall be submitted to the Director for agreement at least one month prior to the trial fireworks displays. The results of the trial fireworks displays shall be submitted to the Director for agreement prior to the operation of the Project. The results of the trial tests and associated air quality data shall be provided to the Advisory Council on the Environment for consultation, as directed by the Director.

5. In accordance with the requirements of the FEP, details of the trial, including an Air Quality Sampling Plan and a Noise Monitoring Plan for the trial fireworks displays were submitted to the Director of Environmental Protection for agreement in April 2005, at least one month prior to the trial fireworks displays. The agreed methodology as presented in the submitted Air Quality Sampling Plan and a Noise Monitoring Plan were adopted for the air quality and noise monitoring of the trial fireworks displays.

(<sup>1</sup>) Construction of an International Theme Park in Penny's Bay of North Lantau and its Essential Associated Infrastructures, February 2000, ERM-Hong Kong, Ltd

6. The key objectives of the trial fireworks displays monitoring is to provide information on the firework emission characteristics and in particular to confirm the commitment in the EIA that certain metals will not be used as part of the fireworks composition. To achieve this objective, more comprehensive air samplings parameters, when compared with the operational monitoring as recommended in the approved Theme Park EIA report (February 2000), were adopted in the trial fireworks displays monitoring.

7. In addition, the noise performance data for the trial fireworks displays at the nearby noise sensitive receivers were collected to determine the significance of noise impacts on sensitive receivers.

### TRIAL FIREWORKS DISPLAYS

8. An initial design of the firework show was developed taking into considerations both the environmental requirements as well as the creativity elements of the fireworks show. Key to the initial fireworks show design is to establish the maximum scenario in terms of the environmental permit requirements for any subsequent show refinement. The trial fireworks displays and associated air and noise monitoring was undertaken on 6th May 2005 based on the initial fireworks show design. The same display and monitoring was also undertaken on 7th May 2005 to ensure that backup data is available, should the monitoring result is incomplete or unsuccessful for 6th May 2005.

### AIR QUALITY MONITORING

9. As agreed with EPD, a total of 5 sampling locations (3 on-site and 2 off-site) were identified for the trial fireworks displays. The purpose of the on-site monitoring is to capture the plume characteristic from the fireworks show; while the off-site locations were to demonstrate that the trial fireworks displays would not adversely affect the air quality at the air sensitive receivers (ASRs) during the operational phase. The sampling locations are listed in *Table 1* and the sampling locations are shown in *Figure 1*.

**Table 1 Sampling Locations**

Sampling Location	Description	Sampling Parameters
AIR1 Rooftop of Hollywood Hotel	An eight storey high hotel, located approximately 330 m from the nearest pyrotechnics launch site	RSP, metals, sulphate, dioxins, TVOC, VOCs and H <sub>2</sub> S
AIR2 Rooftop of Building #304 Buzz Light Year	A single storey high building, located approximately 180 m from the nearest launch site	RSP, metals, sulphate, dioxins, TVOC, VOCs and H <sub>2</sub> S
AIR3 Rooftop of Building #609 Central Maintenance Facility	A single storey high building, located approximately 95 m from the nearest pyrotechnics launch site	RSP, continuous RSP, metals, sulphate, dioxins, TVOC, VOCs and H <sub>2</sub> S
AIR4 Rooftop of Peng Lai Court in Peng Chau	A 5 to 6 storey high building, located approximately 2.8km from the main launch area	24-hr RSP and H <sub>2</sub> S
AIR5 Rooftop of Crestmont Villa Management Office in Discovery Bay	A single storey high building, located approximately 2.7km from the main launch area	24-hr RSP and H <sub>2</sub> S

**Figure 1 Air Quality Sampling Locations**



10. With reference to the approved Theme Park EIA report (February 2000) and the Orlando Trial Test, sampling parameters including respirable suspended particulates (RSP), continuous RSP, metals<sup>(1)</sup>, sulphate, dioxins, total volatile organic compounds (TVOCs), speciated VOCs<sup>(2)</sup> and hydrogen sulphide (H<sub>2</sub>S) have been collected for the trial fireworks displays dated 6th May 2005 to confirm the Orlando Trial Test findings. The same set of parameters was collected on 7th May 2005 as backup. As indicated in *Table 1*, different sampling parameters have been collected for the on-site and off-site sampling locations to ensure that the different objectives are met.

### RESULTS FOR ON-SITE SAMPLING LOCATIONS

11. Hourly RSP, metals, sulphate, H<sub>2</sub>S, TVOC, speciated VOCs, dioxins and furans were measured before the trial fireworks displays and during the trial fireworks displays. A temporary elevation of RSP concentration during the trial fireworks displays was observed at the Central Maintenance Facility (AIR3) on 7<sup>th</sup> May and this proves that the air monitoring at AIR3 has successfully captured the dust plume and results in a short term increase in the measured RSP concentrations.

(1) Metals include aluminium (Al), antimony (Sb), arsenic (As), barium (Ba), chromium (Cr), copper (Cu), iron (Fe), lead (Pb), magnesium (Mg), manganese (Mn), particulate mercury (Hg), molybdenum (Mo), nickel (Ni), potassium (K), strontium (Sr), titanium (Ti) and zinc (Zn).

(2) Freon 12, chloromethane, freon 114, vinyl chloride, 1,3-butadiene, bromomethane, chloroethane, freon 11, 1,1-Dichloroethene, dichloromethane, freon 113, 1,1-dichloroethane, cis-1,2-dichloroethene, chloroform, 1,2-dichloroethane, 1,1,1-trichloroethane, benzene, carbon tetrachloride, 1,2-dichloropropane, trichloroethene, cis-1,3-dichloropropene, trans-1,3-dichloropropene, 1,1,2-trichloroethane, toluene, 1,2-dibromoethane, tetrachloroethene, chlorobenzene, ethylbenzene, m,p-xylene, styrene, 1,1,2,2-tetrachloroethane, o-xylene, 4-ethyltoluene, 1,3,5-trimethylbenzene, 1,2,4-trimethylbenzene, m-dichlorobenzene, o-dichlorobenzene, 1,2,4-trichlorobenzene and hexachlorobutadiene.

12. 17 metals were measured and the measured levels were low or not detectable. In the absence of statutory guidelines for short-term metals concentrations in Hong Kong, international guidelines such as acute reference exposure levels (reference to OEHHA/ARB) or occupational exposure limits are adopted for reference as in the approved Theme Park EIA report (February 2000), and all measured concentrations are well below any acute reference exposure levels or OEL. The measured levels of sulphate at all on-site sampling locations during the trial fireworks displays are low. No H<sub>2</sub>S were detected during the trial fireworks displays. The measured TVOC, 42 speciated VOCs and dioxins were also low and most VOC samples were below detection limit. By reviewing the available background dioxin concentrations measured in Hong Kong, the measured dioxin concentrations are within the general fluctuations of the measured background levels.

13. As most of the key parameters for this Hong Kong trial fireworks displays including the types of fireworks devices used, distance between launch areas and the sampling locations, the meteorological conditions and background air quality are different from the Trial Test conducted in Orlando in year 2000, the measured results obtained from the Hong Kong trial fireworks displays could not be directly compared with those results of the previous Trial Test conducted in Orlando. In general, the findings from the Orlando Trial Test were similar to the current monitoring results which showed short-term elevation of RSP levels for the downwind monitoring station and low concentrations of the metals, sulphates, VOCs and dioxins were measured from both monitoring exercises.

## **RESULTS FOR OFF-SITE SAMPLING LOCATIONS**

14. 24-hour RSP concentrations and H<sub>2</sub>S were also measured at the off-site sampling locations in Peng Chau and Discovery Bay, which are the nearest Air Sensitive Receivers (ASRs) to the theme park. Even though Peng Chau was considered to be in the downwind location on 6<sup>th</sup> May, the measured 24-hour RSP concentration at Peng Chau was low. Due to the large separation between the fireworks launch area and the off-site sampling locations, the contribution from the trial show during both 6<sup>th</sup> May and 7<sup>th</sup> May were low. The measured RSP levels were well below the statutory RSP criterion and the results are considered to be comparable to the annual averaged RSP concentrations measured at EPD Tung Chung and Central/Western AQMSs. H<sub>2</sub>S concentration was measured in Peng Chau and Discovery Bay during the ambient monitoring on 6<sup>th</sup> May; however, no H<sub>2</sub>S concentrations were detectable in Peng Chau and Discovery Bay during the trial show on both days.

15. The trial monitoring results concur with EIA prediction that HKDL fireworks program would not cause any significant impacts to the surrounding environment. Therefore in accordance with the recommendations of the approved Theme Park EIA report (February 2000), an operational monitoring program for key parameters including 24-hour RSP, barium, copper and dioxins and 1-hour H<sub>2</sub>S shall be undertaken during the first operational year for verification purpose.

## **NOISE MONITORING**

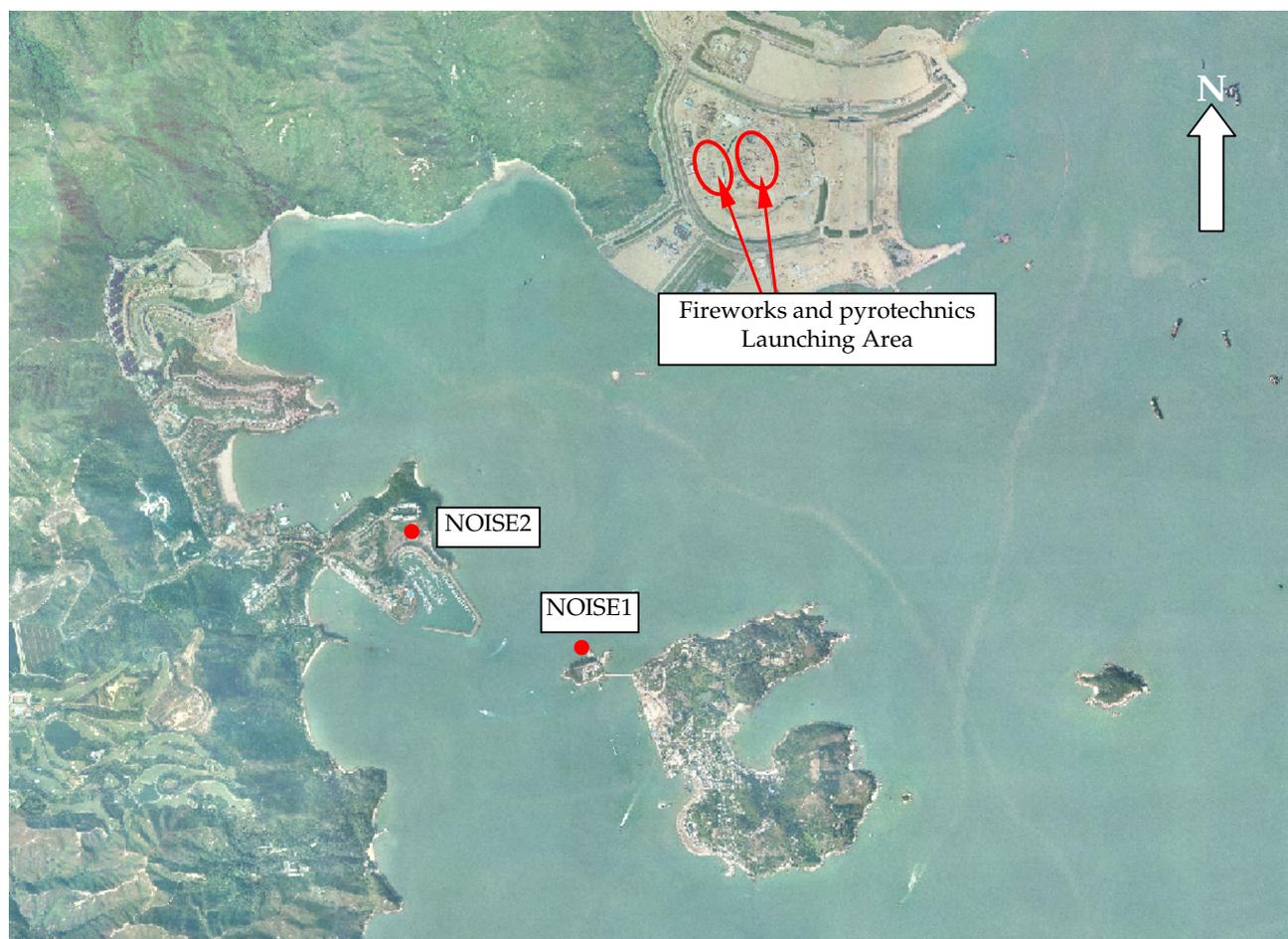
16. With reference to the approved Theme Park EIA report (February 2000), representative noise monitoring locations were identified and agreed with EPD. The monitoring locations are listed in *Table 2* and the monitoring locations are shown in *Figure 2*.

**Table 2 Sampling Locations**

Monitoring Location	Description
NOISE1 Tai Lei, Peng Chau	Located approximately 2.7 km from the main launch area. Façade measurement location was set at 1.2 m above the ground level.
NOISE2 Rooftop of Cherish Court, Discovery Bay	Located approximately 2.4 km from the main launch area. Façade measurement location was set at rooftop of Cherish Court approximately 53 m above the ground level.

17. Façade noise measurements were carried out at two agreed monitoring location, Peng Chau (NOISE1) and Discovery Bay (NOISE2) using sound level meters and calibrators complied with IEC 651: 1979 and 804:1985 (Type 1) specification. The microphone was positioned at 1m from a façade, which has a direct line of sight to the Theme Park perimeter. Noise monitoring was conducted with reference to the calibration and measurement procedures as stated in the *Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites*.

**Figure 2 Noise Monitoring Locations**



18. A  $L_{Aeq, 15 \text{ minute}}$  noise measurement was made starting from the start of the trial firework display. Ambient noise levels of at least 15 minutes were also measured prior to and immediately after the 15 minutes firework measurement period for establishing the averaged background noise level. The noise measurement was conducted in accordance with the agreed monitoring

methodology and any significant extraneous influences on the measured noise levels were taken into account in accordance with standard acoustical principles and practices.

19. On 6<sup>th</sup> May, the actual trial firework display was started on 21:06. The measured results are presented in *Table 3*.

**Table 3** *Monitoring Results – 6<sup>th</sup> May 2005 ( $L_{eq, 15 \text{ min}}$  dB(A))*

	Tai Lei, Peng Chau (NOISE1)	Cherish Court, Discovery Bay (NOISE2)
Corrected Fireworks Noise Levels	51.5	54.6
Noise Criterion ( $L_{eq, 15 \text{ min}}$ )	55	55

20. The monitoring results conducted for the 6<sup>th</sup> May 2005 trial firework display indicated that the firework noise levels at both monitoring locations (Tai Lei, Peng Chau and Cherish Court, Discovery Bay) have complied with the stipulated noise criterion of  $L_{eq, 15 \text{ min}}$  55 dB(A). It is considered that the noise monitoring results for the 6<sup>th</sup> May 2005 represented a worst-case scenario since both monitoring locations are considered to be in the downwind location throughout the 15-minute firework noise monitoring period.

21. On 7<sup>th</sup> May 2005, both monitoring locations are considered to be in the upwind location throughout the 15-minute firework noise monitoring. The noise measurements conducted at Peng Chau, Tai Lei and Cherish Court, Discovery Bay were influenced by significant extraneous noise throughout the trial firework show and after discussion and agreement with the EPD, the noise measurement results for the 7<sup>th</sup> May show are deemed to be invalid due to the significant extraneous noise.