ABSTRACT

Title: An Assessment of Atmospheric Testing and Monitoring in Tunnel
Name: Haji Mohd Esa Baruji
Email: mohd.esa [at] niosh. com. my
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Abstract:

This study was conducted to measure nine atmospheric parameters inside water tunnel (44.6 kilometres in length and 5.2 metres in height), namely Oxygen (O_2), Carbon monoxide (CO), Carbon dioxide (CO_2), Hydrogen sulphide (H_2S), Methane (CH_4), Temperature (T), Pressure (P), Humidity (H) and Air flow (V_{air}). The data obtained were analysed, interpreted and compared with Industry Code of Practice for Safe Working in A Confined Space 2010 (ICOP CS) and Malaysian Standard: Work in Tunnelling – Code of Practice (MS 2363:2010). The study used 3 Multi-Gas Detectors set, and 2 Indoor Air Quality Meter sets, and other support compact camera with high ISO. The readings were measured for every 500 meters at the bottom (from ground level, 0 to 1.73m), middle (from ground level, 1.73m to 3.46m), and top (from ground level, 3.46m to 5.20m) of that point during and after the tunnel construction phase. More than 80 readings recorded for all parameters including water leakage area, trapped area such as space behind ducting, conveyor, pipping, drainage, distribution box which may had potential atmospheric hazard. During construction, O_2, showed very strong positive linear relationships with H and P, and very strong negative linear relationships with T and V_{air}. However, O_2 had low linear relationship with CO_2. CO_2, also had linear relationships with H, T, P and V_{air}. Meanwhile, H, showed very strong negative linear relationships with T, P, and V_{air}. For T, there were two very strong negative linear relationships with P and V_{air}. However, P had very strong negative linear relationships with V_{air}. After construction, O_2 shows low linear relationships with CO_2, T and V_{air}. Besides that, CO_2 shows linear relationship with H and strong positive linear relationship with T. Meanwhile for T, there was only one low linear relationship with $V_{air.}$ Air flow was having the most linear relationship with all five parameters during construction (O_2, CO_2, H, T and P). However, after construction air flow was having linear relationship with only two parameters (O_2 and T). In conclusion, V_{air} the most important factor in controlling all parameters measured in ensuring the atmospheric was in safe condition. The atmospheric monitoring method can be improved by shortening the distance between measurement points, taking more readings at curving and bending space to observe the accuracy and turbulence effect. Proper electrical consumption for machinery and ventilation with cooling system planning required instead of additional generator. Utilities installation, work activities and natural condition inside the tunnel were among other factors to be considered for atmospheric monitoring analysis.

(Keyword: Atmospheric monitoring, air flow, tunnel)