

Organizer



Project Consultant



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Demonstration of an Environmentally Friendly Paper Artifacts Furnace for Traditional Funeral Service and Data Analysis of Particulate Removal Efficiency of the Furnace

環保燒衣爐應用於傳統殯儀服務的示範及微粒去除效率之數據分析

17 – 12 -2013

Presenters

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- Ir Prof Dennis Y C LEUNG 梁耀彰工程師教授
- Ir Sam W K CHENG 鄭永權工程師

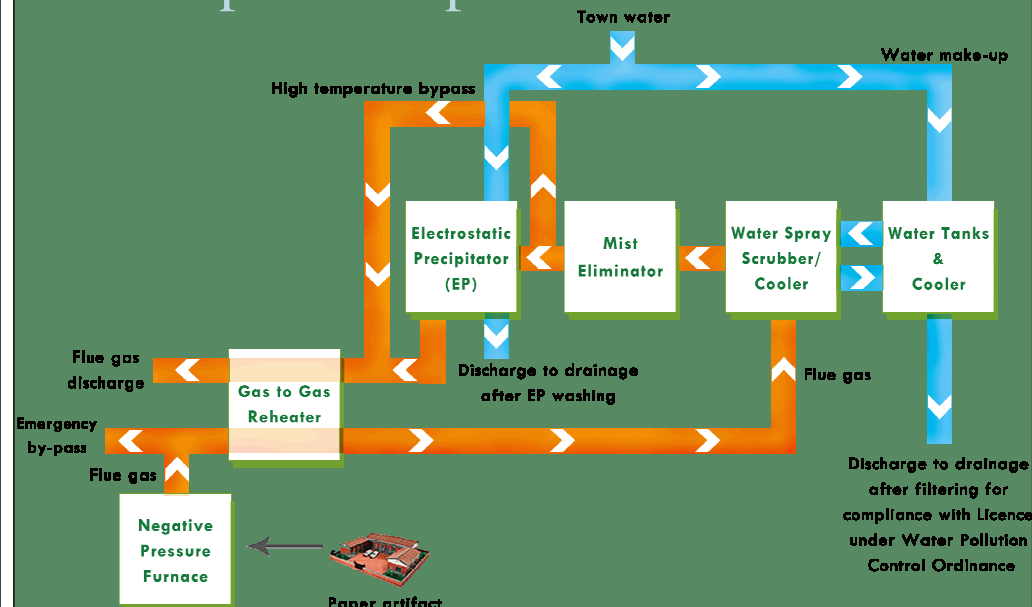
Background

- Traditional Practice
- Emission of particulate and ash leakages
- Back-fires

10 – 15 batches in
1 – 1.5 hours
Each batch about
24 – 25 kg



Conceptual Proposal



http://www.epd.gov.hk/epd/english/compliance_ass/others/files/EPD_Paper_Artifacts_eng.pdf

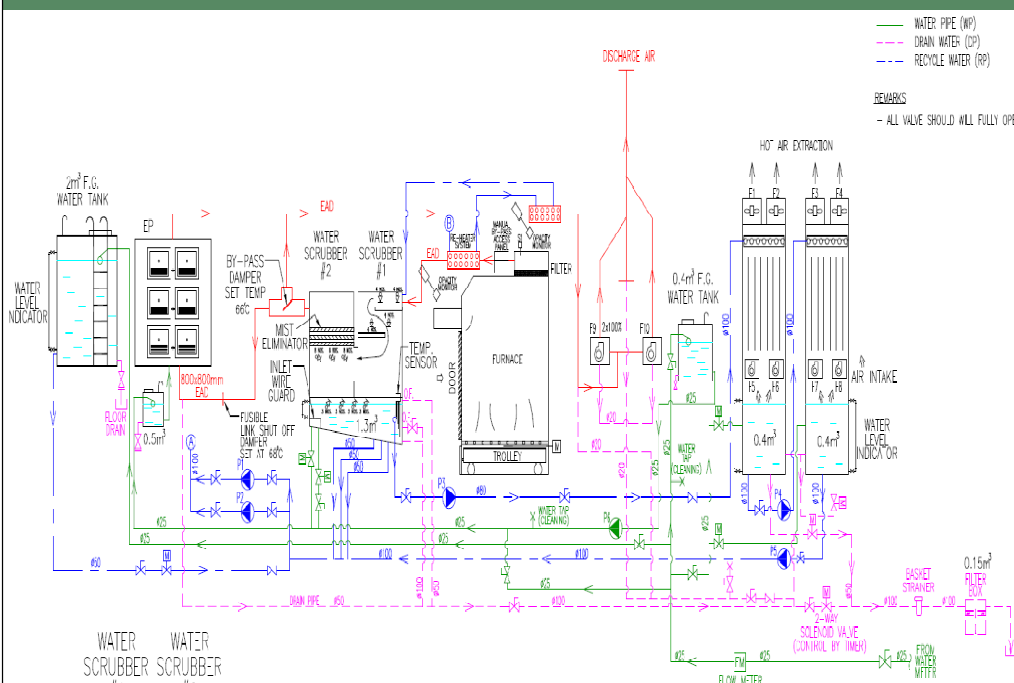
ECF Approval

- Project approved as ECF 27/2010
- Project carried out on rooftop of International Funeral Parlour, 8 Cheong Hang Road, Hung Hom, Kowloon
- Site Work Commencement date: December 2011
- Performance Test: 10 July 2013
- Trial Operations & data evaluation: 15 July – 16 November 2013

As-built Plant



Schematic



Performance Requirements

- Observations of operation & maintenance (O&M) issues – acceptable to operators
- Visual and opacity monitoring of smoke and particulate removal efficiency – no visual smokes & 90% removal efficiency

Lambert Beer's Rule

$$C_{\text{corr}} \propto -T \cdot \ln(1 - O/100)$$

$$\eta = 1 - C_{\text{corr}} \text{ at furnace} / C_{\text{corr}} \text{ at blower suction}$$

T is flue gas absolute temperature of the flue gas

O is the measured opacity percentage

Opacity Meters



O&M Issues (1)

- Modifications of water scrubber sump overflow pipeworks, valves & spray nozzles, removal of ash deposit and blockages
- Alterations of mist eliminator orientation, scrubber pump inlet connections, rectification of water and gas leakages
- EP insulator replacement and electrode connector rods

O&M Issues (2)

- EP insulator replacement and electrode connector rods re-arrangement



O&M Issues (3)

- Scrubber nozzle cleaning once/2 days
- Scrubber sump filter cleaning once/4 days
- Drain water discharge box filter once/day
- Blower fans off when gas temperature below 38°C after burning stopped

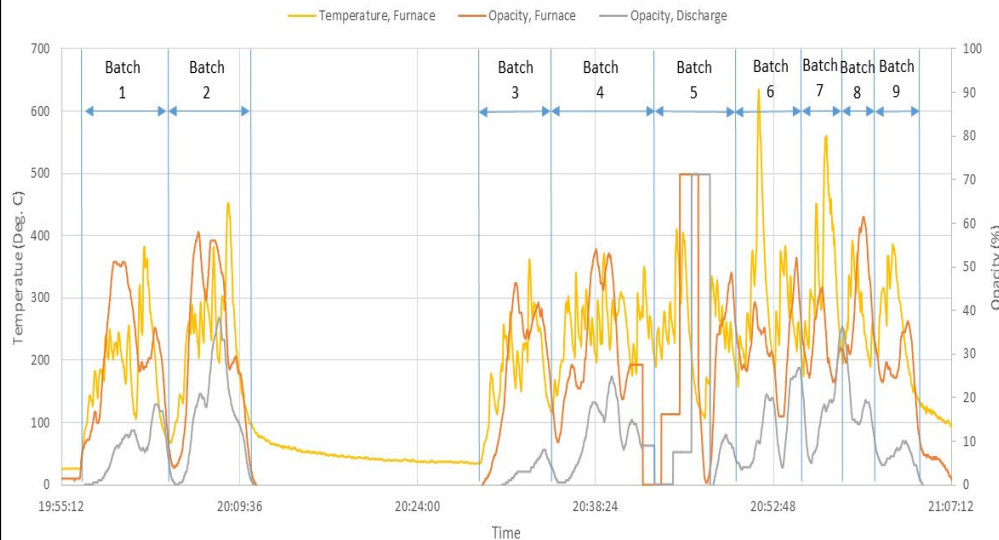
O&M Issues (4)

- Ash removal



Performance (1)

11 November, 2013 - Temperature & Opacity



Performance (2)

- Particulate Removal Efficiency
- High temp. EP bypass, bypass damper leakages, arrangement of EP connector rods in early period contributed to initial low efficiency was later rectified
- Affected by gas temperature

	15/7 – 10/11	11 – 16/11
Avg	47.3%	83.5%
Max	95.9%	96.0%

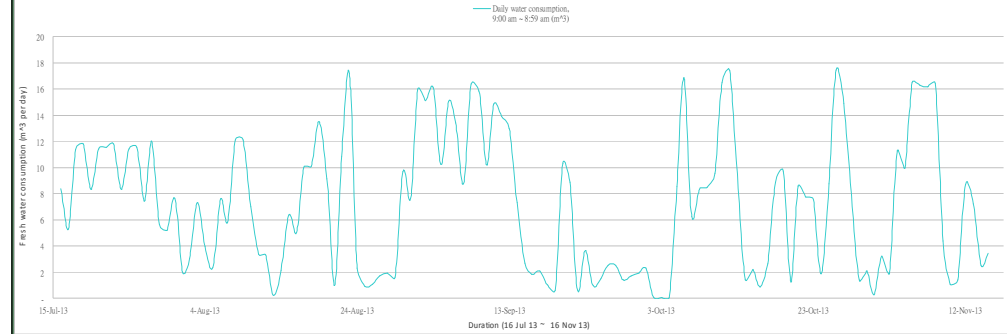
Performance (3)

- Discharge opacity ranged from 2.36% - 36.3% averaged at 10.53%
- On average could meet Ringelmann Scale 1 meeting no visual smoke emissions
- Can be improved with better scrubber cooling

Performance (4)

- Water consumption high averaged 7.30 m³/day with maximum 17.46 m³/day during tank and sump cleaning once every 2 to 3 days
- Water leakages, control of overflows & blowdowns need to be improved

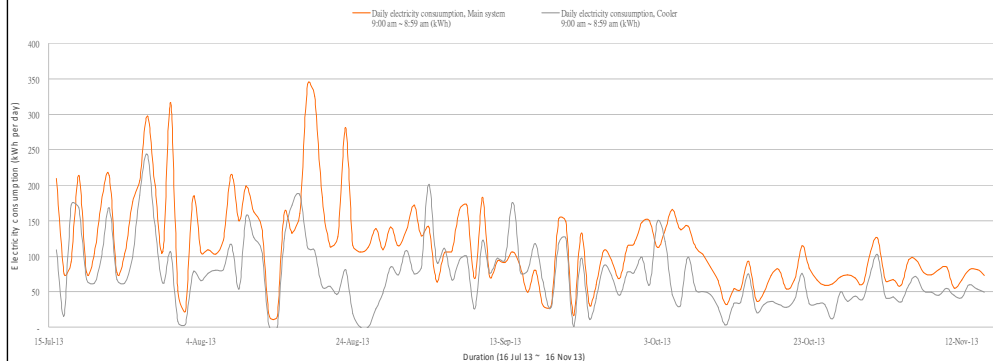
Daily fresh water consumption



Performance (5)

- Energy consumption high
Main 71.5 kWh/day
Cooler System 49.9 kWh/day (could be reduced)
Overall Plant 121.5 kWh/day

Daily electricity consumption



Performance (6)

- 12m³ furnace
- 4-door design
- Sufficient air extraction speed
no back-firing even with all doors open



Concluding Remarks

- With proper design & maintenance, air pollution due to paper artifacts burning can be controlled to acceptable levels
- Based on observation, smoke emissions can be reduced by enhancing scrubber cooling hence lowering gas temperatures & may warrant further researches
- No back-firing with the large furnace & sufficient air extraction
- Prospects exist for reducing water consumption and energy consumption

Videos / Site

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