

Environmental Research, Technology Demonstration and Conference Projects

Project Completion

Project Number	04/2009																	
Project Title	Air quality in Hong Kong : A supersite program for real-time characterization of Particulate Matter (PM) in Hong Kong's air																	
Principal Investigator (PI)	Prof Chak K CHAN, Department of Chemical and Biomolecular Engineering, The Hong Kong University of Science and Technology																	
Project Summary	The project aims to develop a partnership programme between academic institutions and the government to conduct intensive air quality research with state-of-the-art instruments to characterize the physical and chemical properties of particulate pollutants. The outcomes of the project will create a research-based foundation on which to build air quality improvement programmes.																	
Project Duration	48 months. (The original project duration was 42 months, and was subsequently approved to be extended by 6 months. The project, which commenced on 2 July 2010, was completed on 30 June 2014.)																	
Total Amount Approved	\$6,609,000																	
Financial Status (as at project end date on 30 June 2014)	<p>Up to the present, seven disbursements totalling \$5,615,300 were issued to the recipient organization. According to the financial statement submitted by the PI at the end of the project, the total expenditure of the approved budget items amounted to \$6,455,236.12, as shown in the Budget & Expenditure Table below, which has been examined and supported by the Research Projects Vetting Subcommittee (RPVSC):</p> <p style="text-align: center;"><u>Budget & Expenditure Table</u></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 60%; text-align: center;">Item</th> <th style="width: 20%; text-align: center;">Approved Budget (\$) (Revised in February 2011)</th> <th style="width: 20%; text-align: center;">Actual Expenditure (\$) (supported by RPVSC)</th> </tr> </thead> <tbody> <tr> <td>I. Manpower</td> <td></td> <td></td> </tr> <tr> <td>- Postdoctoral Research Associate (\$288,000 x 3 years = \$864,000) Research Assistant (\$192,000 / year x 17.25 years = \$3,312,000) Software Engineer (\$192,000 / year x 2 years = \$384,000)</td> <td style="text-align: center; vertical-align: middle;">4,560,000</td> <td style="text-align: center; vertical-align: middle;">4,556,946.14</td> </tr> <tr> <td>II. Equipment</td> <td></td> <td></td> </tr> <tr> <td>- Fast Cos analyser - Data control and management system for all real time instruments (cont'd)</td> <td style="text-align: center; vertical-align: middle;">100,000 100,000</td> <td style="text-align: center; vertical-align: middle;">100,000 99,883</td> </tr> </tbody> </table>			Item	Approved Budget (\$) (Revised in February 2011)	Actual Expenditure (\$) (supported by RPVSC)	I. Manpower			- Postdoctoral Research Associate (\$288,000 x 3 years = \$864,000) Research Assistant (\$192,000 / year x 17.25 years = \$3,312,000) Software Engineer (\$192,000 / year x 2 years = \$384,000)	4,560,000	4,556,946.14	II. Equipment			- Fast Cos analyser - Data control and management system for all real time instruments (cont'd)	100,000 100,000	100,000 99,883
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	- Fabrication and installation of a rooftop shelter to house equipment	37,000	37,000
	- 3 wavelength nephelometer	554,000	505,944.60
	- Mid-Vol PM _{2.5} sampler	100,000	95,783.52
	III. Consumables		
	- Station maintenance	40,000	3,660
	- Instrument consumables	80,000	63,236.47
	- Instrument maintenance and support	130,000	129,487.74
	- Chemicals	140,000	95,677.30
	- Filters	60,000	68,440
	- Field sampling – transportation	13,000	12,372
	- Sundry and general expenses	32,000	11,938.32
	- Operation cost of equipment	563,000	671,507.03
	IV. Hosting workshop in Hong Kong	100,000	3,360
	Total:	6,609,000	6,455,236.12
Project Results and Achievements	<p>The project has achieved the following objectives:</p> <ul style="list-style-type: none"> • To develop a supersite programme that will integrate real-time measurements and characterization of particulate matter and volatile organic compounds (VOCs) with existing EPD sites for air quality studies in HK. • To evaluate, compare, and deploy modern measurement methods on particulate matter at selected strategic sites. • To describe relationships among emissions, meteorology, and atmospheric chemistry that cause excessive concentrations and how these relationships vary over time. • To quantify source contributions by time of day and time of year. • To determine limiting precursors for secondary PM_{2.5} formed from directly emitted SO₂, NO_x, VOCs, and NH₃ and how these precursors vary over time. • To determine the water uptake of particulate matter and determine how it affects visibility. <p>The followings are the major scientific findings of this project:</p> <p>a. HKUST is an ideal site for investigating regional air pollution, based</p>		

	<p>on long term detailed filter-based and real time aerosol characterization. Overwhelming majority (>75%) of the particulate matter observed at this site are secondary in nature. They are likely transported from outside HK. Secondary PM observed at HKUST can be formed by both photochemical and aqueous phase reactions.</p> <p>b. Nitrate, much less emphasized than sulfate in the past, can be more abundant than sulfate and can account for up to 20% of PM_{2.5} during nitrate episodes, especially in winter.</p> <p>c. Cooking emissions contribute more to organic aerosol in Mong Kok than traffic does. This conclusion is supported by the clear diurnal profiles of cooking organic aerosol, which show aerosol mass spectrometer (AMS) peaks even stronger than those of hydrocarbon-like organic aerosol (HOA) from traffic at meal times. However, this is the first time in HK that HR(high resolution)-AMS measurements were made and these measurements were made only at one site for 4 months. More studies are urgently needed to assess the importance of cooking OA in other urban environments in HK.</p> <p>d. The inclusion of representative size distribution of aerosols, volatility basis set of organic aerosols and the aqueous phase NO₂ oxidation of SO₂ have significantly improved the model predictions of PM_{2.5} and its compositions to the level that it can be used for forecasting purposes.</p> <p>e. Remote sensing techniques have matured and provided reliable surface PM data via aerosol optical depth (AOD) measurements.</p> <p>f. The PolyU Roadside PM was influenced by different sources during the four seasons. In summer, the dominant source of PM is vehicle emission, but in winter, the site is suffered from pollutants from PRD region. Annual mean concentrations of PM₁₀, PM_{2.5} and PM_{1.0} in 2012 are 55.9, 41.4, and 31.0 (µg/m³) respectively. The percentages of reduction are 30.3%, 25.3% and 31.2% respectively compared with 2004-05 data.</p> <p>The project team will present the project results and findings at the ECF Committee meeting scheduled for 17 December 2015</p>
Action Required	<p>Members' views are invited on whether the project completion should be endorsed.</p> <p>Subject to Members' endorsement of the project completion, the total project expenditure will be \$6,455,236.12, and taking into account the amount already issued to the recipient organization as well as the interest income of \$127 generated, an amount of \$839,809.12 will be issued to the recipient organization to finalize the project account.</p>