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SULFUR DIOXIDE IN THE WOLLONGONG/PORT KEMBLA AREA: A HISTORICAL REVIEW OF AMBIENT ATMOSPHERIC LEVELS, MAJOR EMISSION SOURCES AND THEIR REGULATION

A thesis submitted in (partial) fulfilment of the requirements for the award of the degree

Master of Environmental Science (Research)

from

UNIVERSITY OF WOLLONGONG

by

PETER BLOEM, BSc (Hons)

School of Earth and Environmental Sciences

2007

Certification

I, Peter Bloem, declare that this thesis, submitted in partial fulfilment of the requirements for the award of Masters of Environmental Science (Research), in the School of Earth and Environmental Sciences, University of Wollongong, is wholly my own work unless otherwise referenced or acknowledged. The document has not been submitted for qualifications at any other academic institution.

Peter Bloem

23 November 2007

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List of Abbreviations

BoM	Bureau of Meteorology (Commonwealth)
CASANZ	Clean Air Society of Australia and New Zealand
DEC	Department of Environment and Conservation (NSW)
DECC	Department of Environment and Climate Change (NSW)
EC	European Commission
EPA	Environment Protection Authority (NSW)
EPHC	Environment Protection and Heritage Council (Australia)
ERS	The Electrolytic Refining and Smelting Company of Australia Pty Ltd
glc	ground level concentration
MAQS	Metropolitan Air Quality Station
MIC	Mitsubishi Continuous Converter
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NPI	National Pollutant Inventory (Commonwealth)
PKC	Port Kembla Copper Ltd
ppm	parts per million
pphm	parts per hundred million
PRP	Pollution Reduction Program
SCL	Southern Copper Ltd
SPCC	State Pollution Control Commission (NSW)
SO_2	Sulfur dioxide
USEPA	United States of America Environment Protection Agency
WHO	World Health Organisation

Abstract

Air pollution from sulfur dioxide (SO_2) in the Wollongong/Port Kembla region, New South Wales, Australia, has been of major concern for nearly 100 years. This long-term situation is due to the presence of local major industries which emit the gas, in particular, a copper smelter at Port Kembla, established in 1907. Extensive information on the emission and control of sulfur dioxide from this smelter has been reported over the years by the community, government and industry. Systematic monitoring of ambient atmospheric levels of sulfur dioxide was first undertaken in the region between 1957 and 1961. It recommenced in 1970 and has continued to the present day. This study is the first comprehensive, spatio-temporal analysis of all available ambient atmospheric sulfur dioxide monitoring data for the region. Previous reviews have tended to average data for the whole region, without considering the trends in specific locations and did not explore in any detail the relative contributions of major emission sources, such as the smelter. Two key factors were suspected to influence atmospheric sulfur dioxide levels in the region. The first was the nature of primary metallurgical operations undertaken at the smelter known to generate sulfur dioxide and any associated pollution abatement measures. The second was NSW government regulation regarding pollution control at the smelter. The interplay of these factors and their effect on ambient sulfur dioxide levels was explored over four distinct time periods namely; 1908 to 1965, 1966 to 1988, 1989 to 1995 and 1996 to 2006. The study found the copper smelter at Port Kembla has been a dominant source of elevated sulfur dioxide concentrations recorded in the area. There has been an overall decline in the atmospheric levels of sulfur dioxide from 1957 to the present day. The most significant downward trends in these sulfur dioxide concentrations were strongly associated with reductions in the load of sulfur dioxide emitted from the smelter. These were closely linked to changes in smelting technology (progression from batch – type to more continuous operation) and increasing pollution abatement (increasing sulfur capture) at the facility. The most significant of these reductions have tended to coincide with government intervention and regulation. This study provides a valuable retrospective on trends in air quality in the region and the environmental history of technology and regulation at the smelter in addressing ambient sulfur dioxide levels which, to date, have been poorly recorded.

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Lastly, I would like to thank my family and friends, in particular my partner Paul Black, who have supported me in this endeavour over the years.

I would like to dedicate this thesis to attendees, both past and present, of the Port Kembla Pollution Meeting, on its 21st anniversary. This meeting continues to provide an open forum for local community, industry and relevant government agencies to work cooperatively in reducing the levels of pollution that impact on the health and comfort of the community.