SEI STOCKHOLM ENVIRONMENT INSTITUTE

International Institute for Environmental Technology and Management

Final Report on Dust Monitoring Near Kellingley Coal Mine, North Yorkshire

Harry W. Vallack

Working Paper

Published by the Stockholm Environment Institute

1992

ISBN: 91 88116 59 X

Final Report on Dust Monitoring Near Kellingley Coal Mine, North Yorkshire

Harry W. Vallack

Working Paper

Published by the Stockholm Environment Institute
1992

Stockholm Environment Institute
Box 2142
S-103 14 Stockholm
Sweden
Tel +46 8 723 0260
Fax +46 8 723 0348

ISBN: 91 88116 59 X

FINAL REPORT ON DUST MONITORING NEAR KELLINGLEY COAL MINE, NORTH YORKSHIRE OVER TWO FOUR-WEEKLY PERIODS (4 NOVEMBER - 2 DECEMBER, 1991 AND 9 MARCH - 6 APRIL, 1992)

A report prepared by the Stockholm Environment Institute at York, University of York for the Department of Environmental Services, Selby District Council

H. W. Vallack
June 1992

SUMMARY

Dust depostion was monitored at a residential location near Kellingley Coal Mine over two four-weekly periods (in November/December, 1991 and in March/April, 1992) using a wet Frisbee dust deposit gauge. The mean rates of dust deposition for both periods (696.4 and 415.5 mg m^{-2} day^{-1} respectively) were well in excess of a proposed acceptable upper limit (195 mg m^{-2} day^{-1}) for residential conditions. Mean estimated coal dust content during both periods (80.9 and 47.2 per cent) was also high. It is concluded that coal dust from Kellingley Coal Mine gave rise to excessively high levels of dust deposition at the monitoring site, especially during the first four-weekly period. The situation would appear to have deteriorated since a similar monitoring exercise was carried out in 1989.

MATERIALS AND METHODS

Dust monitoring was carried out over two four-weekly periods at a site (5, Glebelands, Kellingley) near Kellingley Coal Mine (Fig. 1) in order to assess the likely contributions of coal dust. The first monitoring period was from 4 November to 2 December, 1991 and the second period was from 9 March to 6 April, 1992. A single aluminium 'wet Frisbee' deposit gauge was used. This gauge was developed and supplied by Warren Spring Laboratory, Stevenage and is described by Vallack and Chadwick (1992).

At weekly intervals the gauges were replaced with clean ones by staff from Selby District Council's Department of Environmental Services and returned to the laboratory for processing. Undissolved solids were collected by filtration through Whatman GF/A glass microfibre filters and the oven-dry (80 °C) weight of dust determined. The proportion of coal in the dust was estimated by visual characterization under a microscope. A representative sample of dust was scraped off the filter onto a microscope slide and mounted in 'Euparal' mountant under a cover-slip. The slide was examined at X 50 magnification with the aid of both background and top light sources. At least 200 particles with diameters ≥ 50 µm were examined from each sample and the proportion consisting of coal fragments was determined. Particles smaller than 50 µm are not usually the subject of complaints of nuisance according to Hamilton and Jarvis (1963).

RESULTS

The rate of dust deposition and coal dust content for each week's collection are given for the first four-week period (November/December, 1991) in Table 1 and for the second four-week period (March/April, 1992) in Table 2. The mean for the second period was considerably lower than that for the first period.

TABLE 1 *Rate of dust deposition and estimated coal content during each of the four seven-day exposure periods in November/December 1991.*

Retrieval date of gauge	Dust deposition rate (mg m^{-2} day^{-1})	Coal dust content (% of particles ≥ 50 µm in diameter)
11 November, 1991	259.1	51.0
18 November, 1991	805.2	90.2
25 November, 1991	403.1	90.0
2 December, 1991	1318.1	92.3
MEAN	696.4	80.9

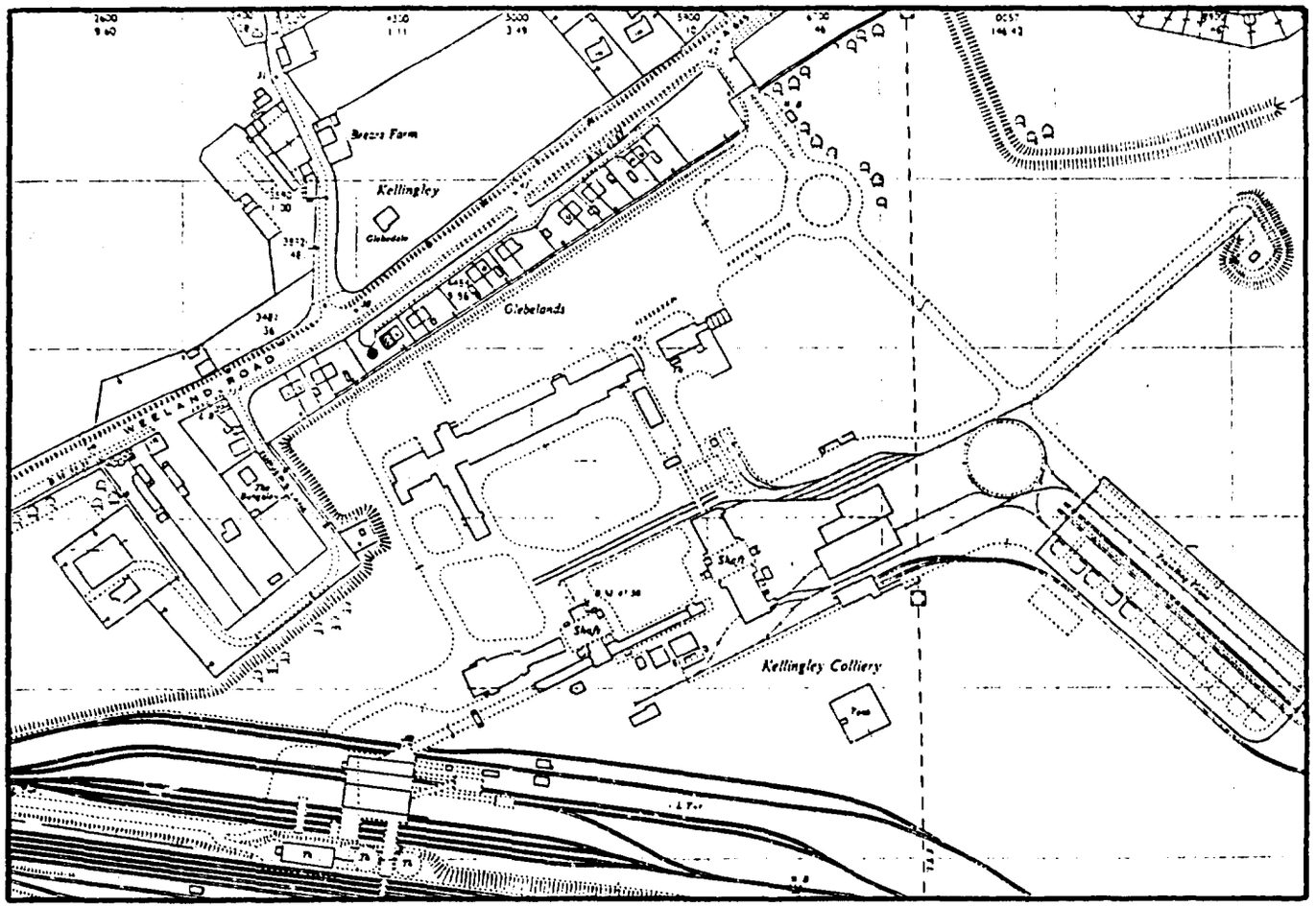

FIGURE 1 *Map of Kellingley Colliery showing the location (•) of the wet frisbee dust deposit gauge.*

TABLE 2 *Rate of dust deposition and estimated coal content during each of the four seven-day exposure periods in March/April 1992.*

Retrieval date of gauge	Dust deposition rate (mg m^{-2} day^{-1})	Coal dust content (% of particles ≥ 50 µm in diameter)
16 March, 1992	714.8	61.4
23 March, 1992	508.7	53.4
30 March, 1992	261.2	34.1
6 April, 1992	177.2	39.9
MEAN	415.5	47.2

In order to provide a measure of the variation in coal dust deposition rate, the total dust weight for each week was multiplied by the percentage coal dust and plotted against time (Fig. 2). The graph shows an extremely high value for the last week of the first monitoring period. Values for the second period were generally lower than those for the first and decreased progressively over the four weeks.

DISCUSSION

Mean rates of dust deposition (696.4 and 415.5 mg m^{-2} day^{-1}) for both four-week periods were much higher than the mean of 288 mg m^{-2} day^{-1} recorded for a wet Frisbee used at the same site over twelve weeks in 1989 (Vallack, 1989). It was concluded in the 1989 report that the 288 mg m^{-2} day^{-1} represented an amount at least three times higher than might be expected at locations on the outskirts of towns in the UK. The estimated rates of coal dust deposition were also higher than in 1989, particularly during the November/December 1991 period. The mean coal dust content during the first four-week period (80.9 per cent) was considerably higher than in 1989 (51 per cent) whereas that obtained in the second period (47.2 per cent) was similar to the 1989 value.

In the absence of official air quality standards for dust deposition a rate of 130 mg m^{-2} day^{-1} (as measured by a British Standard (BS) gauge) was adopted by Anderson *et al* (1989) as the acceptable upper limit for satisfactory residential conditions. In a continuous two-year study, Vallack and Chadwick (1992) found that wet Frisbees collected between 15 and 50 percent more dust than the BS gauges. The equivalent acceptable upper limit for a wet Frisbee would therefore be at most, 195 mg m^{-2} day^{-1} . The mean value of 696.4 mg m^{-2} day^{-1} for the first period of the present study was therefore, over three times higher than this proposed upper limit and even in the second four-week period the mean (415.5 mg m^{-2} day^{-1}) was more than twice this limit. There

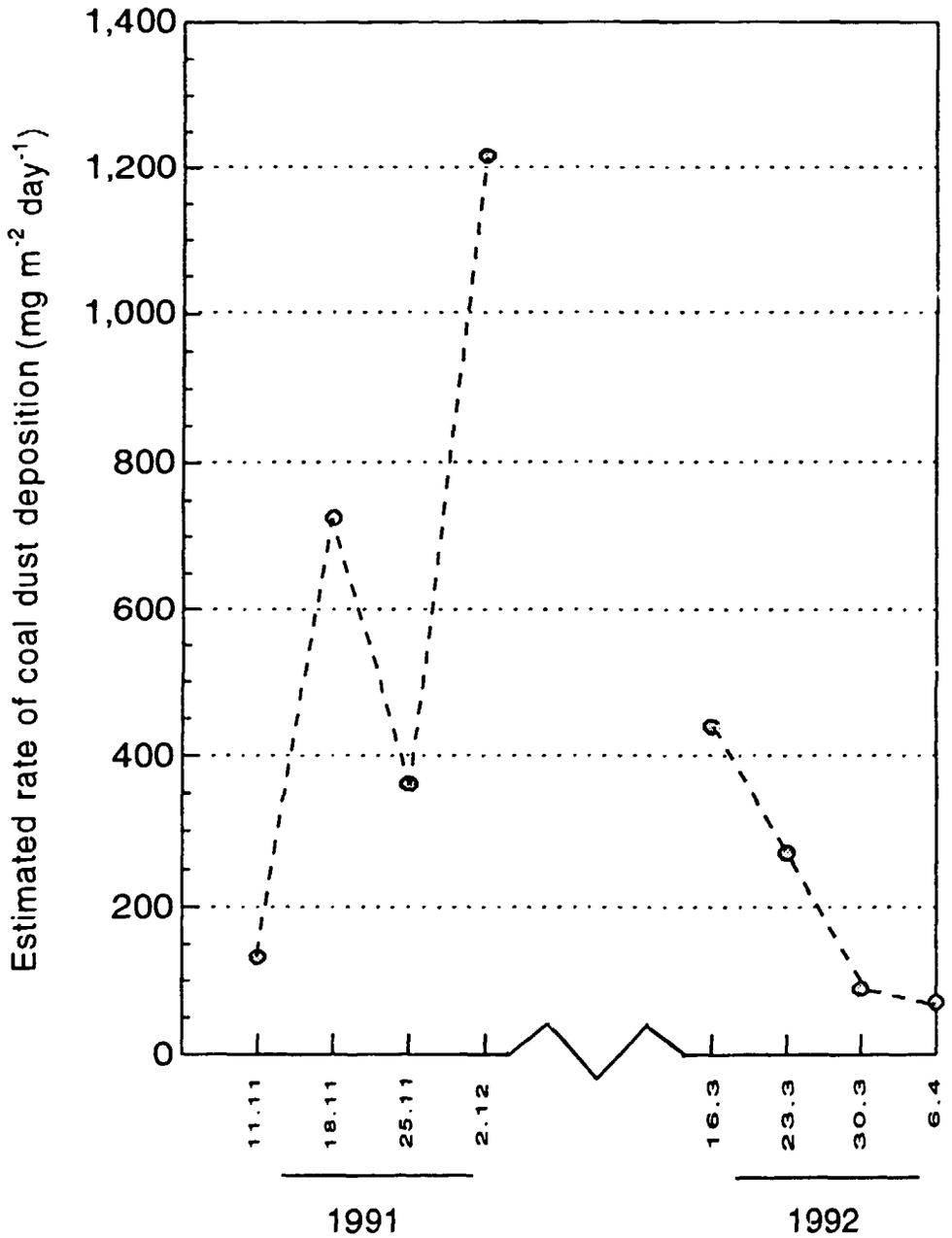

FIGURE 2 *Variation in estimated coal dust deposition rate over the two four-weekly monitoring periods.*

was only one week (ending 6 April, 1992) in which the dust deposition rate was below the limit whereas the value (1318.1 mg m^{-2} day^{-1}) for the week ending 2 December, 1991 was almost seven times the proposed limit.

It can be concluded that this is a very dusty site with deposition rates generally well in excess of the proposed acceptable upper limit for residential areas. One can deduce from the high coal content of the dust, over 90 per cent in some weeks, that activities associated with the neighbouring coal mine are to blame.

It was concluded after the 1989 study, that coal dust was a major contributor to an enhanced rate of dust deposition at the Kellingley site. It would appear from the present study that there has been a considerable increase in coal dust deposited at the site since then.

ACKNOWLEDGEMENTS

This study was funded by the Selby District Council's Department of Environmental Services whose staff also carried out the field work.

REFERENCES

Anderson, W.R., Calderhead, D., Forbes, F., Galbraith, J.M., Holroyd, P., Howe, A.M., Isherwood, S.A., Jeyaratnan, M., Walker, D.S. & West, N.G. (1989). Survey of suspended and deposited particulate in the Hamilton (Maypark) atmosphere. Stevenage: Warren Spring Laboratory, Report LR 708 (PA) M.

Hamilton, E.M. & Jarvis, W.S. (1963). The identification of atmospheric dust by use of the microscope. CEGB, London.

Vallack, H.W. (1989). Dust deposition at a site in Kellingley, North Yorkshire between 14 April, 1989 and 6 July, 1989. Beijer Institute Centre for Resource Assessment and Management (BICRAM), University of York, York.

Vallack, H.W. & Chadwick, M.J. (1992). A field comparison of dust deposit gauge performance at two sites in Yorkshire, 1987-1989. *Atmospheric Environment* **26A**: 1445-51.

SEI Board

STOCKHOLM ENVIRONMENT INSTITUTE
Director: Prof Michael J. Chadwick
Vice Director: Dr Lars Kristoferson
Head of Administration: Ann-Charlotte Bradley
Information Manager: Dr Arno Rosemarin
Librarian: Krister Svärd

Director SEI-Boston: Dr Paul Raskin
Director SEI at York: Michael Prior

Stockholm Environment Institute		SEI-Boston		SEI at York	
Address:	Jarntorget 84, Box 2142 S-103 14 Stockholm, **Sweden**	Address:	89 Broad Street Boston, MA 02110, **USA**	Address:	University of York, Heslington York YO1 5DD, UK
Telephone:	Int +46 8 723 02 60	Telephone:	Int +1 617 426 0836	Telephone:	Int +44 904 43 2897
Telex:	19580 SEI S	Telex:	279926 ESRG BSN UR	Telex:	57933 YORKUL G
Telefax:	Int +46 8 723 03 48	Telefax:	Int +1 617 426 7692	Telefax:	Int +44 904 43 2898

The Stockholm Environment Institute (SEI) was established by the Swedish Parliament in 1989 as an independent Foundation for the purpose of carrying out global environmental research. To achieve its objective, the Institute receives an annual core grant from the Swedish Government. Additional funding, usually linked to specific projects, is received from both national and international as well as Swedish agencies and institutions. The Institute is governed by an international Board (see inside cover overleaf) whose members are drawn from developing and industrialized countries worldwide and acting in their personal capacitites as distinguished persons of considerable experience in dealing with the issues related to environment and development globally.

Central to the Institute's work are the insights on these issues developed by the Stockholm Conference of 1972 and subsequently elaborated by the work of the Brandt and Palme Commissions and more recently, very powerfully highlighted by the Report of the World Commission for Environment and Development (1987).

Thus, it is now very clear worldwide that pollution and degradation of air, water and land are already damaging and even limiting the planetary resource-base needed for current human survival and future socio-economic development. These growing threats to human health and well-being underline the urgent need to manage the environment with the least possible disturbance and degradation. Such "sustainable" management must be at the core of economic development worldwide.

SEI uses scientific and technical analysis as a point of departure for the specification of "minimal harm" technologies and the development of policies which can contribute to strategies for socially responsible environmental management and economic development. A multidisciplinary rolling programme of research actitivities has been designed around the following main themes, which are being executed via internationally collaborative activities with similar institutions and agencies worldwide:

(1) **Environmental Resources, including energy efficiency and global trends, energy, environment and development, and world water resources;**

(2) **Environmental Technology, including clean production and low waste, energy technology, environmental technology transfer, and agricultural biotechnology;**

(3) **Environmental Impacts, including environmentally sound management of low-grade fuels, climate change and sustainable development, and coordinated abatement strategies for acid depositions;**

(4) **Environmental Policy and Management, including environmental problems and urban households, and sustainable environments and common property management; and**

(5) **POLESTAR, a comprehensive modelling and scenario-based activity, investigating the dynamics of a world with 10 billion people by the middle of the next century.**

There is as far as possible an interactive systems approach to these themes and their linked supporting measures.

Apart from its working linkages with the relevant specialized agencies of the UN system, a particular feature of the SEI's shorter term work programme is the role it has played in supporting the work of the Secretariat of the UN Conference on Environment and Development (UNCED) and the action plan Agenda 21 for the next century. This has especially appropriate since the UN General Assembly's resolution establishing UNCED lays down a line of approach closely similar to that adopted for the SEI programme by the Institute's Board in September 1989.

This work programme is carried out by a worldwide network of about 70 full- and part-time and affiliated staff and consultants, who are linked with the SEI Head Office in Stockholm or to the SEI Offices in Boston (USA) and York (UK). An additional centre is being developed in Tallinn, Estonia.

SEI STOCKHOLM ENVIRONMENT INSTITUTE

International Institute for Environmental Technology and Management

Postal address:	Box 2142, S-103 14 Stockholm, Sweden
Telephone:	+46-8-723 0260
Telex:	19580 sei s
Telefax:	+46-8-723 0348
E-mail:	cdp!gn!pns!seihq