



Chemical Agents Monitoring Telsol Ltd, T/A Bimeda

Colomendy Industrial Estate
Rhyl Road
Denbigh
Wales

Verification Information		Comment
Draft	16/07/2018	Peer Reviewed
Version 1	16/07/2018	Issued

EXECUTIVE SUMMARY

Shorcontrol Safety Ltd. has been commissioned by Telsol trading as Bimeda to carry out real-time dust monitoring around the Sinter Kiln. Additionally, a survey of occupational exposure to selenium for specific tasks performed on site were conducted in accordance with the Control of Substances Hazardous to Health Regulations 2002 (S.I. No. 2677 of 2002).^[1] The initial survey was conducted in January, 2018 with a follow up survey in July, 2018 following implementation of engineering control around the kiln.

The significant findings of the survey are:

- Real time particulate matter (PM) concentrations were below the Workplace Exposure Limit (WEL) for inhalable dust (10 mg/m³).^[2]
- During the initial survey of the sintering of sodium selenite there appeared to be an increase in PM concentrations at 9pm and 2am. Following implementation of additional controls around the Kiln, repeat monitoring recorded PM concentrations of < 0.06mg/m³, indicating that controls are effective at reducing airborne concentrations of dust and reducing emissions from the kiln during the sintering process.
- Assuming the sintering process is representative of future sintering processes, it is unlikely to result in increased emissions within the plant and such tasks are unlikely to pose a significant risk to the health of operators, though the employer must make continual efforts to improve control measures detailed within this report.

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MEASUREMENT PARAMETERS & GLOSSARY

The survey results are presented in terms of the following parameters:

WEL is **Workplace Exposure Limit**, an upper limit on the acceptable concentration of a hazardous substance in workplace air for a particular material. WEL's are referred to in the HSE's EH40 document.

The Occupational Exposure Limit Value (OELV) for a hazardous substance is the term in used in Irish legislation to describe the maximum permitted concentration of a chemical agent in the air at the workplace to which a worker may be exposed, for either an **8-hour** or **15-minute** reference period. OEL's are usually measured in milligrams or micrograms of the agent per cubic metre of air (**mg/m³**) or (**µg/m³**) or parts per million (**ppm**).

TWA is the **Time Weighted Average**, defined as the average concentration of a contaminant in air over a reference time period, usually either 8 hours or 15 minutes.

STEL is the **Short-Term Exposure Limit**, defined as the concentration to which workers can be exposed for short periods of time, usually 15 minutes, 4 times per day, without suffering adverse effects and are set to help prevent effects such as eye irritation which may occur following exposure for a few minutes.

RPE is **Respiratory Protective Equipment**, equipment used to protect personnel from inhalation of hazardous materials, i.e. the bubble hood and breathing systems.

PAPR is **Powered Air Purifying Respiratory** equipment, a battery powered blower that forces contaminated air through a filter, and also maintains positive pressure around the head.

SidePak/Dustrak is a miniature battery-operated laser photometer that measures airborne particulate mass-concentration in units of milligrams per cubic meter (**mg/m³**).

PM is **Particulate Matter**, is a complex mixture of extremely small particulates and liquid droplets found in the air.

PPE is **Personal Protective Equipment**, which includes PAPR, gloves shoes etc.

The **Assigned Protection Factor** of RPE reflects the level of protection that a properly functioning respirator would be expected to provide to a population of properly fitted and trained users.

An **Aerosol** is a suspension of liquid or solid particles in the air.

Fumes are small solid particles condensed from the gaseous state.

Vapour is the gaseous form of a material which is normally solid or liquid at room temperature and pressure.

Similarly Exposed Groups or **SEG's** are groups of workers having the same general exposure profile, because of the similarity and frequency of the tasks that they perform, the materials and processes with which they work, and the similarity of the way that they perform the tasks.

Total inhalable fraction is the mass fraction of total airborne particles that are inhaled through the mouth and nose.

Respirable Fraction is the mass fraction of airborne particles that are small enough to enter the gas exchange regions of the lungs. (Smaller than 10 µm in diameter)

A **Combined OELV** is an **OELV** that takes the combined effect of similar substances into account. They are usually used when substances that have similar effects, or target the same organs, such as solvents, are present.

An **LAF** booth is a **LAMINAR AIRFLOW** booth, or Crossflow booth, a booth used for handling hazardous materials with an airflow engineered to move in a laminar fashion through the booth in such a way as to carry airborne contaminants away from the operator.

1.0 INTRODUCTION

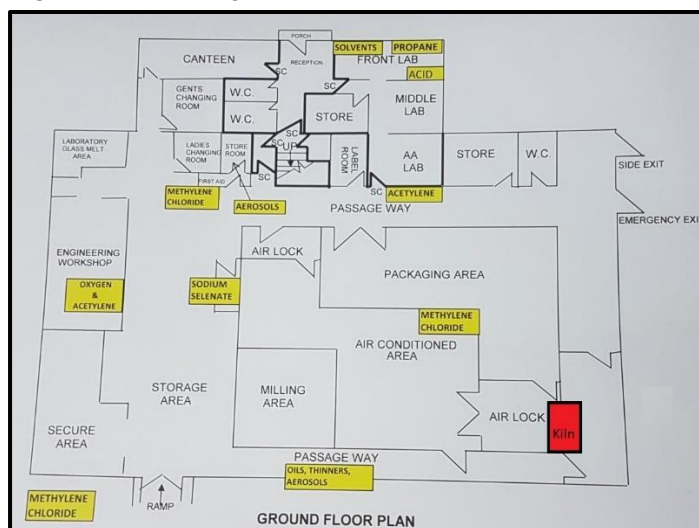
1.1 Objective

The objective of this survey was to conduct a follow up survey of real-time dust monitoring for particulate matter (PM) during the sintering of sodium selenite at three static locations around the Kiln.

1.2 The Plant

Telsol T/A Bimeda, manufacture and market a range of large animal boluses that deliver essential nutrients to livestock. The facility includes the warehouse, sintering plant, offices, labs and glass manufacturing plant. The sintering plant is an enclosed building divided up into the milling, packaging, press machine area and the front of the kiln (as indicated below). The product being manufactured during monitoring was soluble glass selenium cattle boluses (as sodium selenite).

Figure 1: Plant Layout



1.3 Hazard Information

The following 8-hr time-weighted average (8-hr TWA) Workplace Exposure Limits (WELs) have been assigned to the chemical agents measured under EH40/2005 "Workplace exposure limits. Containing the list of workplace exposure limits for use with Control of Substances Hazardous to Health (COSHH) Regulations 2002". [2]

Table 1: List of the British Workplace Exposure Limits.

Substance	Long-term Exposure Limit 8-hour TWA OELV	Short-term Exposure Limit 15-minute STEL
Non-Specific Dust	10 mg/m ³	-
Selenium and compounds (Selenium Selenite and Sodium Selenate)	0.1 mg/m ³	-

2.0 SURVEY DETAILS

2.1 Survey Period & Personnel

The survey was conducted using three photometers which were left in situ during the sintering processes on the night of the 11th of July, 2018.

Monitoring was conducted by Deirdre Rooney, of Shorcontrol Safety Ltd. Deirdre is a member of the Occupational Hygiene Society of Ireland and the British Occupational Hygiene Society.

2.2 Schedule of Equipment Used

The primary instruments used during the follow up survey were three Sidepak AM520's, serial numbers 5201752014, 5201752012 and 5201713003. These laser photometers measure airborne particle mass concentrations in units of milligrams per meter cubed (mg/m^3) and a calibration factor of 1.00 was assigned (the standard ISO test dust).

3.0 ASSESSMENT DETAILS

3.1 Methodology

Direct reading instruments in astatic locations were used during the follow-up survey to quantify particulate matter (PM) concentrations around the Kiln during the sintering process.

Ambient dust concentrations were measured via light-scattering laser photometers. The monitors were set to 1 l/min, 'zeroed' using a zero filter and logging interval set prior to sampling. The photometers were placed in three static locations around the kiln. The meters were then switched on at the start of the sintering process at approx. 17:00 hrs and left to operate all night. At the end of the sampling period at approx. 10:30 hrs. the monitors were switched off and all recorded data downloaded using TrackPro® software. Analysis of the data was conducted alongside the sintering schedule 'New Eurotherm Controller - Sintering Programme Copper Cattle large still'.

3.2 Hours of Operation & Status

There are two shifts for operators working in the manufacturing plant; Milling operators 07:00 to 15:00 and Packaging/Lab operators 08:30 to 16:30 with approximately 60 mins in breaks, giving an exposure time of approximately 7 hours. During repeat monitoring on the 11th of July sodium selenite boluses were in production. In order to achieve the target concentration of selenium during the production of selenium an additional 25% of selenite is added to the mix prior to sintering.

4.0 EXPOSURE SOURCES & CONTROLS

A brief description of the sources of exposure, any relevant high-risk tasks that occur and a summary of the current exposure controls in place in the principal areas are detailed in report reference OCC2457. The following controls were implemented following the initial survey:

Additional Controls Methods:

- Large LEV placed above Kiln with two extractor fans – capturing emissions from the kiln.
- Combined metal and PVC curtaining hanging from above the kiln to half a meter off the ground.
- Maintenance and repair of the Kiln – filters were previously blocked with significant accumulation of dust.

5.0 MONITORING RESULTS

5.1 Explanation of Results

- The figures below illustrate the mass concentration of particulate matter (PM) measurements taken with the DustTrak and SidePak photometers. This data is used to investigate PM concentrations over a known period of time and check compliance with the WEL's for total inhalable dust.

5.2 Result Details

Figure 2: Photometric results of ambient PM concentrations at the back of the Kiln during the sintering of Selenium Boluses using sodium selenite as the raw material on the 11th of July.

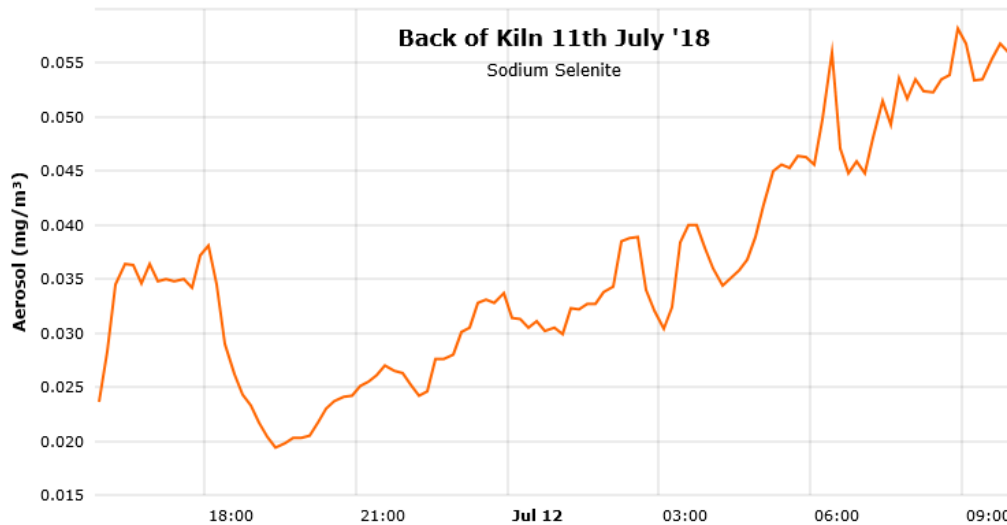
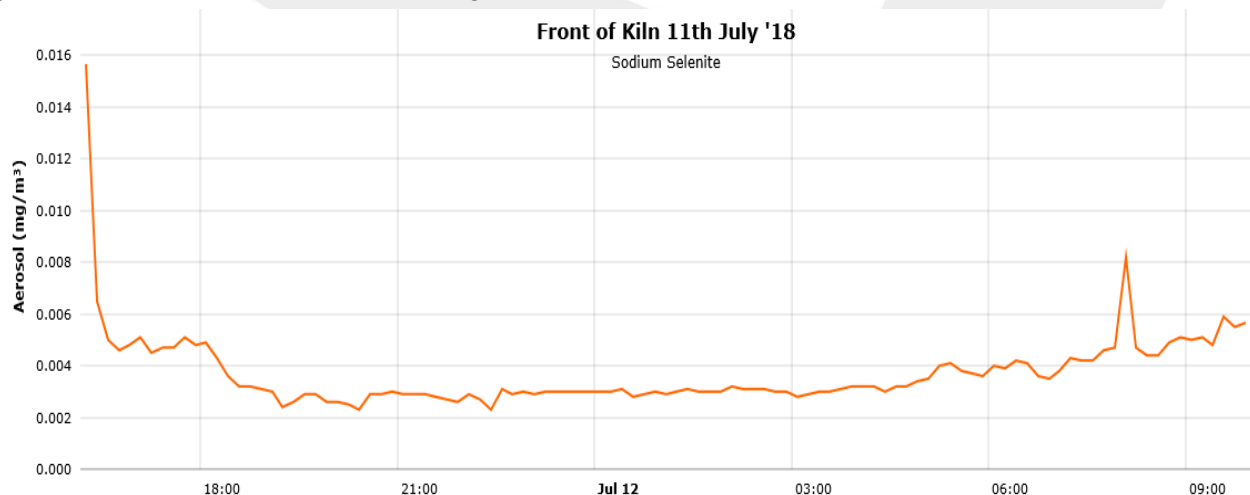


Figure 3: Photometric results of ambient PM concentrations above the Kiln during the production of Selenium Boluses using sodium selenite as the raw material on the 11th of July.



Figure 4: Photometric results of ambient PM concentrations at the front of the Kiln during the production of Selenium Boluses using sodium selenite as the raw material.



6.0 RECOMMENDATIONS

6.1 Recommendations for Engineering Control

Operators have reported that the pungent smell within the warehouse, lab, changing facilities and offices of the manufacturing plant the morning after the sintering kiln has been operating, has reduced significantly since the implementation of controls, indicating that emissions have reduced.

Photometric data collected during the initial survey indicated that there was an increase in PM concentrations at specific times and locations around the kiln. Following the recommendations in report reference OCC2457 and industry guidance, efforts were made to reduce emissions from the Kiln as detailed in section 4.0 as well as the images in appendix C.

6.2 Personal Protection

It is preferable to reduce the use of chemical or physical agents entering the working environment through improved work practices and equipment. Use of Respiratory Protective Equipment (RPE) should be considered only as a temporary measure, or if other control measures are insufficient or impractical.

The results of the monitoring for selenium do not indicate that the use of RPE (Respiratory Protective Equipment) is required for the tasks monitored however, it is recommended that operators within the Sintering plant continue to wear RPE as per the recommendations in previous exposure monitoring programmes.

6.3 Health Surveillance

Where exposures are considerably below the WELs and there is no reason to consider that a significant risk to health exists, health surveillance is not normally appropriate. As all exposures are below the limit of detection and therefore significantly below the WELs for Selenium and its compounds, health surveillance is not deemed necessary.

7.0 CONCLUSION

The follow up survey concluded that the engineering controls implemented are effective in reducing PM concentrations within the facility. Additionally, employees have reported a reduction in the odour detected around the plant following the sintering process, a positive indication that controls are effective at reducing emissions into the plant.

Appendix A – References

- [1] Control of substances hazardous to health (Fifth edition). The Control of Substances Hazardous to Health Regulations 2002 (as amended). Approved Code of Practice and guidance L5 (Fifth edition) HSE Books 2005 ISBN 978 0 7176 2981 7
<http://www.hse.gov.uk/pubns/priced/l5.pdf>

- [2] Health and Safety Executive (2002). EH40/2005 Workplace exposure limits. Containing the list of workplace exposure limits for use with the Control of Substances Hazardous to Health Regulations 2002/2677 The Stationery Office 2002.
<http://www.hse.gov.uk/pubns/priced/eh40.pdf>

- [3] Health and Safety Executive (2006). Monitoring strategies for toxic substances. HSG173. HSE Books, 2006. <http://www.hse.gov.uk/pubns/priced/hsg173.pdf>

- [4] Health and Safety Executive (2000). General methods for sampling and gravimetric analysis of respirable and inhalable dust MDHS14/4 (Fourth edition). HSE Books, 2000.
<http://www.hse.gov.uk/pubns/mdhs/pdfs/mdhs14-4.pdf>

Appendix B – Legislative Obligations

The Control of Substances Hazardous to Health Regulations (2002) detail the responsibilities of employers in relation to controlling occupational exposure to chemical agents, these can be summarised as follows:

- 1. Assess Risks**
Assess risks to health from hazardous substances used or created in the workplace
- 2. Decide What Precautions are Needed**
Don't carry out work that can expose employers to hazardous substances without first considering the risk, and necessary precautions
- 3. Prevent or Control Exposure**
Where prevention is not reasonably practicable, exposure must be adequately controlled
- 4. Ensure that Control Measures are Maintained**
Ensure that control measures are used and maintained properly, and that safety procedures are followed
- 5. Monitor Exposure**
Monitor the exposure of employees to hazardous substances, if necessary
- 6. Carry out Health Surveillance**
Carry out appropriate health surveillance if your risk assessment shows it is necessary, or if there is a specific COSHH requirement
- 7. Plan for Accidents & Emergencies**
Prepare plans and procedure to deal with accidents and emergencies involving hazardous substances

Appendix C – Monitoring Locations & Other Pictures

Fig 5 – Photometer at the back of the Kiln



Fig 6 – Photometer above the kiln.



Fig 7 – Photometer at the front of the kiln.



Fig 8 – Two extractor fans at the east of the manufacturing plant near the back of the kiln.



Fig 9 –Large LEV above the front door of the kiln



Fig 10 –New enclosure above kiln and extractor fans. (Red staining visible on roof due to previous emissions from kiln.)



Fig 15 –New enclosure around kiln.



Fig 16 –New enclosure around kiln.



Fig 16 –Additional extraction above kiln.



Appendix D –Photometric Results from Initial Survey OCC2457

Figure 2: Photometric results of ambient PM concentrations at the back of the Kiln during the sintering of Selenium Boluses using sodium selenite as the raw material on the 22nd of January.

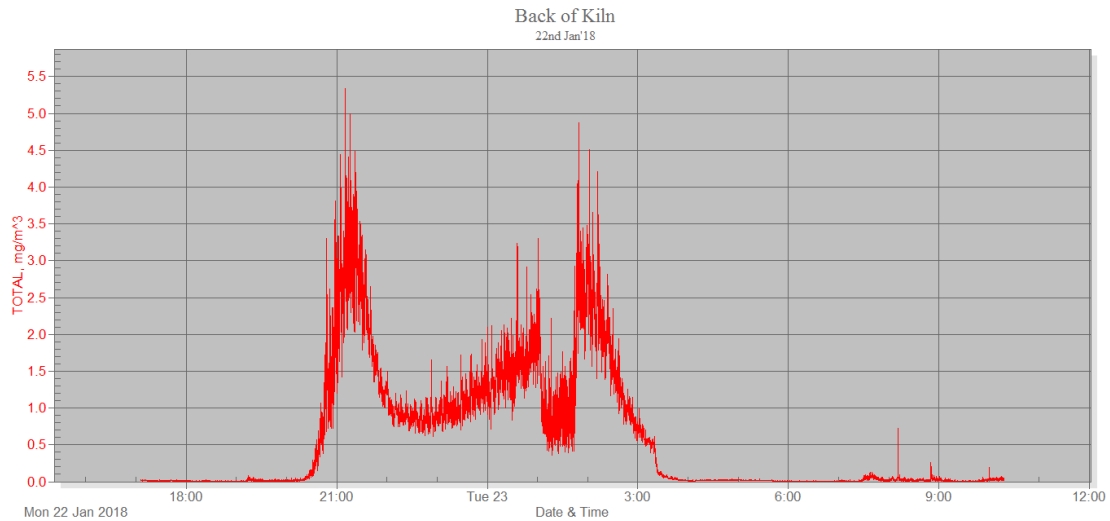


Figure 3: Photometric results of ambient PM concentrations above the Kiln during the production of Selenium Boluses using sodium selenite as the raw material on the 22nd of January.

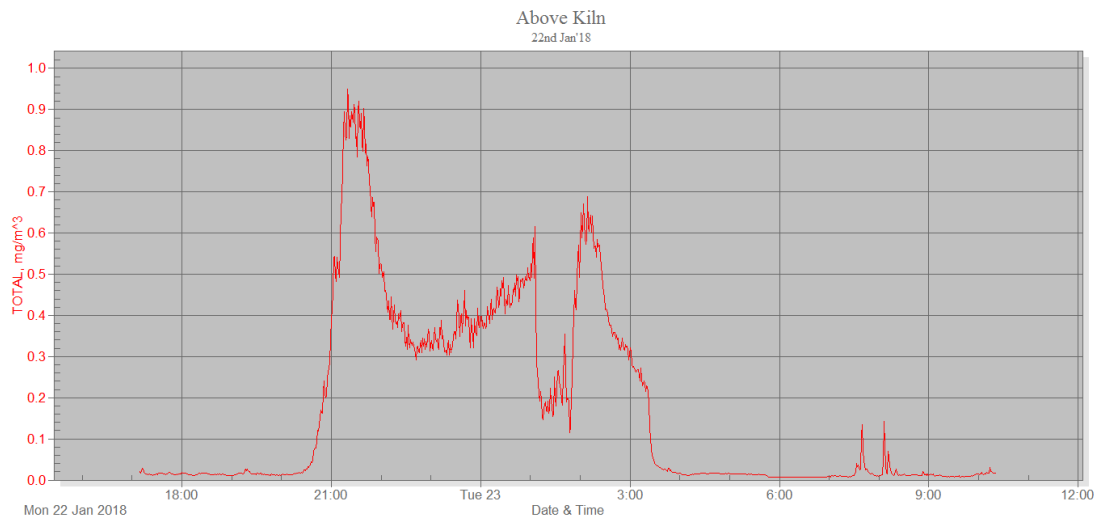


Figure 4: Photometric results of ambient PM concentrations at the front of the Kiln during the production of Selenium Boluses using sodium selenite as the raw material on the 22nd of January.

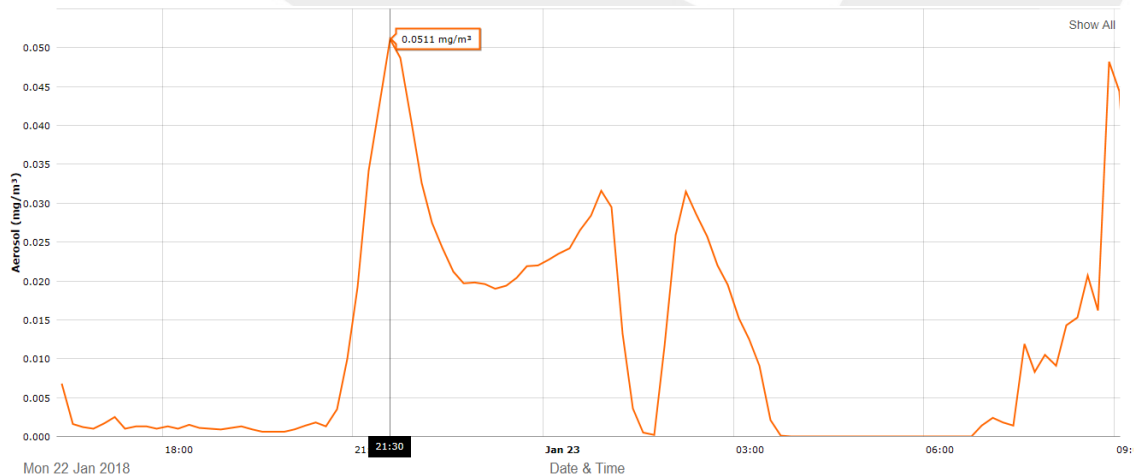


Figure 5: Photometric results of ambient PM concentrations at the back of the Kiln during the production of Selenium Boluses using sodium selenate as the raw material on the 23rd of January.

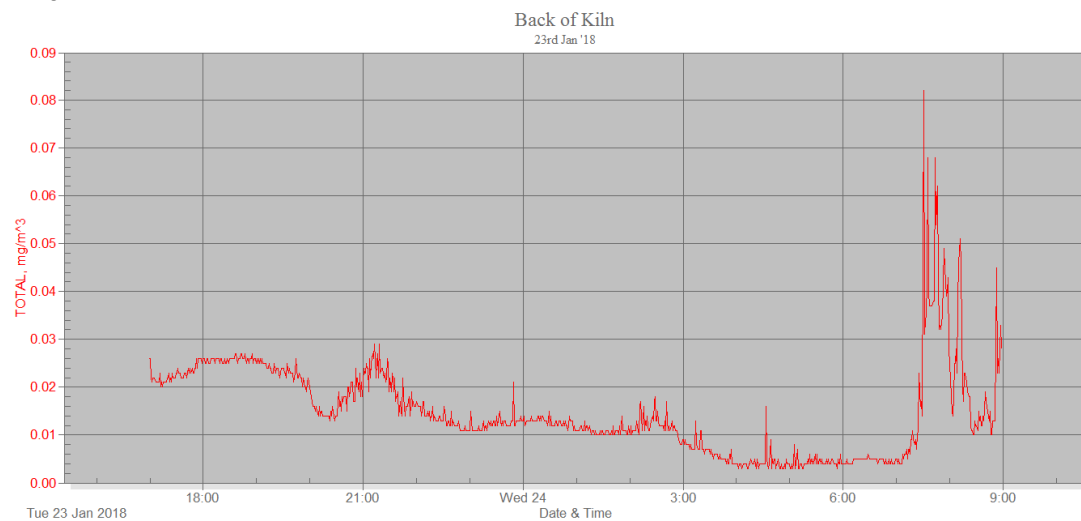


Figure 6: Photometric results of ambient PM concentrations at above the Kiln during the production of Selenium Boluses using sodium selenate as the raw material on the 23rd of January.

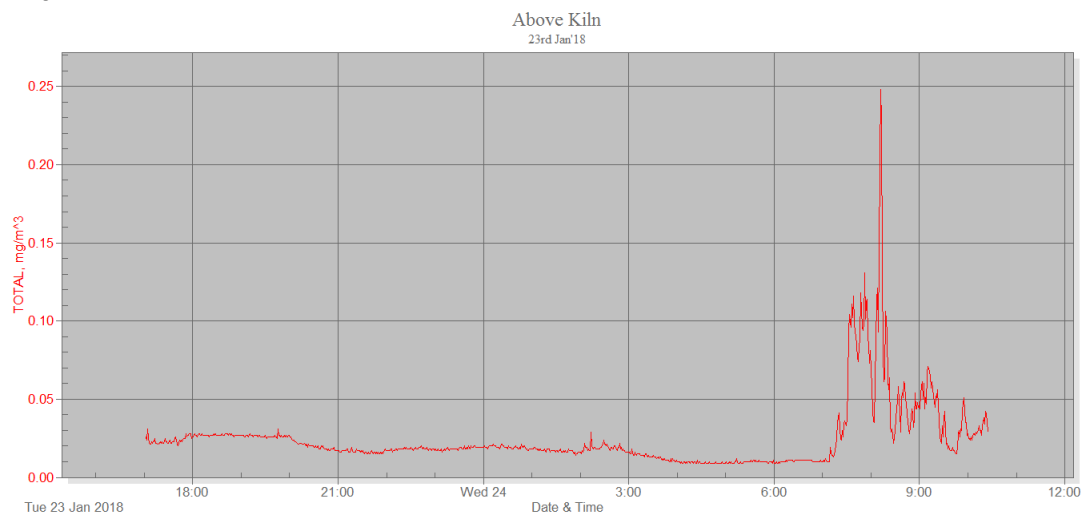


Figure 7: Photometric results of ambient PM concentrations at the front of the Kiln during the production of Selenium Boluses using sodium selenate as the raw material.

Appendix E –Calibration Certs

Photometers Calibration Certificates

CERTIFICATE OF CALIBRATION AND TESTING
TSI Incorporated, 580 Cardigan Road, Shoreview, MN 55126 USA
Tel: 1-800-874-2811 1-651-496-2811 Fax: 1-651-496-2824 <http://www.tsi.com>

Environment Conditions		Model	AM520
Temperature	76.3 (24.6) °F (°C)	Serial Number	5201752014
Relative Humidity	25 %RH		
Barometric Pressure	29.21 (989.2) inHg (hPa)		

☒ As Left ☐ As Found ☒ In Tolerance ☐ Out of Tolerance

Concentration Linearity Plot

System ID: DT100-01

CONCENTRATION				Unit: mg/m3			
#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE
1	0.052	0.040	0.036-0.068	4	12.343	12.186	11.073-13.605
2	0.189	0.182	0.161-0.217	5	66.564	66.472	59.908-73.220
3	1.083	1.054	0.975-1.181				

TSI Incorporated does hereby certify that all materials, components, and workmanship used in the manufacture of this equipment are in strict accordance with the applicable specifications agreed upon by TSI and the customer and with all published specifications. All performance and acceptance tests required under this contract were successfully conducted according to required specifications. There is no NIST standard for optical mass measurement. Calibration of this instrument performed by TSI has been done using every oil and has been normally adjusted to respirable mass per standard ISO 12153-1. At test dust (Arizona dust). Our calibration ratio is greater than 4:1.

Measurement Variable	System ID	Last Cal.	Cal. Due	Measurement Variable	System ID	Last Cal.	Cal. Due
Flowmeter	E004123	09-05-17	03-31-18	Flowmeter	E004570	06-19-17	06-30-18
DC Voltage/Kentley	E002839	09-21-17	09-30-18	Resistors	8001124	11-02-16	11-30-18
Temp/Humidity	E000676	03-31-17	03-31-18	Temp/Humidity	E005557	03-06-17	03-31-18
Pressure	E003440	07-27-17	07-31-18				

Randa Nilsen
Calibrated
January 3, 2018
Date

CERTIFICATE OF CALIBRATION AND TESTING
TSI Incorporated, 580 Cardigan Road, Shoreview, MN 55126 USA
Tel: 1-800-874-2811 1-651-496-2811 Fax: 1-651-496-2824 <http://www.tsi.com>

Environment Conditions		Model	AM520
Temperature	76.8 (24.9) °F (°C)	Serial Number	5201752012
Relative Humidity	25 %RH		
Barometric Pressure	29.35 (995.9) inHg (hPa)		

☒ As Left ☐ As Found ☒ In Tolerance ☐ Out of Tolerance

Concentration Linearity Plot

System ID: DT100-01

CONCENTRATION				Unit: mg/m3			
#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE
1	0.052	0.072	0.053-0.107	4	12.384	12.874	11.146-13.621
2	0.189	0.263	0.237-0.307	5	66.868	66.626	60.181-73.555
3	1.083	1.486	1.181-1.687				

TSI Incorporated does hereby certify that all materials, components, and workmanship used in the manufacture of this equipment are in strict accordance with the applicable specifications agreed upon by TSI and the customer and with all published specifications. All performance and acceptance tests required under this contract were successfully conducted according to required specifications. There is no NIST standard for optical mass measurement. Calibration of this instrument performed by TSI has been done using every oil and has been normally adjusted to respirable mass per standard ISO 12153-1. At test dust (Arizona dust). Our calibration ratio is greater than 4:1.

Measurement Variable	System ID	Last Cal.	Cal. Due	Measurement Variable	System ID	Last Cal.	Cal. Due
Flowmeter	E004123	09-05-17	03-31-18	Flowmeter	E004770	06-19-17	06-30-18
DC Voltage/Kentley	E002839	09-21-17	09-30-18	Resistors	M001124	11-02-16	11-30-18
Temp/Humidity	E000676	03-31-17	03-31-18	Temp/Humidity	E005637	03-06-17	03-31-18
Pressure	E003440	07-27-17	07-31-18				

Bro Lee
Calibrated
December 29, 2017
Date

CERTIFICATE OF CALIBRATION AND TESTING
TSI Instruments Ltd, Viking Road, Croydon Business Park
High Wycombe Bucks HP12 3ST England
Tel: (Int +44) (UK 6) 1494 459200 Fax: (Int +44) (UK 6) 1494 459700 <http://www.tsi.co.uk>

Environment Conditions		Model	AM520
Temperature	20.9 °C	Serial Number	5201713003
Relative Humidity	39.23 %RH		
Barometric Pressure	1001.7 hPa		

☒ As Left ☐ As Found ☒ In Tolerance ☐ Out of Tolerance

Concentration Linearity Plot

System ID: DT100-01

CONCENTRATION				Unit: mg/m3			
#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE
1	0.1	0.1	0.0-0.1	4	14.5	14.6	13.1-16.0
2	0.2	0.2	0.2-0.2	5	57.5	59.9	52.6-65.7
3	1.8	1.8	1.6-1.9				

TSI Incorporated does hereby certify that all materials, components and workmanship used in the manufacture of this equipment are in strict accordance with the applicable specifications agreed upon by TSI and the customer and with all published specifications. All performance and acceptance tests required under this contract were successfully conducted according to required specifications. There is no NIST standard for optical mass measurement. Calibration of this instrument performed by TSI has been done using every oil and has been normally adjusted to respirable mass per standard ISO 12153-1. At test dust (Arizona dust). Our calibration ratio is greater than 4:1.

Measurement Variable	System ID	Last Cal.	Cal. Due	Measurement Variable	System ID	Last Cal.	Cal. Due
Barometric Pressure	E004187	09-05-17	09-05-18	Temperature	E001182	09-05-17	09-05-18
Humidity	E004182	09-05-17	09-05-18	Flowmeter	E003356	11-09-17	11-03-18
Mass Balance	UK-W0130001	03-01-18	03-01-19	Flow and Temperature	UK-410009003	18-01-11	18-01-19
Pressure	E006180	09-05-17	09-05-18	DC Voltage	E003222	10-05-17	10-05-18
DC Voltage	E003223	09-05-17	09-05-18				

[Signature]
Calibrated
20 February, 2018
Date

Notes: