



REFERENCE NUMBER: MK ENV 01092002

POTENTIAL AIRBORNE POLLUTANTS EVALUATION RESULTS

***IDENTIFICATION, SAMPLING, ANALYSIS AND EVALUATION
OF EXPOSURE TO POTENTIAL AIRBORNE POLLUTANTS***

***Conducted in terms of the
“Guideline for the compilation of a Mandatory Code of Practice for an Occupational
Health Programme on Personal Exposure to Airborne Pollutants”
(DME Reference Number: 16/3/2/4-A1)***

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1.0. PURPOSE

To identify and evaluated occupational health risks associated with airborne pollutants at the various underground operations of the AngloGold West Wits and Vaal River Regions.

2.0. INTRODUCTION

An Airborne Pollutant Code of Practice (COP) was compiled for each underground operation. The aim of the COP is to protect and improve the health of employees at the mines, by monitoring and reducing their exposure to airborne pollutants. The COP should assist the employer to establish and maintain a system of occupational hygiene measurements with respect to airborne pollutants.

3.0. SURVEY METHODOLOGY

Refer to the Department of Minerals and Energy (DME) and the AngloGold Airborne Pollutant COP for survey methodology (Annexure 1).

A list of potential airborne pollutant sources at underground operations (Refer to Annexure 2) were compiled and individual exposures of employees (213 Occupations) to 310 potential pollutant sources were measured. The total amount of potential pollutant sources was divided between the seven underground operations for measurement. The results obtained during this survey will highlight all significant exposures to airborne pollutants, which will be the basis for the compilation of occupational hygiene measurement program.

Not all the identified airborne pollutant sources were evaluated:

- For four (4) pollutants a database already exist as part of our current monitoring systems (Annexure 3).
- Fourteen (14) pollutants (Annexure 4) were listed as not being hazardous on the NIOSH database.
- Nine (9) potential pollutant sources (Annexure 5) were not available for evaluation or the media for the measurement thereof were not available.

The various airborne pollutants were then identified per task, together with their health hazards and the exposure risks by a working committee. The members of the working committee are listed in Annexure 6.

Sample analysis was done by FHG Scientific Services (Annexure 7). Sampling and analysis methodology were performed according to international accepted standards.

4.0. STATUTORY REQUIREMENTS

According to the Codebook of the South African Mines Occupational Hygiene Program (SAMOHP) issued by the Department of Minerals and Energy, the employer must establish and maintain a system of occupational hygiene measurements, as contemplated in Section 12. An occupational hygiene-monitoring program must be implemented when the following airborne pollutant limits are reached (Table 1):

Table 1

Airborne Pollutant	Limit
Particles	$\geq 1/10$ of Occupational Exposure Limit
Gases & Vapours	$\geq 1/2$ of Occupational Exposure Limit

5.0. FINDINGS

Measurement results are reflected in Annexure 8. From the evaluation results it is clear that specific investigations must be conducted for the following activities:

- Welding (Cadmium = 3500% of OEL)
- Electrocleaning (Tetrachloro-ethylene = 1352% of OEL, Xylene = 90.8% of OEL and Hydrocarbons = 295% of OEL).
- Galvanised welding (Potassium = 17% of OEL and Zinc = 39.4% of OEL).

The specific investigation must be conducted as per section 4.1.3 and Figure 1 of the operation specific “Mandatory Code of Practice for an Occupational Hygiene Programme on Personal Exposure to Airborne Pollutants”.

Exposure to Blasting Fumes (Annexure 3) must be controlled as per the operations currently implemented administrative controls (e.g. blasting schedules, withdrawal of employees, etc.) as well as applicable managerial instructions. Adherence to these standards will result in no exposure to harmful pollutants.

Exposure to diesel fumes must be evaluated after completion of SIMRAC Report GEN 010 (Control of Diesel Exhaust in Underground Workings).

6.0. CONCLUSION

Of the 310 identified potential pollutant sources only three activities with exposures greater than the OEL were identified. Specific investigations must be conducted for these activities. Exposure to Airborne Pollutants indicated in Annexure 5, as well as Blasting Fumes, were not measured and must be evaluated during the next revision of the COP. Although not specifically evaluated during this process, exposure to respirable dust will be controlled and monitored as per the process described in the Mandatory Code of Practice for an Occupational Hygiene Programme on personal exposure to Airborne Pollutants (Annexe 1).

ANNEXE 1

MANDATORY CODE OF PRACTICE FOR AN OCCUPATIONAL HYGIENE PROGRAMME ON PERSONAL EXPOSURE TO AIRBORNE POLLUTANTS



Mine Logo

XXXXXX MINE

**MANDATORY CODE OF PRACTICE
FOR AN OCCUPATIONAL HYGIENE PROGRAMME ON
PERSONAL EXPOSURE TO AIRBORNE POLLUTANTS**

Status of this Code of Practice:

- This Code of Practice was drawn up in accordance with guideline Department of Minerals and Energy Reference Number DME 16/3/2/4-A1 issued by the Chief Inspector of Mines,
- This is a mandatory Code of Practice in terms of section 9(2) and (3) of the Mine Health and Safety Act. 1996 (Act no.29 of 1996),
- This Code of Practice may be used in an investigation / inquiry to ascertain and also to establish whether the Code of Practice is effective and fit for purpose,
- This Code of Practice supersedes all previous relevant Code of Practices,
- All managerial instructions, recommended procedures and standards on the relevant topics must comply with this Code of Practice and must be reviewed to ensure compliance.

REV	DESCRIPTION OF REVISION	REVISION DATE	EFFECTIVE DATE	APPROVED BY MANAGER
Draft 01	Original		Not later than 01-07-2002	Date: Signature:

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1. MEMBERS OF THE DRAFTING COMMITTEE

In terms of section 9(4) of the Mine Health and Safety Act, the Employer consulted with the Health and Safety Committee on the preparation, implementation and / or revision of this Code of Practice.

After consultation with the Health and Safety Committee the Employer appointed a Drafting Committee responsible for drafting this Code of Practice.

The Drafting Committee consisted of the following members:

Full Name	<i>Designation</i>	<i>Affiliation/s</i>	<i>Experience</i>
e.g.			
Jacobus Johan Dekker	Environmental Safety and Health Manager	Anglogold Corporate Office	Mine Occupational Hygienist since November 1988

NOTE:

It is suggested that at least the following persons be included in the drafting committee:

- Mine Occupational Hygienist
- Mine Occupational Health Practitioner
- Mine Legal Co-ordinator

2. GENERAL INFORMATION

2.1 Description of Mine and its location:

XXXXX Mine is a gold mine situated in the ??? Province near town / city. Mining takes place at a mean rock-breaking depth of ??? meters. Production from stoping and development amounts to approximately ??? tons per month.

2.2 Commodities produced:

Gold, Uranium, Sulphuric Acid, etc.

2.3 Mining method:

The following mining methods are utilised:

- Breast stoping – Conventional drilling and blasting
- Multi-blast development – Hydropower drilling and conventional blasting
- Slime dam recovery – Water jetting and enclosed pipe transportation
- Gold recovery – Carbon in leach metallurgical plant
- Etc.

The results of the investigations, into the extend of mechanisation, and the potential pollutants associated with the mechanisation will be (after proper investigation – see section 4) filed in the office of the Mine Occupational Hygienist.

2.4 General ventilation arrangements:

The mine is ventilated by quantity & duty surface exhaust fans. An additional quantity auxiliary fans are utilised to direct the ventilation flow.

2.5 Related Codes of Practices and other Management Standards:

Other related Codes of Practices and Management Standards are listed in Appendix A.

3. DEFINITIONS AND ACRONYMS (note: delete those not applicable)

“airborne pollutant” means any substance in the air that is harmful to health, including dust, fumes, aerosols, gases, fibres, vapours or mists;

“analysis methodology” means analysis techniques used to quantify a pollutant collected on or in sampling media (e.g. gas chromatography/mass spectrometry);

“COP” means Code of Practice;

“DME” means the Department of Minerals and Energy;

“dose” means the amount of a pollutant to which a person is exposed;

“exposure” means the subjection of a person to an airborne pollutant in the course of employment through any route of entry (e.g. inhalation, ingestion, skin contact, or absorption);

“HEG” means a homogeneous exposure group;

“homogeneous exposure group ” means a group of employees who experience pollutant exposures similar enough that monitoring exposures of any representative sub group of employees in the group provides data useful for predicting exposures of the remaining employees;

“Mine Occupational Hygienist” means the person appointed in terms of section 12(1) of the MHSA;

“Mine Occupational Medical Practitioner” means the person appointed in terms of section 13(3) of the MHSA;

“MOHAC” means Mining Occupational Health Advisory Committee;

“monitoring” means the repetitive and continued observation, measurement, and evaluation of health and/or environmental or technical data, according to prearranged schedules, using nationally or internationally acceptable methodologies;

“MHSA” means Mine Health and Safety Act, 1996 (Act No.29 of 1996);

“NIOSH” means the United States National Institute for Occupational Safety and Health;

“SAMOHP” means the South African Mines Occupational Hygiene Programme Codebook;

“significant airborne pollutant” means any airborne pollutant to which any employee is exposed in concentrations equal to or exceeding the hazard limits contemplated in regulation 9.2.1.;

“90th percentile” means the value which must be used to determine when HEG’s need to be re-classified. This value can be calculated by:

- 1) using Microsoft Excel programme (percentile function); or
- 2) first placing all sample results in order from the lowest concentration to the highest concentration (i.e., concentration of specific contaminants). Next, assign each sample result a number, starting with the number 1 for the lowest concentration result up to the highest concentration being given the number equal to the total number of samples collected in that HEG. Multiply the total number of samples collected by 0.9. The sample result with the number corresponding to this calculated value is the 90th percentile.

4. RISK MANAGEMENT / OCCUPATIONAL HEALTH PROGRAMME

The Occupational Health Programme for personal exposure to airborne pollutants is summarised in figure 1.

4.1 Occupational Hygiene Programme.

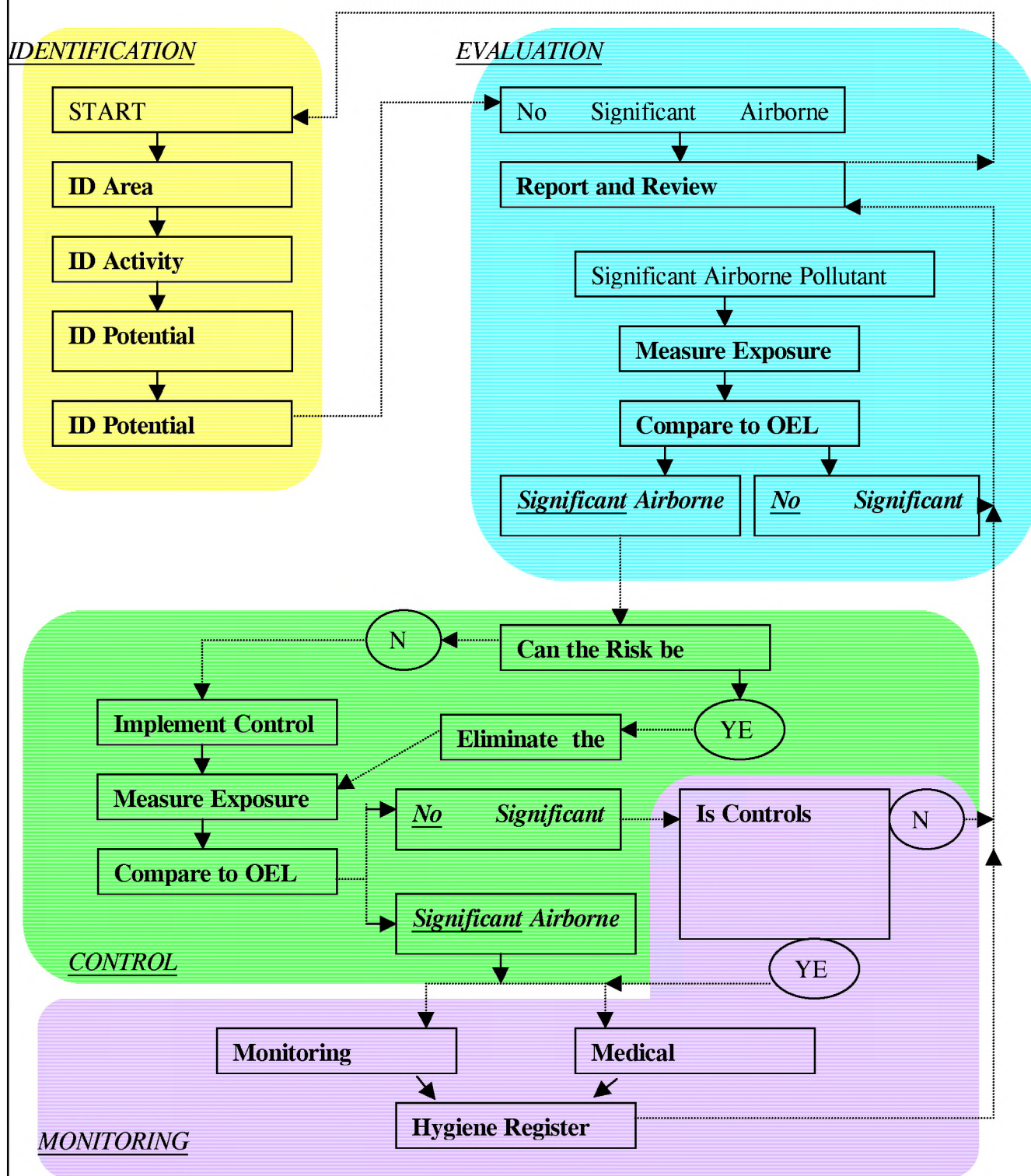
Appendix B is attached to this COP to assist the Mine Occupational Hygienist in conducting the risk assessment.

4.1.1 Identification.

- a) The Mine will be sub-divided into sampling areas.
e.g. Surface = Sampling Area 1 (or “S1” for surface sampling area 1)
Underground Ventilation District 1 = Sampling Area 2 (or “VD1” for underground ventilation district 1).
- b) Each sampling area will then be sub-divided in Activity Areas, as per the Activity Area Code List found in SAMOHP, part B, section 3.
e.g. Sampling Area 2 = Underground Ventilation District 2 = VD2
This sampling area has 3 Activity Areas, namely:
 - Stoping [08],
 - Development (Single Shift) [09], and
 - Ground Handling (Conveyor/Loco’s) [15]
- c) The potential pollutant sources (e.g. task being performed, type of tools / mechanisation being utilised, etc.) for each Activity Area will be identified.
- d) The potential pollutants for each pollutant source will be identified.
- e) The characteristic properties of each potential pollutant will be identified. This includes it’s:
 - Airborne nature (e.g. gas, fume, vapour, mist, fibre, dust, etc),
 - Route of entry (e.g. inhalation, absorption, ingestion, etc), and
 - Health effects that it can have on employees (e.g. asthma, cancer, pneumoconiosis, ocular, etc).
- f) The following information sources may be utilised to identify the pollutant sources, the potential pollutants and the characteristic properties of the potential pollutants:
 - Mine Occupational Hygienist professional judgement,
 - Accident statistics and investigation reports,
 - Research reports,
 - Manufacturers specifications and reference documentation,
 - Design criteria and performance figures for equipment,
 - Material Safety Data Sheets,
 - Etc.

FIGURE 1

OCCUPATIONAL HEALTH PROGRAMME



4.1.2 Evaluation.

- a) The Pollutant Concentration (PC) for each potential pollutant will be calculated as follows:

$$\text{PC for a single pollutant} = \frac{\text{Average pollutant concentration}}{\text{OEL (Legal Limit)}} \times 100$$

- b) The Air Quality Index (AQI) will be calculated (as indicated below) when two or more pollutants; with additive effects; are present.

$$\text{Pollutant Index (PI)} = \frac{\text{Average pollutant concentration}}{\text{OEL (Legal Limit)}}$$

$$\text{AQI} = \text{PI}_1 + \text{PI}_2 + \text{PI}_3 + \dots + \text{PI}_n$$

- c) The average pollutant concentration can be obtained from previously measured data. Where no previous data exist, measurements / samples will be taken in accordance with an acceptable international method (e.g. NIOSH Occupational Exposure Sampling Strategy Manual, British Standard BS EN 689:1996, etc).
- d) The results obtained in sections 4.1.1.a and 4.1.1.b will then be utilised to determine the classification band for each pollutant in the specific activity area. The classification band table as indicated in SAMOHP – Part A – Section 2.1.3 will be utilised for this purpose.

4.1.3 Control.

- a) The Mine Occupational Hygienist will determine how the significant airborne pollutants, identified in the risk assessment process, must be dealt with.
- b) As far as reasonably practicable:
- attempts will first be made to eliminate the risk,
 - thereafter to control or isolate the risk at source,
 - thereafter to minimise the risk,
 - thereafter, insofar as the risk remains, to provide personal protective equipment, and to institute a programme to monitor the risk and related controls.
- c) The Mine Occupational Hygienist shall draw up and co-ordinate the implementation of a formal action plan to reduce or maintain exposures to below the OEL's.
- d) Where controls of any sort is utilised to reduce the airborne pollutant exposure concentrations the Mine Occupational Hygienist shall implement a program to ensure that the controls are:
- Maintained at regular intervals,

- Inspected and tested for efficiency at regular intervals.
- e) Records of the action plans and progress reports shall be filed in the office of the Mine Occupational Hygienist.

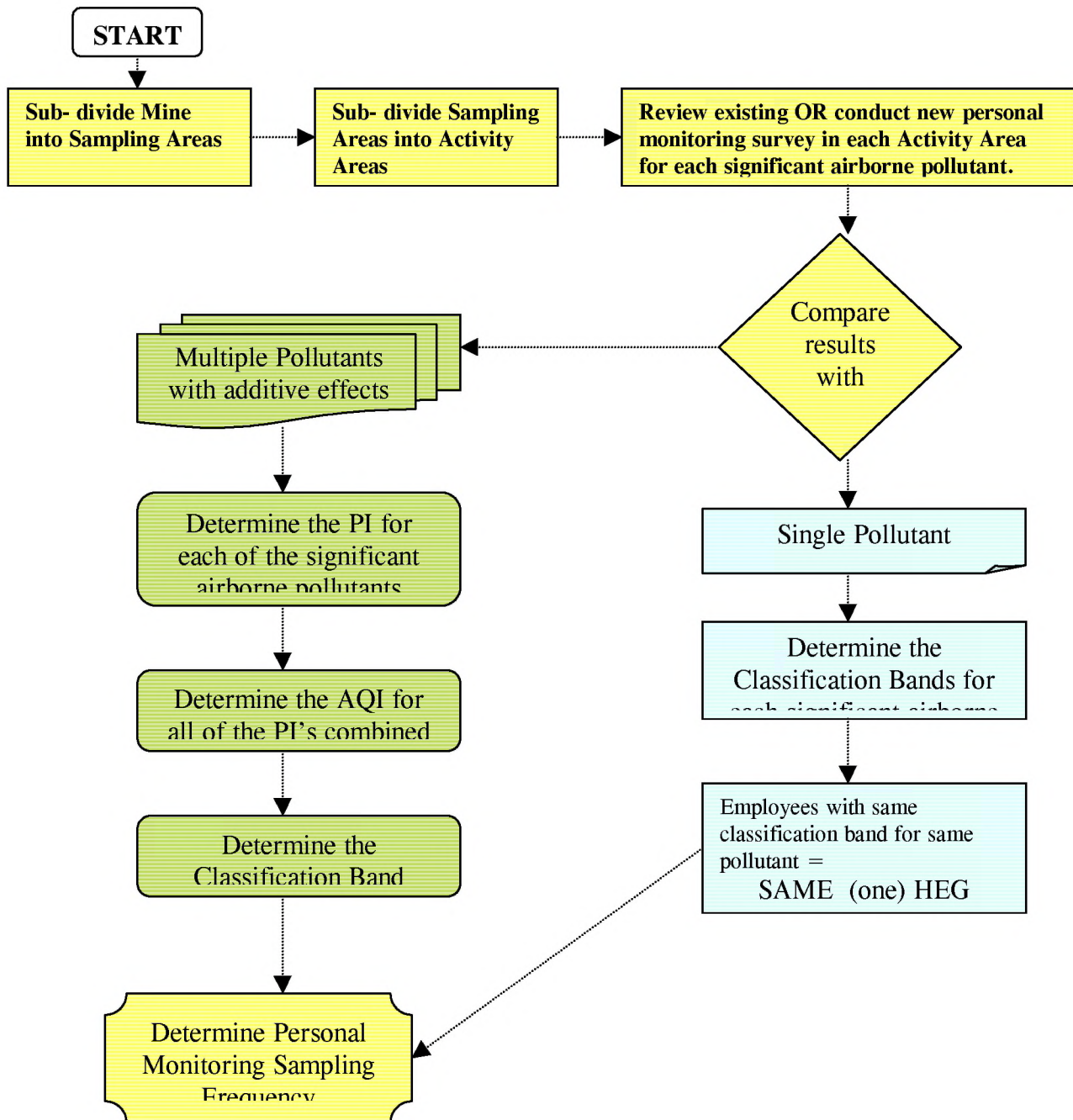
4.1.4 Personal Exposure Monitoring

4.1.4.1 Determination of HEGs and sampling frequency.

- a) A summary of the HEG and sampling frequency determination process is illustrated in figure 2 and an example is represented in example 1.
- b) HEG determination will only be done for:
 - Single pollutants with a Pollutant Concentration $\geq 10\%$, and
 - Pollutants with additive effects with an AQI $\geq 0,1$.
- c) The Activity Areas will be determined as per sections 4.1.3.1.a and b of this COP.
- d) The Pollutant Concentration and Air Quality Index will be calculated as per sections 4.1.3.2.a to c of this COP.
- e) The measured airborne pollutant 90th percentile value for each activity area will be calculated. (See Appendix C for methodology).
- f) The average pollutant concentration and the Classification band table (SAMOHP – Part A – Section 2.1.3) will be utilised to determine the classification category for each pollutant.
- g) Employees with the same classification band for the same pollutant, within the same activity area will then form one HEG.
- h) HEGs will be clearly demarcated on a plan or sketch or description document. This plan or sketch or description document will be made available in the office of the Mine Occupational Hygienist. Where chemical processes are involved, a flow chart of the process will be made available in the office of the Mine Occupational Hygienist.
- i) The average pollutant concentration and the Mandatory Frequency of sampling table (SAMOHP – Part A – Section 2.1.4) will be utilised to obtain the personal monitoring sampling frequency for each HEG.
- j) HEGs will be re-assessed and / or re-classified when:
 - the 90th percentile indicates the need (see example 2 for explanation);
 - exposure levels change due to controls being initiated and likewise when controls deteriorate;

FIGURE 2

DETERMINATION OF HEG's AND SAMPLING FREQUENCY



- employee complaints are received;
- processes are changed (e.g. change in procedures, mining and ventilation layouts, mining methods, plant, equipment or material);
- occupational illness occurs;
- a change in exposure category occurs; and
- other events warranting re-evaluation occurs (i.e. new technological data and new regulatory initiatives).
- re-classification will only be done if results are proven and consistent.

4.1.4.2 Personal Exposure Sampling

- a) Accurate, meaningful samples, which are representative of all full working shifts for each HEG, will be obtained from personal monitoring.
- b) The exposures measured (dose allocated) for any individual employee within that HEG will be allocated to the Hygiene record/s of that specific employee and to all the other employees within that HEG.
- c) For a given HEG samples will be randomly assigned covering all shifts (to different employees on different days over the monitoring time period). All job categories within a HEG will be randomly sampled on each shift.
- d) The Mine Occupational Hygienist will determine whether additional samples need to be taken in order to increase the confidence that HEGs are appropriately categorised.

4.1.4.3 Sampling Strategy

A sampling strategy including a monitoring schedule for each HEG will be compiled for the cycle period, and records thereof will be kept in the office of the Mine Occupational Hygienist for a period of at least two years.

4.1.4.4 Sampling Methodology

- a) For each significant pollutant identified, an appropriate sampling methodology, which complies with internationally compatible best practice, will be selected and implemented.
- b) The relevant methodology chosen for each significant pollutant identified will be listed in Appendix D.
- c) A quality control programme for the sampling methodology, compatible with internationally acceptable methodology will be developed, implemented and also referenced in Appendix D.

4.1.4.5 Analysis Methodology

- a) For each significant pollutant identified, an appropriate analysis methodology, which complies with internationally compatible best practice, will be selected, implemented and also referenced in Appendix D.
- b) A laboratory that is accredited in terms of the South African National Accreditation System (S.A.N.A.S) to do so, will be contracted to do the sample analysis.

4.1.5 Reporting and Recording

4.1.5.1 Activity area assessment records and reports.

A record keeping system, which records the history of each activity area for a period of at least 5 years, will be kept in the office of the Mine Occupational Hygienist. This system will include information on the following:

- Reasons for any deviation of sample results (e.g. controls not operating effectively, events or factors which have influenced the results),
- Hierarchy of Controls initiated (description of method used e.g. elimination, engineering controls, administrative controls, personal protective equipment).

4.1.5.2 Mandatory DME reports.

Reports will be submitted to the DME in the format and at the frequencies as described in SAMOHP – Part A.

4.1 Occupational Health Programme (Medical Surveillance).

4.2.1 Linkage between occupational hygiene and medical surveillance

- a) The Integrated Risk Management System (IRMS) Occupational Hygiene Modules will be utilised to link personal monitoring to medical records.
- b) Effective communication between the Mine Occupational Hygienist and the Occupational Medical Practitioner will be established to ensure that exposure history and medical manifestation of systems are meaningful.

4.2.2. Code of Practice for Medical Examinations and Medical Surveillance.

The Code of Practice for the Establishment of a System of Medical Surveillance (also available on the AngloGold Intranet site at [http://172.18.212.22/ahs/Documents/COP Medical Surveillance.doc](http://172.18.212.22/ahs/Documents/COP%20Medical%20Surveillance.doc)) describes how the following examinations required by the MHSA will be conducted at the mine:

- a) Initial examination – in terms of section 13(2)(c) of the MHSA.
- b) Periodic examination – in terms of section 13(2)(c) of the MHSA.
- c) Exit examination – in terms of section 17 and 19(2) of the MHSA.

4.2.3 *Occupational Medicine Manual.*

The Occupational Medicine Manual (also available on the AngloGold Intranet site at <http://172.18.212.22/ahs/default.asp>) describes:

- a) The methodological standards for the test techniques forming part of the medical surveillance program.
- b) How lung function testing will be conducted.
- c) The Tuberculosis surveillance program.
- d) The system of medical surveillance that combines the requirements of medical surveillance for different significant hazards in such a way that these requirements are met effectively and efficiently.

5. **IMPLEMENTATION PLAN**

- 5.1 The Mine Health and Safety Committee will draw up a detailed implementation plan to effectively ensure compliance with the requirements of this COP. (see Appendix F for suggested format)
- 5.2 The Mine Occupational Hygienist will monitor compliance of the completion dates (as indicated in the implementation plan) and report any deviations to the Mine Health and Safety Committee for action.

6. **COMPLIANCE WITH THIS COP**

The Mine Occupational Hygienist will conduct audits (at least once per annum) to monitor and ensure compliance with this COP.

7. **ACCESS TO THE COP AND RELATED DOCUMENTS**

- 7.1 The complete COP and related documents will be kept in the office of the Mine Occupational Hygienist and will be made readily available for examination by any affected person (describe the process).
- 7.2 A registered trade union with members at the mine or where there is no such union, a health and safety representative on the mine, or, if there is no health and safety representative, an employee representing the employees on the mine, will be provided with a copy of the COP (on written request to the manager).
- 7.3 A register will be kept (in the office of the Legal Co-ordinator) of such persons or institutions with copies to facilitate updating of such copies.
- 7.4 The Manager (employer) will ensure that all employees are fully conversant with those sections of the COP relevant to their respective areas of responsibilities.

8. **REVIEW**

- 8.1 This COP will be reviewed at least annually.
- 8.2 The COP will also be reviewed when:

- employee complaints are received;
- processes are changed (e.g. change in procedures, mining and ventilation layouts, mining methods, plant, equipment or material);
- an increase in existing occupational illness occurs;
- new occupational illnesses are reported;
- other events warranting review occurs (i.e. new technological data and new regulatory initiatives).

8.3 All the related documents (as referenced in Appendix A) will be reviewed very time that this COP is reviewed.

APPENDIX A

LIST OF RELATED CODES OF PRACTICES AND MANAGEMENT STANDARDS

(Forms part of this COP)

Document Title	Reference Number	Revision		Status of document
		Number	Date	
e.g.				
Crystalline Silica, Occupational Health Modus Operandi	Mine reference			Modus Operandi
Lead Guideline	AG SA Met 2.1	0	01 August 2001	Guideline

APPENDIX B

IDENTIFICATION OF MECHANISATION AND THE POTENTIAL POLLUTANTS ASSOCIATED WITH IT AND OTHER SOURCES (Risk Assessment Performa – Assistance document)

Mine Name: _____

Report reference number: _____

Sampling area number: _____

Compiled by: _____

Sampling area description: _____

Date: _____

IDENTIFICATION						
Activity area code ⁽¹⁾						
Activity area description ⁽¹⁾						
Task / Activity being performed						
<i>Potential Pollutant Sources</i>						
Number	1	2	3	4	5	6
Description						
Pollutant Code ⁽²⁾						
Pollutant Description ⁽²⁾						
Pollutant Airborne nature						
Possible exposure pathways						
Possible health effects						

(1) – SAMOHP, Part B, Section 3

(2) – SAMOHP, Part B, Section 5

EVALUATION						
Source Number	Pollutant Code	Measured exposure	Legal Limit ⁽³⁾	Pollutant Concentration (PC)	Air Quality Index (AQI)	Classification Band Category ⁽⁴⁾

(3) – Schedule 22.9(2)(a) of MHSA

(4) – SAMOHP, Part A, Section 2.1.3

CONTROL				
Action Required		Responsible Person		
What	By when	Name	Designation	Signature

Additional remarks (if any):

Mine Occupational Hygienist	ESH Manager	Section Manager	Mine Manager
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APPENDIX C

DETERMINING THE 90TH PERCENTILE BY UTILIZING MICROSOFT EXCEL (Assistance document)

To install the Analysis ToolPak:

- On the **Tools** menu, select **Add-Ins**.
- If **Analysis ToolPak** is not listed in the **Add-Ins** dialog box, click **Brows** and locate the drive, folder name, and file name for the Analysis ToolPak Add-Ins, Analys32.xll (usually located in the Library\Analysis folder, or run the Setup program if it isn't installed).
- Select the **Analyses ToolPak** check box.

To use the Analyses ToolPak:

- Before using the analysis tool, you must first arrange the data you want to analyse in one column (e.g. A1 to A40 – if you have 40 values that you want to analyse).
- On the **Tools** menu, click **Data Analyses**.
- In the **Analysis Tools** box, select the **Rank and Percentile** tool.
- Enter the input range (e.g. A1 to A40).
- Select the **Grouped by Columns** option.
- Select the output range (e.g. B1 to B40).
- Select **OK**.
- In the **Percent** column, select the % value closest to 90%.
- The Column 1 value corresponding with this selected % value is the 90th percentile.

APPENDIX D

REFERENCE TO SAMPLING AND ANALYST METHODOLOGY AND QUALITY CONTROL PROGRAM (Forms part of this COP)

[illegible]

(1) – SAMOHP, Part B, Section 5

APPENDIX E

DETAILED IMPLEMENTATION PLAN (Assistance document)

Action Required	Completion	Responsible Person		
		Name	Designation	Signature

APPENDIX F

REFERENCE DOCUMENTS (for information only)

1. Guidelines for the gravimetric sampling of airborne particulate for risk assessment in terms of the Occupational Diseases in Mines and Works act No 78 of 1973
Reference: GME 16/2/3/2/3
2. NIOSH Manual of Analytical Methods - 4th edition - C. QUALITY ASSURANCE
3. Occupational Exposure Sampling Strategy Manual – NIOSH
PB 274 792
US Department of Health, Education and Welfare
4. SIMRAC Project – Practical Guide to the Risk Assessment Process
5. South African Mines Occupational Hygiene Programme Codebook (SAMOHP)

EXAMPLE 1

DETERMINATION OF SAMPLING FREQUENCY

Step	Action	Section of this COP
1	Sampling Area = Underground Ventilation District 1 (VD1)	4.1.3.1.a)
2	Activity Area = Stopping [08]	4.1.3.1.b)
3	Potential Pollutant Source = Drilling	4.1.3.1.c)
4	Potential Pollutant = Crystalline Quartz Silica [552]	4.1.3.1.d)
5	Occupational Exposure Limit (OEL) for Crystalline Quartz Silica = 0,1 mg/m ³	4.1.3.2.a)
6	Historical data for pollutant 552 (Crystalline Quartz Silica) = Sample No. 1 2 3 4 5 6 7 TWA (mg/m ³) 0,01 0,02 0,05 0,1 0,11 0,06 0,07 Sample No. 8 9 10 <i>Average</i> TWA (mg/m ³) 0,01 0,11 0,1 <i>0,064 mg/m³</i>	4.1.3.2.c)
7	$\text{Pollutant Concentration (PC)} = \frac{0,064}{0,1} \times 100$ $= 64 \% \text{ of OEL}$	4.1.3.2.a)
8	Classification Band Category = B	4.1.3.2.d)
9	Sampling Frequency = 5% of employees on a 6 monthly basis with a minimum of 5 samples	4.1.3.4.1.i)

EXAMPLE 2

EXPLANATION ON THE USE OF THE 90TH PERCENTILE VALUE

The 90th percentile value is only utilised as a test mechanism to determine if a HEG is correctly populated.

A HEG is only correctly populated if the Pollutant Concentration (calculated by both the average concentrations AND the 90th percentile value) results in the same classification band category.

FOR EXAMPLE,

The following sample results were obtained from HEG 1 after 3 months of sampling:

Sample Number	TWA (mg/m³)
1	0,01
2	0,02
3	0,02
4	0,03
5	0,04
6	0,05
7	0,09
8	0,09
9	0,11
10	0,11
<i>Average</i>	<i>0,057</i>
<i>90th Percentile</i>	<i>0,11</i>

$$\begin{aligned}\text{Pollutant Concentration (PC)} &= \frac{\text{Average concentration}}{\text{OEL}} \times 100 \\ &= \frac{0,057}{0,1} \times 100 \\ &= \underline{57 \%}\end{aligned}$$

Thus, classification band category = B

BUT

$$\text{PC calculated by means of the 90th percentile value} = \frac{0,11}{0,1} \times 100 = \underline{110 \%}$$

Thus, classification band category now = A

REMEMBER that both classification band categories must be the same!

After investigation HEG 1 was divided into 2 separate HEGs, with the following results:

HEG 1a			HEG 1b		
Sample No		TWA	Sample No		TWA
PC by means of	1	0,01	PC by means of	7	0,09
	2	0,02		8	0,09
	3	0,02		9	0,11
	4	0,03		10	0,11
	5	0,04		Average	0,1
	6	0,05		90 th Percentile	0,11
Classification band category	Average	0,028	Classification band category	Average	100%
	90 th Percentile	0,04		90 th Percentile	110%
	Average	28 %		Average	A
	90 th Percentile	40 %		90 th Percentile	A
	Average	C			
	90 th Percentile	C			

From the above it is clear that HEG 1 needs to be re-populated into HEG 1a and HEG 1b.

ANNEXURE 2
HEGS IDENTIFICATION DOCUMENT

HEG Identification : **TRACKLESS MINING (13)**

Activity Description	
Activity Area Code	
Occupations	Code
Load haul dump driver	21106
Loader driver	21104

Chemicals Involved

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
<i>Dust</i>		Dust	Inhalation or eye contact	Coughing & mild irritation. Eye contact may result in tears and mild irritation to the eyes.	Blasting, scraping, tipping, drilling, transport, travelling, spillage.	Finely divided solid matter.	OEL = 1 mg/m³ STEL = n/a	
Silica Dust (respirable)	522	Dust	Inhalation, skin and/or eye contact	Coughing and mild irritation. Skin contact may result in granulomas. Silicosis may occur with prolonged exposure.	Blasting, scraping, tipping, drilling, transport, travelling,	Colourless to white, green, purple or black crystals. Odourless.	OEL = 0.1mg/m³	14808-60-7

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				Carcinogenogen.	spillage.			
Diesel fumes		Mist Vapour	Inhalation	Carcinogen	Diesel machinery	Colourless oily liquid. May burn if strongly heated.	<u>NO2-</u> OEL = 5mg/m3 STEL = 9mg/m3 <u>SO2-OEL</u> = 5mg/m3 STEL = 13mg/m3 <u>NO</u> OEL = 30mg/m3 STEL = 45mg/m3 <u>CO</u> OEL = 55mg/m3 <u>DIESEL PARTICULATE MATTER</u> OEL = ?	
Ammonia	24	Gas	Inhalation, ingestion (solution), skin and/or eye contact (solution/liquid)	Corrosive gas - may be fatal if inhaled. Lung injury. Severe respiratory tract irritant. Irritating to the nose and throat. Mildly irritating to moist skin - blisters may occur.	Blasting operations	Colourless gas with a sharp, pungent, suffocating, intensely irritating odour. Colourless liquid under pressure but can decompose at high temperature to form very flammable hydrogen and toxic nitrogen	OEL = 17 mg/m3 STEL = 24mg/m3	7664-41-7

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
						dioxide.		
Carbon oil	43	Liquid Vapour	Inhalation, ingestion (solution), skin and/or eye contact (solution/liquid)	Harmful when inhaled or swallowed. Central nervous system depressant. It causes headache, nausea, dizziness, drowsiness, and confusion. It may cause blood and bone marrow effects. Aspiration hazard. Prolonged exposure may result in dermatitis. Carcinogen & Mutagen.	Engineering operations	Clear and colourless liquid. Aromatic hydrocarbon odour. Vapour is heavier than air, thus might spread long distances. Liquid can float on water, thus might spread fire. Decompose at high temperature and forming toxic gases.	Toluene-OEL = 188mg/m3 STEL = 560mg/m3 Tetrachloroethylene-OEL = 335mg/m3 STEL = 1000mg/m3 EthylBenzene-OEL = 435 STEL = 545mg/m3 Xylene-OEL = 435 STEL = 650mg/m3	
Hydraulic Fluid		Liquid Mist Vapour	Inhalation Skin and/or eye contact Ingestion	It is mildly irritating to the skin and eyes. Inhalation may result in mild irritation of the upper respiratory tract. This product is slightly toxic when swallowed.	LHD machinery Engineering operations	Amber lubricating liquid. It has a hydrocarbon odour. Is oxidating.	None available	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Degreaser		Gas Mist	Inhalation, skin and/or eye contact	May cause pain and irritation to the skin and eyes. Inhalation may cause headache, dizziness, anesthesia, and unconsciousness. Repeated exposure may cause kidney and liver effects. Pulmonary irritation may occur and dermatitis may result from repeated exposure.	Engineering operations	Colourless liquid with an irritating odour. It is slightly soluble in water. Corrosive.	Not applicable	
Mineral oil	450	Gas Mist	Inhalation, skin and/or eye contact	Skin, eye and lung irritation.	Engineering operations	Colourless to light brown liquid. It is flammable.	OEL = 5 mg/m ³ STEL = 10 mg/m ³	
Grease	298	Fluid	Inhalation Skin	Mild skin and eye irritation. Inhalation of smoke contaminated with grease may cause throat irritation, coughing and tightness in chest. Lungs may become irritated from fluorine components.	Engineering operations	White dense and viscous fluid	Not applicable	
Welding fumes	598	Fumes	Inhalation	<i>Metal fume fever:</i> Muscle pains Shivering Chest tightness	Welding operations		OEL = 5 mg/m ³	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				Feverishness				
Aerosol Paint		Liquid Vapour Fumes Mist	Inhalation Skin and/or eye contact Ingestion	May cause skin and eye irritation. When inhaled or ingested person may suffer from severe respiratory distress as well as central nervous system depression. Prolonged and/or repeated skin contact may cause dermatitis.	Marking off	Various colours Flammable	Not applicable	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
White wash		Liquid Vapour Mist Dust	Inhalation Skin and/or eye contact Ingestion	May cause skin and eye, nose and throat irritation. Harmful if inhaled. Aspiration hazard when swallowed. With chronic exposure central nervous system disorders like weakness, loss of co-ordination, fatigue, confusion and blurred vision may occur. Liver abnormalities as well as kidney, lung spleen and eye damage may occur. Cardiac effect on some persons.	For fire retardant application	Ammonia-like odour Flammable	<u>Titanium dioxide-</u> OEL = 10mg/m3 <u>Calcium</u> <u>Carbonate-</u> OEL = 10mg/m3 <u>Propylene glycol-</u> OEL = 470mg/m3 <u>Dimethylene</u> <u>Glycol-OEL = ?</u> <u>Xylene-</u> OEL = 435mg/m3 STEL = 650mg/m3 <u>Acetone-</u> OEL = 1780mg/m3 STEL = 3560mg/m3 <u>Ethyl Benzene-</u> OEL = 435mg/m3 STEL = 545mg/m3 <u>Toluene-</u> OEL = 188mg/m3 STEL = 560mg/m3 <u>Tetrachloroethylene</u> -OEL = 335mg/m3 STEL = 1000mg/m3	
Ammonium nitrate		Liquid Gas Mist	Inhalation Skin and/or eye contact Ingestion	Skin and eye contact may cause dryness and irritation. Inhalation may cause a sore throat, coughing and a shortness of breath. Ingestion may	Blasting operations	White to cream in colour, but odourless.	None available	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				cause dizziness, cramps, vomiting, blood disorders, weakness and depression.				
Metal Powder		Dust	Inhalation Skin and/or eye contact	Fumes generated may be dangerous. Dryness and irritation of the throat, nose, eyes, and lungs may occur. Dizziness and nausea may result. May be a carcinogen.	Blasting operations	Odourless metallic grey powder.	None available	
Copper metal	154/155	Dust Vapour Fumes	Inhalation Skin and/or eye contact Ingestion	Is a mechanical irritant when in eye which may cause severe corneal damage. When ingested it may cause intense abdominal pain. Inhalation may cause metal fume fever, headache, a metallic taste in mouth, cough, thirst, shortness of breath, fever, pain in the legs and chest. May discolour the skin.	Blasting operations	Bright reddish, lustrous metal in the form of foil, wire or turnings. Odourless.	OEL = 1 mg/m³ STEL = 2 mg/m³	7440-50-8
Nitrocellulose		Dust Gas	Inhalation Skin and/or eye contact	Skin and eye contact may cause irritation. Inhalation may cause narcosis, weakness,	Blasting operations	Alcohol odour.	None available	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				drowsiness and unconsciousness.				
Tin	567/568	Dust Fumes	Inhalation Skin and/or eye contact Ingestion	Skin and eye contact may cause mechanical irritation. Inhalation may cause fatigue and anaemia. Central nervous system damage, nasal inflammation and kidney disfunction may occur. It may also cause headache, nausea, muscular pain and possible liver damage.	Blasting operations	Silver-grey metal that's odourless. Various shapes and sizes.	OEL = 2 mg/m³ STEL = 4 mg/m³	
Citric acid		Dust	Inhalation Skin and/or eye contact	Skin and eye contact may cause a slight irritation. If inhaled irritation may occur.	Blasting operations	Powder with no known odour. Colourless crystals.	None available	
Gold reference		Liquid Mist	Inhalation Skin and/or eye contact Ingestion	Skin and eye contact may cause irritation, burns, blisters, watering, conjunctivitis and dermatitis. Inhalation may also cause irritation of the eyes, nose, throat, and upper respiratory tract, coughing and choking. Over exposure may lead	Blasting operations	Clear, yellow liquid with a slight hydrochloric acid odour.	None available	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				to ulceration of the oral and nasal mucosa. Ingestion may cause burns to the mouth, throat, oesophagus and stomach. It may also cause nausea and vomiting.				
Iron	348	Dust Fumes Mist	Inhalation Skin and/or eye contact Ingestion	It may cause mild irritation to the respiratory tract when inhaled. Large doses ingested may cause gastrointestinal disturbances. Skin and eye contact may cause irritation.	Blasting operations	White crystals with no odour.	OEL = 5 mg/m STEL = 10 mg/m³	1309-37-1
Activated charcoal		Dust	Inhalation Skin and/or eye contact Ingestion	If inhaled it may cause respiratory tract and cardiovascular effects. When ingested it may cause mild irritation to the gastrointestinal tract. Skin and eye contact may cause redness.	Blasting operations	Fine black powder that's odourless. Flammable	None available	
Polyethylene		Dust Vapours	Inhalation Skin and/or eye contact Ingestion	Eye contact may result in irritation or corneal injury due to mechanical action.	Blasting operations	No odour.	None available	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Potassium nitrate		Dust Fumes	Inhalation Eye contact	Eye contact may cause mild irritation and may burn. Dust may be irritating when inhaled. Symptoms like weakness, depression, headache, mental impairment, dizziness, abdominal cramps, vomiting, bloody diarrhea, convulsions and collapse may occur.	Blasting operations	White to buff crystals. No odour.	None available	
Polycarbonate		Dust Fumes	Inhalation Skin and/or eye contact Ingestion	Eye contact may cause irritation and corneal injury due to mechanical action. Prolonged exposure to skin may cause irritation due to mechanical irritation. Dust inhaled may cause irritation to the upper respiratory tract.	Blasting operations	Milky white or coloured solid with a mild odour.	None available	
Silicon dioxide		Dust Gas Mist	Inhalation Skin and/or eye contact Ingestion	It is slightly irritating to the skin, and mildly irritating to the eyes. Inhalation may result in upper respiratory irritation and emphysema. Repeated exposure may result in	Blasting operations	Clear to cloudy liquid. It is odourless.	OEL = 10mg/m ³	7440-21-3

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				lung changes.				
Quartz	521	Dust	Inhalation Skin and/or eye contact Ingestion	Skin and eye contact may cause mechanical irritation. Inhalation of dust may cause irritation of the respiratory tract.	Blasting operations	White pellets with no odour.	OEL = 0.1 mg/m3	14808-60-7
Isocyanine	356	Gas Mist	Inhalation Skin and/or eye contact Ingestion	Skin and eye contact may cause irritation. Ingestion will cause adverse health effects. Inhalation will cause irritation of the respiratory tract. It may result in asthma-like spasms of the bronchial tubes and difficulty in breathing. People with a history of respiratory disease or hypersensitivity should not be exposed to this product.	Blasting operations	Brown	OEL = 0.02 mg/m3	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Potassium perchlorate		Dust	Inhalation Skin and/or eye contact Ingestion Absorption through skin	Inhalation of the product may cause irritation to the respiratory tract, coughing, shortness of breath and pulmonary edema. Ingestion may cause irritation to the mucous membranes and may result in vomiting, nausea, fever and rushes. Skin may turn blue due to an oxygen deficiency. Red blood cells may be broken down which will result in kidney damage. It may also effect the bone marrow. Skin and eye contact may cause irritation resulting in redness, itching and pain.	Blasting operations	White odourless powder. It is flammable and a strong oxidizer.	None available	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Wood dust	600/601	Dust	Inhalation Skin and/or eye contact	Harmful when inhaled or swallowed. It may cause eye and skin irritation. Prolonged exposure to the eye may cause conjunctivitis or allergic dermatitis. Prolonged exposure may also lead to inflammation of the nasal passage, lung diseases or asthma. Wood dust is a fire and explosion hazard when exposed to heat.	Installation of wooden support	Wood particles of various size produced by any manual or mechanical cutting, chipping, sawing or sanding.	OEL = 5 mg/m³ (Hard & Soft wood) STEL = 10 mg/m³ (Soft wood)	
Carbon monoxide		Gas	Inhalation Skin and/or eye contact	Skin and eye contact may cause frostbite. Systemic toxicity may cause visual disturbances. Inhalation May cause adverse central nervous system, cardiovascular, respiratory, kidney and liver effects. These effects may include suffocation, discoloured skin, dilated pupils, hearing loss, nausea, vomiting, chest	Blasting operations Mine fires Diesel machinery	Colourless, odourless and tasteless. Flammable. Poisonous.	OEL = 55 mg/m³ STEL = 100 ppm	630-08-0

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				pain, lung damage, twitching, muscle spasms, in coordination, weakness, numbness, headache, dizziness, drowsiness, confusion, hallucinations, convulsions, blood disorders, heart failure, kidney failure, collapse, unconsciousness, coma and death.				
Carbon dioxide gas		Gas Liquid	Inhalation Skin and/or eye contact	Over exposure when inhaled may cause excitation and depression of the central nervous system. Carbon dioxide displaces oxygen which cause a fall in blood pressure. Eye contact may cause a stinging sensation and inhalation may effect vision. Skin contact may cause frostbite.	Blasting operations Mine fires Diesel machinery	Colourless, odourless, and tasteless. Could be a liquid under pressure.	OEL = 9000 mg/m3 STEL = 54000 mg/m3	124-38-9
Soudal foam		Foam Mist	Inhalation Skin and/or eye contact	The product may be irritating to skin, eyes and the respiratory system.	Vent sealing and tamping of holes.	Foam	None available	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Glue Epoxy Resin		Liquid Vapour Mist	Inhalation Skin and/or eye contact	Skin and eye contact will cause irritation. Inhalation of the product will cause respiratory tract irritation. Ingestion may cause adverse health effects.	Backfill products Vent curtaining	Brown liquid with a faint odour. It is corrosive.	Phenol- OEL = 19mg/m3 STEL = 38mg/m3 Formaldehyde- OEL = 2.5mg/m3 STEL = 2.5mg/m3 Sodium Hydroxide- STEL = 2mg/m3 Amine-OEL = ?	
PH Powder		Dust	Inhalation Eye contact	Irritation to the respiratory system when inhaled. Eye contact can result in corneal damage or blindness. Inflammation of the eye is characterized by redness, watering and itching.	Toilet product	White powder consisting of a combination of alkali's.	Not applicable	
Portabloo		Liquid Mist Vapour	Inhalation Skin and/or eye contact	The product is harmful with skin contact and will cause burns and irritation. Inhalation may cause dizziness and shortness of breath.	Toilet product	Translucent blue liquid with a mild amine odour.	Not applicable	
PRLC 40		Liquid Fumes Gas	Inhalation Skin and/or eye contact Ingestion	This product may cause respiratory tract, skin and eye irritation. It may cause a shortness of breath as well as nose	Batch plant operations	Pink liquid that's odourless.	Not applicable	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				bleeds. Ingestion may cause nausea. Direct contact may cause irritation, redness, pain, erythema, flustering, exfoliation, ulceration, necrosis and scaring.				
SP 100		Liquid Fumes Vapour	Inhalation Skin and/or eye contact Ingestion	It is irritating to the eyes and skin and may be harmful if swallowed. Vapour may be an irritant to the mucous membranes and respiratory tract.	Batch plant operations	Clear brown liquid with blan odour. Flammable	Not applicable	
PRPL 25		Liquid Dust Vapour Mist	Inhalation Skin and/or eye contact Ingestion	Swallowing of the product may irritate the mouth, throat and stomach causing pain, nausea and vomiting. If it is inhaled it may cause irritation to the upper respiratory tract causing a sore throat, coughing or breathing difficulties.	Batch plant operations	Dark brown liquid with a slight non-distinct odour. Flammable	Amine-OEL=?	
Meyco SA 160		Liquid Mist	Inhalation Skin and/or eye contact	It may cause skin and eye irritation.	Batch plant operations	White to beige liquid.	Not applicable	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Meyco TCC 735		Liquid Mist Vapour	Inhalation Skin and/or eye contact Ingestion		Batch plant operations	White liquid with a low odour.	Parrafin-OEL = 2mg/m³ STEL = 6mg/m³	
Myco TCC 766		Liquid Aerosol Mist	Inhalation Skin and/or eye contact Ingestion	May be irritating to the skin and eyes.	Batch plant operations	Dark brown liquid with no odour.	Not applicable	
Polyheed SG		Liquid Mist Gas	Inhalation Skin and/or eye contact Ingestion	It may cause irritation to the skin and eyes. Inhalation dangerous if in contact with acid because toxic gasses form.	Batch plant operations	Brown liquid with a wood resin odour.	Not applicable	
DELVO Stabilizer 10		Liquid Mist	Inhalation Skin and/or eye contact Ingestion	Skin and eye irritation may occur with burning to the eyes.	Batch plant operations	Light pink liquid with a slightly acidic odour. It reacts with oxidants and alkaline compounds.	Hydrochloric Acid-STEL = 7mg/m³	
Plaster/Gypsum		Dust	Inhalation Skin and/or eye contact Ingestion	May cause irritation of the upper respiratory tract. Skin and eye contact may cause burning, irritation and hardening. If ingested it may cause obstruction.	Sealing of vent walls, timber treatment for fire prevention.	Light coloured to white powder. Slightly soluble.	OEL = 10 mg/m³	26499-65-0
Mono blue							Not applicable	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Vent Seal		Liquid	Inhalation Skin and/or eye contact	High airborne concentration may cause drowsiness and lethargy. Skin and eye contact may cause temporary irritation.	Vent sealing	Comp. A: Brown liquid Comp. B: Red viscous liquid with amine odour.	None available	
Helium		Gas	Inhalation Skin and/or eye contact	Inhalation causes a high voice. Skin contact may cause frostbite and eye contact may cause blurred vision, deep burns and pain.	Drill intersections	Colourless, odourless. When refrigerated it forms a liquefied gas.	Not applicable	
Portland cement	120/121	Dust	Inhalation Skin and/or eye contact Ingestion	No serious harm when dry. Inhalation may cause irritation or inflammation. Wet cement may cause serious burns, eyes may be irritated and chemical burns as well as blindness may occur. Prolonged exposure may cause silicosis. Irritation of the moist mucous membranes, nose, throat and upper respiratory tract. It may contain traces of substances that's listed as carcinogenic.	Batch plant operations Concrete mixing	Light grey powder.	OEL = 10 mg/m ³	65997-15-1

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Methane rich gas	296	Liquid Gas	Inhalation Skin and/or eye contact Ingestion	Inhalation may cause central nervous system effects. Headaches, nausea, dizziness and a loss of balance and coordination may occur. Unconsciousness, coma and respiratory failure as well as death may be results of exposure.	Flammable gas Drilling Intersections	Colourless, odourless. Flammable.	STEL = 1,4%	74--82-8
Silent Seal		Vapour Liquid	Inhalation Skin and/or eye contact Ingestion	Inhalation reduces oxygen available. It irritates the mucous membranes, cause tightness in chest, coughing, asthma-like sensitivity, dizziness, headache, lethargy, heart irregularations and it may lead to bronchitis or pulmonary edema. Skin contact may cause irritation, redding, swelling and dermatitis. Eye contact may cause irritation and physical damage. Ingestion of the product may cause irritation to mucous membranes, the mouth	Vent sealing	Comp. A: Amber to brown liquid. Slightly musty odour. Insoluble in water. Comp. B: Dark brown with yellow undertone viscous liquid with fluorocarbon and amine odour.	None available	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				and digestive tract.				

HEG Identification : GROUND HANDLING (15)

Activity Description	
Activity Area Code	
Occupations	Code
Bell signaler	21305
Beltsman	30205
Conveyer belt attendant	21202
Conveyer belt team leader	21201
Lasher & Loader	29905
Loco driver	21002
Loco guard	21003
Mud press operator	40529
Orepass & Box controller	21404
Stationary Hydraulic rock breaker	
Tip team leader	21405
Tip worker	21406

Chemicals Involved

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Dust		Dust	Inhalation or eye contact	Coughing & mild irritation. Eye contact may result in tears and mild irritation to the eyes.	Blasting, scraping, tipping, drilling, transport, travelling, spillage.	Finely divided solid matter.	OEL = 1mg/m ³	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Silica Dust (respirable)	522	Dust	Inhalation, skin and/or eye contact	Coughing and mild irritation. Skin contact may result in granulomas. Silicosis may occur with prolonged exposure. Carcinogen.	Blasting, scraping, tipping, drilling, transport, travelling, spillage.	Colourless to white, green, purple or black crystals. Odourless.	OEL = 0.1 mg/m³	14808-60-7
Diesel fumes		Mist Vapour	Inhalation	Carcinogen	Diesel machinery	Colourless oily liquid. May burn if strongly heated.	<u>NO₂</u>- OEL = 5mg/m³ STEL = 9mg/m³ <u>SO₂</u>-OEL = 5mg/m³ STEL = 13mg/m³ <u>NO</u> OEL = 30mg/m³ STEL = 45mg/m³ <u>CO</u> OEL = 55mg/m³ <u>DIESEL PARTICULATE MATTER</u> OEL = ?	
Ammonia	24	Gas	Inhalation, ingestion (solution), skin and/or eye contact (solution/liquid)	Corrosive gas - may be fatal if inhaled. Lung injury. Severe respiratory tract irritant. Irritating to the nose and throat. Mildly irritating to moist skin - blisters may occur.	Blasting operations	Colourless gas with a sharp, pungent, suffocating, intensely irritating odour. Colourless liquid under pressure but can decompose at	OEL = 17 mg/m³ STEL = 24mg/m³	7664-41-7

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
						high temperature to form very flammable hydrogen and toxic nitrogen dioxide.		
Carbon oil	43	Liquid Vapour	Inhalation, ingestion (solution), skin and/or eye contact (solution/liquid)	Harmful when inhaled or swallowed. Central nervous system depressant. It causes headache, nausea, dizziness, drowsiness, and confusion. It may cause blood and bone marrow effects. Aspiration hazard. Prolonged exposure may result in dermatitis. Carcinogen & Mutagen.	Engineering operations	Clear and colourless liquid. Aromatic hydrocarbon odour. Vapour is heavier than air, thus might spread long distances. Liquid can float on water, thus might spread fire. Decompose at high temperature and forming toxic gases.	Toluene-OEL = 188mg/m3 STEL = 560mg/m3 Tetrachloroethylene-OEL = 335mg/m3 STEL = 1000mg/m3 EthylBenzene-OEL = 435 STEL = 545mg/m3 Xylene-OEL = 435 STEL = 650mg/m3	
Rubber solvent			Liquid Mist Vapour	It may cause moderate skin irritation, defatting and dermatitis. Inhalation may cause dizziness, headache and unconsciousness. Ingestion cause vomiting, nausea and diarrhea. Inhalation	Engineering operations	Flammable liquid with a mild odour.	None available	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				may cause bronchopneumonia and Pulmonary edema.				
Mineral oil	450	Gas Mist	Inhalation, skin and/or eye contact	Skin, eye and lung irritation.	Engineering operations	Colourless to light brown liquid. It is flammable.	OEL = 5 mg/m ³ STEL = 10 mg/m ³	
Welding fumes	598	Fumes	Inhalation	<i>Metal fume fever:</i> Muscle pains Shivering Chest tightness Feverishness	Welding operations		OEL = 5 mg/m ³	
Ammonium nitrate		Liquid Gas Mist	Inhalation Skin and/or eye contact Ingestion	Skin and eye contact may cause dryness and irritation. Inhalation may cause a sore throat, coughing and a shortness of breath. Ingestion may cause dizziness, cramps, vomiting, blood disorders, weakness and depression.	Blasting operations	White to cream in colour, but odourless.	None available	
Metal Powder		Dust	Inhalation Skin and/or eye contact	Fumes generated may be dangerous. Dryness and irritation of the throat, nose, eyes, and lungs may occur. Dizziness and nausea may result. May be a carcinogen.	Blasting operations	Odourless metallic grey powder.	None available	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Copper metal	154/155	Dust Vapour Fumes	Inhalation Skin and/or eye contact Ingestion	Is a mechanical irritant when in eye which may cause severe corneal damage. When ingested it may cause intense abdominal pain. Inhalation may cause metal fume fever, headache, a metallic taste in mouth, cough, thirst, shortness of breath, fever, pain in the legs and chest. May discolour the skin.	Blasting operations	Bright reddish, lustrous metal in the form of foil, wire or turnings. Odourless.	OEL = 1 mg/m³ STEL = 2 mg/m³	7440-50-8
Nitrocellulose		Dust Gas	Inhalation Skin and/or eye contact	Skin and eye contact may cause irritation. Inhalation may cause narcosis, weakness, drowsiness and unconsciousness.	Blasting operations	Alcohol odour.	None available	
Tin	567/568	Dust Fumes	Inhalation Skin and/or eye contact Ingestion	Skin and eye contact may cause mechanical irritation. Inhalation may cause fatigue and anaemia. Central nervous system damage, nasal inflammation and kidney disfunction may occur. It may also cause headache, nausea, muscular pain and possible liver damage.	Blasting operations	Silver-grey metal that's odourless. Various shapes and sizes.	OEL = 2 mg/m³ STEL = 4 mg/m³	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Citric acid		Dust	Inhalation Skin and/or eye contact	Skin and eye contact may cause a slight irritation. If inhaled irritation may occur.	Blasting operations	Powder with no known odour. Colourless crystals.	None available	
Gold reference		Liquid Mist	Inhalation Skin and/or eye contact Ingestion	Skin and eye contact may cause irritation, burns, blisters, watering, conjunctivitis and dermatitis. Inhalation may also cause irritation of the eyes, nose, throat, and upper respiratory tract, coughing and choking. Over exposure may lead to ulceration of the oral and nasal mucosa. Ingestion may cause burns to the mouth, throat, oesophagus and stomach. It may also cause nausea and vomiting.	Blasting operations	Clear, yellow liquid with a slight hydrochloric acid odour.	None available	
Iron	348	Dust Fumes Mist	Inhalation Skin and/or eye contact Ingestion	It may cause mild irritation to the respiratory tract when inhaled. Large doses ingested may cause gastrointestinal disturbances. Skin and eye contact may cause irritation.	Blasting operations	White crystals with no odour.	OEL = 5 mg/m STEL = 10 mg/m³	1309-37-1

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Activated charcoal		Dust	Inhalation Skin and/or eye contact Ingestion	If inhaled it may cause respiratory tract and cardiovascular effects. When ingested it may cause mild irritation to the gastrointestinal tract. Skin and eye contact may cause redness.	Blasting operations	Fine black powder that's odourless. Flammable	None available	
Polyethylene		Dust Vapours	Inhalation Skin and/or eye contact Ingestion	Eye contact may result in irritation or corneal injury due to mechanical action.	Blasting operations	No odour.	None available	
Potassium nitrate		Dust Fumes	Inhalation Eye contact	Eye contact may cause mild irritation and may burn. Dust may be irritating when inhaled. Symptoms like weakness, depression, headache, mental impairment, dizziness, abdominal cramps, vomiting, bloody diarrhea, convulsions and collapse may occur.	Blasting operations	White to buff crystals. No odour.	None available	
Polycarbonate		Dust Fumes	Inhalation Skin and/or eye contact Ingestion	Eye contact may cause irritation and corneal injury due to mechanical action. Prolonged exposure to skin may cause irritation due to	Blasting operations	Milky white or coloured solid with a mild odour.	None available	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				mechanical irritation. Dust inhaled may cause irritation to the upper respiratory tract.				
Silicon dioxide		Dust Gas Mist	Inhalation Skin and/or eye contact Ingestion	It is slightly irritating to the skin, and mildly irritating to the eyes. Inhalation may result in upper respiratory irritation and emphysema. Repeated exposure may result in lung changes.	Blasting operations	Clear to cloudy liquid. It is odourless.	OEL = 10mg/m3	7440-21-3
Quartz	521	Dust	Inhalation Skin and/or eye contact Ingestion	Skin and eye contact may cause mechanical irritation. Inhalation of dust may cause irritation of the respiratory tract.	Blasting operations	White pellets with no odour.	OEL = 0.1 mg/m3	14808-60-7
Isocyanine	356	Gas Mist	Inhalation Skin and/or eye contact Ingestion	Skin and eye contact may cause irritation. Ingestion will cause adverse health effects. Inhalation will cause irritation of the respiratory tract. It may result in asthma-like spasms of the bronchial tubes and difficulty in breathing. People with a history of respiratory disease or hyper	Blasting operations	Brown	OEL = 0.02 mg/m3	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				sensitivity should not be exposed to this product.				
Potassium perchlorate		Dust	Inhalation Skin and/or eye contact Ingestion Absorption through skin	Inhalation of the product may cause irritation to the respiratory tract, coughing, shortness of breath and pulmonary edema. Ingestion may cause irritation to the mucous membranes and may result in vomiting, nausea, fever and rushes. Skin may turn blue due to an oxygen deficiency. Red blood cells may be broken down which will result in kidney damage. It may also effect the bone marrow. Skin and eye contact may cause irritation resulting in redness, itching and pain.	Blasting operations	White odourless powder. It is flammable and a strong oxidizer.	None available	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Carbon monoxide		Gas	Inhalation Skin and/or eye contact	Skin and eye contact may cause frostbite. Systemic toxicity may cause visual disturbances. Inhalation May cause adverse central nervous system, cardiovascular, respiratory, kidney and liver effects. These effects may include suffocation, discoloured skin, dilated pupils, hearing loss, nausea, vomiting, chest pain, lung damage, twitching, muscle spasms, in coordination, weakness, numbness, headache, dizziness, drowsiness, confusion, hallucinations, convulsions, blood disorders, heart failure, kidney failure, collapse, unconsciousness, coma and death.	Blasting operations Mine fires Diesel machinery	Colourless, odourless and tasteless. Flammable. Poisonous.	OEL = 55 mg/m³ STEL = 100 ppm	630-08-0
Carbon dioxide gas		Gas Liquid	Inhalation Skin and/or eye contact	Over exposure when inhaled may cause excitation and depression of the central nervous system. Carbon dioxide displaces oxygen which	Blasting operations Mine fires Diesel machinery	Colourless, odourless, and tasteless. Could be a liquid under pressure.	OEL = 9000 mg/m³ STEL = 54000 mg/m³	124-38-9

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				cause a fall in blood pressure. Eye contact may cause a stinging sensation and inhalation may effect vision. Skin contact may cause frostbite.				
PH Powder		Dust	Inhalation Eye contact	Irritation to the respiratory system when inhaled. Eye contact can result in corneal damage or blindness. Inflammation of the eye is characterized by redness, watering and itching.	Toilet product	White powder consisting of a combination of alkali's.	Not applicable	
Portabloo		Liquid Mist Vapour	Inhalation Skin and/or eye contact	The product is harmful with skin contact and will cause burns and irritation. Inhalation may cause dizziness and shortness of breath.	Toilet product	Translucent blue liquid with a mild amine odour.	Not applicable	

HEG Identification :

DEVELOPMENT (9/10)

Activity Description	
Activity Area Code	
Occupations	Code
Developer	20303
Development team leader	20310
Development team worker	20701
Drill rig operator	20401
Driller: Jackhammer	20402
Drilling worker	20499
Load haul dump driver	21106
Loader driver	21004
Miners assistant: Cheesa	20504
Multi task worker	20704
Night shift cleaner	20308
Scraper winch driver	20901
Scrapping worker	20999

Chemicals Involved

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
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Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Dust		Dust	Inhalation or eye contact	Coughing & mild irritation. Eye contact may result in tears and mild irritation to the eyes.	Blasting, scraping, tipping, drilling, transport, travelling, spillage.	Finely divided solid matter.	OEL = 1mg/m³	
Ammonia	24	Gas	Inhalation, ingestion (solution), skin and/or eye contact (solution/liquid)	Corrosive gas - may be fatal if inhaled. Lung injury. Severe respiratory tract irritant. Irritating to the nose and throat. Mildly irritating to moist skin - blisters may occur.	Blasting operations	Colourless gas with a sharp, pungent, suffocating, intensely irritating odour. Colourless liquid under pressure but can decompose at high temperature to form very flammable hydrogen and toxic nitrogen dioxide.	OEL = 17mg/m³ STEL = 24mg/m³	7664-41-7
Silica Dust-respirable	522	Dust	Inhalation, skin and/or eye contact	Coughing and mild irritation. Skin contact may result in granulomas. Silicosis may occur with prolonged exposure. Carcinogen.	Blasting, scraping, tipping, drilling, transport, travelling, spillage.	Colourless to white, green, purple or black crystals. Odourless.	OEL = 0.1 mg/m³	14808-60-7

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Diesel fumes		Mist Vapour	Inhalation	Carcinogen	Diesel machinery	Colourless oily liquid. May burn if strongly heated.	NO2- OEL = 5mg/m3 STEL = 9mg/m3 SO2-OEL = 5mg/m3 STEL = 13mg/m3 NO OEL = 30mg/m3 STEL = 45mg/m3 CO OEL = 55mg/m3 DIESEL PARTICULATE MATTER OEL = ?	
Carbon oil	43	Liquid Vapour	Inhalation, ingestion (solution), skin and/or eye contact (solution/liquid)	Harmful when inhaled or swallowed. Central nervous system depressant. It causes headache, nausea, dizziness, drowsiness, and confusion. It may cause blood and bone marrow effects. Aspiration hazard. Prolonged exposure may result in dermatitis. Carcinogen & Mutagen.	Engineering operations	Clear and colourless liquid. Aromatic hydrocarbon odour. Vapour is heavier than air, thus might spread long distances. Liquid can float on water, thus might spread fire. Decompose at high temperature and forming toxic gases.	Toluene- OEL = 188mg/m3 STEL = 560mg/m3 Tetrachloroethylene -OEL = 335mg/m3 STEL = 1000mg/m3 EthylBenzene- OEL = 435 STEL = 545mg/m3 Xylene-OEL = 435 STEL = 650mg/m3	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Degreaser		Gas Mist	Inhalation, skin and/or eye contact	May cause pain and irritation to the skin and eyes. Inhalation may cause headache, dizziness, anaesthesia, and unconsciousness. Repeated exposure may cause kidney and liver effects. Pulmonary irritation may occur and dermatitis may result from repeated exposure.	Engineering operations	Colourless liquid with a irritating odour. It is slightly soluble in water. Corrosive.	Not applicable	
Mineral oil	450	Gas Mist	Inhalation, skin and/or eye contact	Skin, eye and lung irritation.	Engineering operations	Colourless to light brown liquid. It is flammable.	OEL = 5 mg/m ³ STEL = 10 mg/m ³	
Grease	298	Fluid	Inhalation Skin	Mild skin and eye irritation. Inhalation of smoke contaminated with grease may cause throat irritation, coughing and a tightness in chest. Lungs may become irritated from fluorine components.	Engineering operations	White dense and viscous fluid	Not applicable	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Welding fumes	598	Fumes	Inhalation	<i>Metal fume fever:</i> Muscle pains Shivering Chest tightness Feverishness	Welding operations		OEL = 5 mg/m ³	
Aerosol Paint		Liquid Vapour Fumes Mist	Inhalation Skin and/or eye contact Ingestion	May cause skin and eye irritation. When inhaled or ingested person may suffer from severe respiratory distress as well as central nervous system depression. Prolonged and/or repeated skin contact may cause dermatitis.	Marking off	Various colours Flammable	None available	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
White wash		Liquid Vapour Mist Dust	Inhalation Skin and/or eye contact Ingestion	May cause skin and eye, nose and throat irritation. Harmful if inhaled. Aspiration hazard when swallowed. With chronic exposure central nervous system disorders like weakness, loss of co-ordination, fatigue, confusion and blurred vision may occur. Liver abnormalities as well as kidney, lung spleen and eye damage may occur. Cardiac effect on some persons.	For fire retardant application	Ammonia-like odour Flammable	<u>Titanium dioxide-</u> OEL = 10mg/m3 <u>Calcium</u> <u>Carbonate-</u> OEL = 10mg/m3 <u>Propylene glycol-</u> OEL = 470mg/m3 <u>Dimethylene</u> <u>Glycol-OEL = ?</u> <u>Xylene-</u> OEL = 435mg/m3 STEL = 650mg/m3 <u>Acetone-</u> OEL = 1780mg/m3 STEL = 3560mg/m3 <u>Ethyl Benzene-</u> OEL = 435mg/m3 STEL = 545mg/m3 <u>Toluene-</u> OEL = 188mg/m3 STEL = 560mg/m3 <u>Tetrachloroethylene</u> -OEL = 335mg/m3 STEL = 1000mg/m3	
Ammonium nitrate		Liquid Gas Mist	Inhalation Skin and/or eye contact Ingestion	Skin and eye contact may cause dryness and irritation. Inhalation may cause a sore throat, coughing and a shortness of breath. Ingestion may	Blasting operations	White to cream in colour, but odourless.	None available	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				cause dizziness, cramps, vomiting, blood disorders, weakness and depression.				
Metal Powder		Dust	Inhalation Skin and/or eye contact	Fumes generated may be dangerous. Dryness and irritation of the throat, nose, eyes, and lungs may occur. Dizziness and nausea may result. May be a carcinogen.	Blasting operations	Odourless metallic grey powder.	None available	
Copper metal	154/155	Dust Vapour Fumes	Inhalation Skin and/or eye contact Ingestion	Is a mechanical irritant when in eye which may cause severe corneal damage. When ingested it may cause intense abdominal pain. Inhalation may cause metal fume fever, headache, a metallic taste in mouth, cough, thirst, shortness of breath, fever, pain in the legs and chest. May discolour the skin.	Blasting operations	Bright reddish, lustrous metal in the form of foil, wire or turnings. Odourless.	OEL = 1 mg/m³ STEL = 2 mg/m³	7440-50-8
Nitrocellulose		Dust Gas	Inhalation Skin and/or eye contact	Skin and eye contact may cause irritation. Inhalation may cause narcosis, weakness,	Blasting operations	Alcohol odour.	None available	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				drowsiness and unconsciousness.				
Tin	567/568	Dust Fumes	Inhalation Skin and/or eye contact Ingestion	Skin and eye contact may cause mechanical irritation. Inhalation may cause fatigue and anaemia. Central nervous system damage, nasal inflammation and kidney disfunction may occur. It may also cause headache, nausea, muscular pain and possible liver damage.	Blasting operations	Silver-grey metal that's odourless. Various shapes and sizes.	OEL = 2 mg/m³ STEL = 4 mg/m³	
Citric acid		Dust	Inhalation Skin and/or eye contact	Skin and eye contact may cause a slight irritation. If inhaled irritation may occur.	Blasting operations	Powder with no known odour. Colourless crystals.	None available	
Gold reference		Liquid Mist	Inhalation Skin and/or eye contact Ingestion	Skin and eye contact may cause irritation, burns, blisters, watering, conjunctivitis and dermatitis. Inhalation may also cause irritation of the eyes, nose, throat, and upper respiratory tract, coughing and choking. Over exposure may lead to ulceration of	Blasting operations	Clear, yellow liquid with a slight hydrochloric acid odour.	None available	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				the oral and nasal mucosa. Ingestion may cause burns to the mouth, throat, oesophagus and stomach. It may also cause nausea and vomiting.				
Iron	348	Dust Fumes Mist	Inhalation Skin and/or eye contact Ingestion	It may cause mild irritation to the respiratory tract when inhaled. Large doses ingested may cause gastrointestinal disturbances. Skin and eye contact may cause irritation.	Blasting operations	White crystals with no odour.	OEL = 5 mg/m STEL = 10 mg/m³	1309-37-1
Activated charcoal		Dust	Inhalation Skin and/or eye contact Ingestion	If inhaled it may cause respiratory tract and cardiovascular effects. When ingested it may cause mild irritation to the gastrointestinal tract. Skin and eye contact may cause redness.	Blasting operations	Fine black powder that's odourless. Flammable	None available	
Polyethylene		Dust Vapours	Inhalation Skin and/or eye contact Ingestion	Eye contact may result in irritation or corneal injury due to mechanical action.	Blasting operations	No odour.	None available	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Potassium nitrate		Dust Fumes	Inhalation Eye contact	Eye contact may cause mild irritation and may burn. Dust may be irritating when inhaled. Symptoms like weakness, depression, headache, mental impairment, dizziness, abdominal cramps, vomiting, bloody diarrhea, convulsions and collapse may occur.	Blasting operations	White to buff crystals. No odour.	None available	
Polycarbonate		Dust Fumes	Inhalation Skin and/or eye contact Ingestion	Eye contact may cause irritation and corneal injury due to mechanical action. Prolonged exposure to skin may cause irritation due to mechanical irritation. Dust inhaled may cause irritation to the upper respiratory tract.	Blasting operations	Milky white or coloured solid with a mild odour.	None available	
Silicon dioxide		Dust Gas Mist	Inhalation Skin and/or eye contact Ingestion	It is slightly irritating to the skin, and mildly irritating to the eyes. Inhalation may result in upper respiratory irritation and emphysema. Repeated exposure may result in lung changes.	Blasting operations	Clear to cloudy liquid. It is odourless.	OEL = 10mg/m ³	7440-21-3

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Quartz	521	Dust	Inhalation Skin and/or eye contact Ingestion	Skin and eye contact may cause mechanical irritation. Inhalation of dust may cause irritation of the respiratory tract.	Blasting operations	White pellets with no odour.	OEL = 0.1 mg/m3	14808-60-7
Isocyanine	356	Gas Mist	Inhalation Skin and/or eye contact Ingestion	Skin and eye contact may cause irritation. Ingestion will cause adverse health effects. Inhalation will cause irritation of the respiratory tract. It may result in asthma-like spasms of the bronchial tubes and difficulty in breathing. People with a history of respiratory disease or hyper sensitivity should not be exposed to this product.	Blasting operations	Brown	OEL = 0.02 mg/m3	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Potassium perchlorate		Dust	Inhalation Skin and/or eye contact Ingestion Absorption through skin	Inhalation of the product may cause irritation to the respiratory tract, coughing, shortness of breath and pulmonary edema. Ingestion may cause irritation to the mucous membranes and may result in vomiting, nausea, fever and rushes. Skin may turn blue due to an oxygen deficiency. Red blood cells may be broken down which will result in kidney damage. It may also effect the bone marrow. Skin and eye contact may cause irritation resulting in redness, itching and pain.	Blasting operations	White odourless powder. It is flammable and a strong oxidizer.	None available	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Wood dust	600/601	Dust	Inhalation Skin and/or eye contact	Harmful when inhaled or swallowed. It may cause eye and skin irritation. Prolonged exposure to the eye may cause conjunctivitis or allergic dermatitis. Prolonged exposure may also lead to inflammation of the nasal passage, lung diseases or asthma. Wood dust is a fire and explosion hazard when exposed to heat.	Instillation of wooden support	Wood particles of various size produced by any manual or mechanical cutting, chipping, sawing or sanding.	OEL = 5 mg/m ³ (Hard & Soft wood) STEL = 10 mg/m ³ (Soft wood)	
Soudal foam		Foam Mist	Inhalation Skin and/or eye contact	The product may be irritating to skin, eyes and the respiratory system.	Vent sealing and tamping of holes.	Foam	None available	
Carbon monoxide		Gas	Inhalation Skin and/or eye contact	Skin and eye contact may cause frostbite. Systemic toxicity may cause visual disturbances. Inhalation May cause adverse central nervous system, cardiovascular, respiratory, kidney and liver effects. These effects may include suffocation, discoloured skin, dilated pupils, hearing loss, nausea,	Blasting operations Mine fires Diesel machinery	Colourless, odourless and tasteless. Flammable. Poisonous.	OEL = 55 mg/m ³ STEL = 100 ppm	630-08-0

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				vomiting, chest pain, lung damage, twitching, muscle spasms, in coordination, weakness, numbness, headache, dizziness, drowsiness, confusion, hallucinations, convulsions, blood disorders, heart failure, kidney failure, collapse, unconsciousness, coma and death.				
Carbon dioxide gas		Gas Liquid	Inhalation Skin and/or eye contact	Over exposure when inhaled may cause excitation and depression of the central nervous system. Carbon dioxide displaces oxygen which cause a fall in blood pressure. Eye contact may cause a stinging sensation and inhalation may effect vision. Skin contact may cause frostbite.	Blasting operations Mine fires Diesel machinery	Colourless, odourless, and tasteless. Could be a liquid under pressure.	OEL = 9000 mg/m³ STEL = 54000 mg/m³	124-38-9

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Glue Epoxy Resin		Liquid Vapour Mist	Inhalation Skin and/or eye contact	Skin and eye contact will cause irritation. Inhalation of the product will cause respiratory tract irritation. Ingestion may cause adverse health effects.	Backfill products Vent curtaining	Brown liquid with a faint odour. It is corrosive.	Phenol- OEL = 19mg/m³ STEL = 38mg/m³ Formaldehyde- OEL = 2.5mg/m³ STEL = 2.5mg/m³ Sodium Hydroxide- STEL = 2mg/m³ Amine-OEL = ?	
PH Powder		Dust	Inhalation Eye contact	Irritation to the respiratory system when inhaled. Eye contact can result in corneal damage or blindness. Inflammation of the eye is characterized by redness, watering and itching.	Toilet product	White powder consisting of a combination of alkali's.	Not applicable	
Portabloo		Liquid Mist Vapour	Inhalation Skin and/or eye contact	The product is harmful with skin contact and will cause burns and irritation. Inhalation may cause dizziness and shortness of breath.	Toilet product	Translucent blue liquid with a mild amine odour.	Not applicable	
PRLC 40		Liquid Fumes Gas	Inhalation Skin and/or eye contact Ingestion	This product may cause respiratory tract, skin and eye irritation. It may cause a shortness of breath as well as nose	Batch plant operations	Pink liquid that's odourless.	Not applicable	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				bleeds. Ingestion may cause nausea. Direct contact may cause irritation, redness, pain, erythema, flustering, exfoliation, ulceration, necrosis and scaring.				
SP 100		Liquid Fumes Vapour	Inhalation Skin and/or eye contact Ingestion	It is irritating to the eyes and skin and may be harmful if swallowed. Vapour may be an irritant to the mucous membranes and respiratory tract.	Batch plant operations	Clear brown liquid with blan odour. Flammable	Not applicable	
PRPL 25		Liquid Dust Vapour Mist	Inhalation Skin and/or eye contact Ingestion	Swallowing of the product may irritate the mouth, throat and stomach causing pain, nausea and vomiting. If it is inhaled it may cause irritation to the upper respiratory tract causing a sore throat, coughing or breathing difficulties.	Batch plant operations	Dark brown liquid with a slight non-distinct odour. Flammable	Amine-OEL=?	
Meyco SA 160		Liquid Mist	Inhalation Skin and/or eye contact	It may cause skin and eye irritation.	Batch plant operations	White to beige liquid.	Not applicable	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Meyco TCC 735		Liquid Mist Vapour	Inhalation Skin and/or eye contact Ingestion		Batch plant operations	White liquid with a low odour.	Paraffin- OEL = 2mg/m³ STEL = 6mg/m³	
Myco TCC 766		Liquid Aerosol Mist	Inhalation Skin and/or eye contact Ingestion	May be irritating to the skin and eyes.	Batch plant operations	Dark brown liquid with no odour.	Not applicable	
Polyheed SG		Liquid Mist Gas	Inhalation Skin and/or eye contact Ingestion	It may cause irritation to the skin and eyes. Inhalation dangerous if in contact with acid because toxic gasses form.	Batch plant operations	Brown liquid with a wood resin odour.	Not applicable	
DELVO Stabilizer 10		Liquid Mist	Inhalation Skin and/or eye contact Ingestion	Skin and eye irritation may occur with burning to the eyes.	Batch plant operations	Light pink liquid with a slightly acidic odour. It reacts with oxidants and alkaline compounds.	Hydrochloric acid- OEL = 7mg/m³	
Plaster/Gypsum		Dust	Inhalation Skin and/or eye contact Ingestion	May cause irritation of the upper respiratory tract. Skin and eye contact may cause burning, irritation and hardening. If ingested it may cause obstruction.	Sealing of vent walls, timber treatment for fire prevention.	Light coloured to white powder. Slightly soluble.	OEL = 10 mg/m³	26499-65-0
Mono blue							Not applicable	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Vent Seal		Liquid	Inhalation Skin and/or eye contact	High airborne concentration may cause drowsiness and lethargy. Skin and eye contact may cause temporary irritation.	Vent sealing	Comp. A: Brown liquid Comp. B: Red viscous liquid with amine odour.	None available	
Helium		Gas	Inhalation Skin and/or eye contact	Inhalation causes a high voice. Skin contact may cause frostbite and eye contact may cause blurred vision, deep burns and pain.	Drill intersections	Colourless, odourless. When refrigerated it forms a liquefied gas.	None available	
Portland cement	120/121	Dust	Inhalation Skin and/or eye contact Ingestion	No serious harm when dry. Inhalation may cause irritation or inflammation. Wet cement may cause serious burns, eyes may be irritated and chemical burns as well as blindness may occur. Prolonged exposure may cause silicosis. Irritation of the moist mucous membranes, nose, throat and upper respiratory tract. It may contain traces of substances that's listed as carcinogenic.	Batch plant operations Concrete mixing	Light grey powder.	OEL = 10 mg/m ³	65997-15-1

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Methane rich gas	296	Liquid Gas	Inhalation Skin and/or eye contact Ingestion	Inhalation may cause central nervous system effects. Headaches, nausea, dizziness and a loss of balance and coordination may occur. Unconsciousness, coma and respiratory failure as well as death may be results of exposure.	Flammable gas Drilling Intersections	Colourless, odourless. Flammable.	STEL = 1,4%	74--82-8
Silent Seal		Vapour Liquid	Inhalation Skin and/or eye contact Ingestion	Inhalation reduces oxygen available. It irritates the mucous membranes, cause tightness in chest, coughing, asthma-like sensitivity, dizziness, headache, lethargy, heart irregularations and it may lead to bronchitis or pulmonary edema. Skin contact may cause irritation, redding, swelling and dermatitis. Eye contact may cause irritation and physical damage. Ingestion of the product may cause irritation to mucous membranes, the mouth	Vent sealing	Comp. A: Amber to brown liquid. Slightly musty odour. Insoluble in water. Comp. B: Dark brown with yellow undertone viscous liquid with fluorocarbon and amine odour.	None available	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				and digestive tract.				

HEG Identification : **SHAFT SINKING (11)**

Activity Description	
Activity Area Code	
Occupations	Code
Grab operator	21401
Handy man	21504
Shaft sinker	21501
Stage worker	21509

Chemicals Involved

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Dust		Dust	Inhalation or eye contact	Coughing & mild irritation. Eye contact may result in tears and mild irritation to the eyes.	Blasting, scraping, tipping, drilling, transport, travelling, spillage.	Finely divided solid matter.	OEL = 1mg/m ³	
Silica Dust (respirable)	522	Dust	inhalation, skin and/or eye contact	Coughing and mild irritation. Skin contact may result in granulomas. Silicosis may occur with prolonged exposure. Carcinogen.	Blasting, scraping, tipping, drilling, transport, travelling, spillage.	Colourless to white, green, purple or black crystals. Odourless.	OEL = 0.1 mg/m ³	14808-60-7

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Diesel fumes		Mist Vapour	Inhalation	Carcinogen	Diesel machinery	Colourless oily liquid. May burn if strongly heated.	<u>NO2-</u> OEL = 5mg/m3 STEL = 9mg/m3 <u>SO2-OEL = 5mg/m3</u> STEL = 13mg/m3 <u>NO</u> OEL = 30mg/m3 STEL = 45mg/m3 <u>CO</u> OEL = 55mg/m3 <u>DIESEL PARTICULATE MATTER</u> OEL = ?	
Carbon oil	43	Liquid Vapour	inhalation, ingestion (solution), skin and/or eye contact (solution/liquid)	Harmful when inhaled or swallowed. Central nervous system depressant. It causes headache, nausea, dizziness, drowsiness, and confusion. It may cause blood and bone marrow effects. Aspiration hazard. Prolonged exposure may result in dermatitis. Carcinogen & Mutagen.	Engineering operations	Clear and colourless liquid. Aromatic hydrocarbon odour. Vapour is heavier than air, thus might spread long distances. Liquid can float on water, thus might spread fire. Decompose at high temperature and forming toxic gases.	Toluene- OEL = 188mg/m3 STEL = 560mg/m3 Tetrachloroethylene- OEL = 335mg/m3 STEL = 1000mg/m3 EthylBenzene- OEL = 435 STEL = 545mg/m3 Xylene-OEL = 435 STEL = 650mg/m3	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Ammonia	24	Gas	inhalation, ingestion (solution), skin and/or eye contact (solution/liquid)	Corrosive gas - may be fatal if inhaled. Lung injury. Severe respiratory tract irritant. Irritating to the nose and throat. Mildly irritating to moist skin - blisters may occur.	Blasting operations	Colourless gas with a sharp, pungent, suffocating, intensely irritating odour. Colourless liquid under pressure but can decompose at high temperature to form very flammable hydrogen and toxic nitrogen dioxide.	OEL = 17 mg/m³ STEL = 24mg/m³	7664-41-7
Ammonium nitrate		Liquid Gas Mist	Inhalation Skin and/or eye contact Ingestion	Skin and eye contact may cause dryness and irritation. Inhalation may cause a sore throat, coughing and a shortness of breath. Ingestion may cause dizziness, cramps, vomiting, blood disorders, weakness and depression.	Blasting operations	White to cream in colour, but odourless.	None available	
Metal Powder		Dust	Inhalation Skin and/or eye contact	Fumes generated may be dangerous. Dryness and irritation of the throat, nose, eyes, and lungs may occur. Dizziness and	Blasting operations	Odourless metallic grey powder.	None available	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				nausea may result. May be a carcinogen.				
Copper metal	154/155	Dust Vapour Fumes	Inhalation Skin and/or eye contact Ingestion	Is a mechanical irritant when in eye which may cause severe corneal damage. When ingested it may cause intense abdominal pain. Inhalation may cause metal fume fever, headache, a metallic taste in mouth, cough, thirst, shortness of breath, fever, pain in the legs and chest. May discolour the skin.	Blasting operations	Bright reddish, lustrous metal in the form of foil, wire or turnings. Odourless.	OEL = 1 mg/m³ STEL = 2 mg/m³	7440-50-8
Nitrocellulose		Dust Gas	Inhalation Skin and/or eye contact	Skin and eye contact may cause irritation. Inhalation may cause narcosis, weakness, drowsiness and unconsciousness.	Blasting operations	Alcohol odour.	None available	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Tin	567/568	Dust Fumes	Inhalation Skin and/or eye contact Ingestion	Skin and eye contact may cause mechanical irritation. Inhalation may cause fatigue and anaemia. Central nervous system damage, nasal inflammation and kidney disfunction may occur. It may also cause headache, nausea, muscular pain and possible liver damage.	Blasting operations	Silver-grey metal that's odourless. Various shapes and sizes.	OEL = 2 mg/m³ STEL = 4 mg/m³	
Citric acid		Dust	Inhalation Skin and/or eye contact	Skin and eye contact may cause a slight irritation. If inhaled irritation may occur.	Blasting operations	Powder with no known odour. Colourless crystals.	None available	
Gold reference		Liquid Mist	Inhalation Skin and/or eye contact Ingestion	Skin and eye contact may cause irritation, burns, blisters, watering, conjunctivitis and dermatitis. Inhalation may also cause irritation of the eyes, nose, throat, and upper respiratory tract, coughing and choking. Over exposure may lead to ulceration of the oral and nasal mucosa. Ingestion may cause burns to the mouth, throat, oesophagus and stomach. It may also	Blasting operations	Clear, yellow liquid with a slight hydrochloric acid odour.	None available	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				cause nausea and vomiting.				
Iron	348	Dust Fumes Mist	Inhalation Skin and/or eye contact Ingestion	It may cause mild irritation to the respiratory tract when inhaled. Large doses ingested may cause gastrointestinal disturbances. Skin and eye contact may cause irritation.	Blasting operations	White crystals with no odour.	OEL = 5 mg/m STEL = 10 mg/m³	1309-37-1
Activated charcoal		Dust	Inhalation Skin and/or eye contact Ingestion	If inhaled it may cause respiratory tract and cardiovascular effects. When ingested it may cause mild irritation to the gastrointestinal tract. Skin and eye contact may cause redness.	Blasting operations	Fine black powder that's odourless. Flammable	None available	
Polyethylene		Dust Vapours	Inhalation Skin and/or eye contact Ingestion	Eye contact may result in irritation or corneal injury due to mechanical action.	Blasting operations	No odour.	None available	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Potassium nitrate		Dust Fumes	Inhalation Eye contact	Eye contact may cause mild irritation and may burn. Dust may be irritating when inhaled. Symptoms like weakness, depression, headache, mental impairment, dizziness, abdominal cramps, vomiting, bloody diarrhoea, convulsions and collapse may occur.	Blasting operations	White to buff crystals. No odour.	None available	
Polycarbonate		Dust Fumes	Inhalation Skin and/or eye contact Ingestion	Eye contact may cause irritation and corneal injury due to mechanical action. Prolonged exposure to skin may cause irritation due to mechanical irritation. Dust inhaled may cause irritation to the upper respiratory tract.	Blasting operations	Milky white or coloured solid with a mild odour.	None available	
Silicon dioxide		Dust Gas Mist	Inhalation Skin and/or eye contact Ingestion	It is slightly irritating to the skin, and mildly irritating to the eyes. Inhalation may result in upper respiratory irritation and emphysema. Repeated exposure may result in lung changes.	Blasting operations	Clear to cloudy liquid. It is odourless.	OEL = 10mg/m ³	7440-21-3

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Quartz	521	Dust	Inhalation Skin and/or eye contact Ingestion	Skin and eye contact may cause mechanical irritation. Inhalation of dust may cause irritation of the respiratory tract.	Blasting operations	White pellets with no odour.	OEL = 0.1 mg/m3	14808-60-7
Isocyanine	356	Gas Mist	Inhalation Skin and/or eye contact Ingestion	Skin and eye contact may cause irritation. Ingestion will cause adverse health effects. Inhalation will cause irritation of the respiratory tract. It may result in asthma-like spasms of the bronchial tubes and difficulty in breathing. People with a history of respiratory disease or hyper sensitivity should not be exposed to this product.	Blasting operations	Brown	OEL = 0.02 mg/m3	
Potassium perchlorate		Dust	Inhalation Skin and/or eye contact Ingestion Absorption through skin	Inhalation of the product may cause irritation to the respiratory tract, coughing, shortness of breath and pulmonary edema. Ingestion may cause irritation to the mucous membranes and may result in vomiting, nausea, fever and rushes. Skin may turn blue due to	Blasting operations	White odourless powder. It is flammable and a strong oxidizer.	None available	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				an oxygen deficiency. Red blood cells may be broken down which will result in kidney damage. It may also effect the bone marrow. Skin and eye contact may cause irritation resulting in redness, itching and pain.				
PRLC 40		Liquid Fumes Gas	Inhalation Skin and/or eye contact Ingestion	This product may cause respiratory tract, skin and eye irritation. It may cause a shortness of breath as well as nose bleeds. Ingestion may cause nausea. Direct contact may cause irritation, redness, pain, erythema, flustering, exfoliation, ulceration, necrosis and scaring.	Batch plant operations	Pink liquid that's odourless.	Not applicable	
SP 100		Liquid Fumes Vapour	Inhalation Skin and/or eye contact Ingestion	It is irritating to the eyes and skin and may be harmful if swallowed. Vapour may be an irritant to the mucous membranes and respiratory tract.	Batch plant operations	Clear brown liquid with bland odour. Flammable	Not applicable	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
PRPL 25		Liquid Dust Vapour Mist	Inhalation Skin and/or eye contact Ingestion	Swallowing of the product may irritate the mouth, throat and stomach causing pain, nausea and vomiting. If it is inhaled it may cause irritation to the upper respiratory tract causing a sore throat, coughing or breathing difficulties.	Batch plant operations	Dark brown liquid with a slight non-distinct odour. Flammable	Amiene-OEL=?	
Meyco SA 160		Liquid Mist	Inhalation Skin and/or eye contact	It may cause skin and eye irritation.	Batch plant operations	White to beige liquid.	Not applicable	
Meyco TCC 735		Liquid Mist Vapour	Inhalation Skin and/or eye contact Ingestion		Batch plant operations	White liquid with a low odour.	Parraffin-OEL=2mg/m3 STEL=6mg/m3	
Myco TCC 766		Liquid Aerosol Mist	Inhalation Skin and/or eye contact Ingestion	May be irritating to the skin and eyes.	Batch plant operations	Dark brown liquid with no odour.	Not applicable	
Polyheed SG		Liquid Mist Gas	Inhalation Skin and/or eye contact Ingestion	It may cause irritation to the skin and eyes. Inhalation dangerous if in contact with acid because toxic gasses form.	Batch plant operations	Brown liquid with a wood resin odour.	Not applicable	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
DELVO Stabilizer 10		Liquid Mist	Inhalation Skin and/or eye contact Ingestion	Skin and eye irritation may occur with burning to the eyes.	Batch plant operations	Light pink liquid with a slightly acidic odour. It reacts with oxidants and alkaline compounds.	Hydrochloric Acid- STEL = 7mg/m³	
Plaster/Gypsum		Dust	Inhalation Skin and/or eye contact Ingestion	May cause irritation of the upper respiratory tract. Skin and eye contact may cause burning, irritation and hardening. If ingested it may cause obstruction.	Sealing of vent walls, timber treatment for fire prevention.	Light coloured to white powder. Slightly soluble.	OEL = 5 mg/m³ STEL = 10 mg/m³	26499-65-0
Mono blue							Not applicable	
PH Powder		Dust	Inhalation Eye contact	Irritation to the respiratory system when inhaled. Eye contact can result in corneal damage or blindness. Inflammation of the eye is characterized by redness, watering and itching.	Toilet product	White powder consisting of a combination of alkali's.	Not applicable	
Portabloo		Liquid Mist Vapour	Inhalation Skin and/or eye contact	The product is harmful with skin contact and will cause burns and irritation. Inhalation may cause dizziness and shortness of	Toilet product	Translucent blue liquid with a mild amine odour.	Not applicable	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				breath.				
Methane rich gas	296	Liquid Gas	Inhalation Skin and/or eye contact Ingestion	Inhalation may cause central nervous system effects. Headaches, nausea, dizziness and a loss of balance and coordination may occur. Unconsciousness, coma and respiratory failure as well as death may be results of exposure.	Flammable gas Drilling Intersections	Colourless, odourless. Flammable.	STEL = 1,4%	74--82-8
Welding fumes	598	Fumes	Inhalation	<i>Metal fume fever:</i> Muscle pains Shivering Chest tightness Feverishness	Welding operations		OEL = 5 mg/m3	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Carbon monoxide		Gas	Inhalation Skin and/or eye contact	Skin and eye contact may cause frostbite. Systemic toxicity may cause visual disturbances. Inhalation May cause adverse central nervous system, cardiovascular, respiratory, kidney and liver effects. These effects may include suffocation, discoloured skin, dilated pupils, hearing loss, nausea, vomiting, chest pain, lung damage, twitching, muscle spasms, in coordination, weakness, numbness, headache, dizziness, drowsiness, confusion, hallucinations, convulsions, blood disorders, heart failure, kidney failure, collapse, unconsciousness, coma and death.	Blasting operations Mine fires Diesel machinery	Colourless, odourless and tasteless. Flammable. Poisonous.	OEL = 55 mg/m ³ STEL = 100 ppm	630-08-0

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Carbon dioxide gas		Gas Liquid	Inhalation Skin and/or eye contact	Over exposure when inhaled may cause excitation and depression of the central nervous system. Carbon dioxide displaces oxygen which cause a fall in blood pressure. Eye contact may cause a stinging sensation and inhalation may effect vision. Skin contact may cause frostbite.	Blasting operations Mine fires Diesel machinery	Colourless, odourless, and tasteless. Could be a liquid under pressure.	OEL = 9000 mg/m3 STEL = 54000 mg/m3	124-38-9
Degreaser		Gas Mist	Inhalation, skin and/or eye contact	May cause pain and irritation to the skin and eyes. Inhalation may cause headache, dizziness, anaesthesia, and unconsciousness. Repeated exposure may cause kidney and liver effects. Pulmonary irritation may occur and dermatitis may result from repeated exposure.	Engineering operations	Colourless liquid with a irritating odour. It is slightly soluble in water. Corrosive.	Not applicable	
Mineral oil	450	Gas Mist	Inhalation, skin and/or eye contact	Skin, eye and lung irritation.	Engineering operations	Colourless to light brown liquid. It is flammable.	OEL = 5 mg/m3 STEL = 10 mg/m3	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
White wash		Liquid Vapour Mist Dust	Inhalation Skin and/or eye contact Ingestion	May cause skin and eye, nose and throat irritation. Harmful if inhaled. Aspiration hazard when swallowed. With chronic exposure central nervous system disorders like weakness, loss of co-ordination, fatigue, confusion and blurred vision may occur. Liver abnormalities as well as kidney, lung spleen and eye damage may occur. Cardiac effect on some persons.	For fire retardant application	Ammonia-like odour Flammable	<u>Titanium dioxide-</u> OEL = 10mg/m3 <u>Calcium</u> <u>Carbonate-</u> OEL = 10mg/m3 <u>Propylene glycol-</u> OEL = 470mg/m3 <u>Dimethylene</u> <u>Glycol-OEL = ?</u> <u>Xylene-</u> OEL = 435mg/m3 STEL = 650mg/m3 <u>Acetone-</u> OEL = 1780mg/m3 STEL = 3560mg/m3 <u>Ethyl Benzene-</u> OEL = 435mg/m3 STEL = 545mg/m3 <u>Toluene-</u> OEL = 188mg/m3 STEL = 560mg/m3 <u>Tetrachloroethylene</u> -OEL = 335mg/m3 STEL = 1000mg/m3	
Helium		Gas	Inhalation Skin and/or eye contact	Inhalation causes a high voice. Skin contact may cause frostbite and eye contact may cause blurred vision, deep burns and pain.	Drill intersections	Colourless, odourless. When refrigerated it forms a liquefied gas.	None available	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Portland cement	120/121	Dust	Inhalation Skin and/or eye contact Ingestion	No serious harm when dry. Inhalation may cause irritation or inflammation. Wet cement may cause serious burns, eyes may be irritated and chemical burns as well as blindness may occur. Prolonged exposure may cause silicoses. Irritation of the moist mucous membranes, nose, throat and upper respiratory tract. It may contain traces of substances that's listed as carcinogenic.	Batch plant operations Concrete mixing	Light grey powder.	OEL = 10 mg/m3	65997-15-1

HEG Identification : RAISE BORING / DRY DRILLING (12)

Activity Description	
Activity Area Code	
Occupations	Code
Raise and tunnel bore operator	20607
Raise and tunnel bore supervisor	20606

Chemicals Involved

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Dust		Dust	Inhalation or eye contact	Coughing & mild irritation. Eye contact may result in tears and mild irritation to the eyes.	Blasting, scraping, tipping, drilling, transport, travelling, spillage.	Finely divided solid matter.	OEL = 1mg/m3	
Silica Dust (respirable)	522	Dust	inhalation, skin and/or eye contact	Coughing and mild irritation. Skin contact may result in granulomas. Silicosis may occur with prolonged exposure. Carcinogen.	Blasting, scraping, tipping, drilling, transport, travelling, spillage.	Colourless to white, green, purple or black crystals. Odourless.	OEL = 0.1mg/m3	14808-60-7
Methane rich gas	296	Liquid Gas	Inhalation Skin and/or eye contact	Inhalation may cause central nervous system effects. Headaches,	Flammable gas Drilling	Colourless, odourless. Flammable.	STEL = 1,4%	74--82-8

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
			Ingestion	nausea, dizziness and a loss of balance and coordination may occur. Unconsciousness, coma and respiratory failure as well as death may be results of exposure.	Intersections			
Mineral oil	450	Gas Mist	Inhalation, skin and/or eye contact	Skin, eye and lung irritation.	Engineering operations	Colourless to light brown liquid. It is flammable.	OEL = 5 mg/m3 STEL = 10 mg/m3	
Hydrogen	296	Gas Vapour	Inhalation, skin and/or eye contact	Inhalation may cause dizziness, asphixia, laboured breathing and unconsciousness. Skin contact may cause frost bite. Inhalation may also cause a high voice and suffocation.	Flammable gas Drilling Intersections	Odourless, colourlessliquefied gas. Extremely Flammable	STEL = 1,4%	1333-74-0
Hydraulic Fluid		Liquid Mist Vapour	Inhalation Skin and/or eye contact Ingestion	It is mildly irritating to the skin and eyes. Inhalation may result in mild irritation of the upper respiratory tract. This product is slightly toxic when swallowed.	LHD machinery Engineering operations	Amber lubricating liquid. It has a hydrocarbon odour. Is oxidating.	Not applicable	
Carbon monoxide		Gas	Inhalation Skin and/or eye contact	Skin and eye contact may cause frostbite. Systemic toxicity may cause visual	Blasting operations Mine fires	Colourless, odourless and tasteless.	OEL = 55 mg/m3 STEL = 100 ppm	630-08-0

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				disturbances. Inhalation May cause adverse central nervous system, cardiovascular, respiratory, kidney and liver effects. These effects may include suffocation, discoloured skin, dilated pupils, hearing loss, nausea, vomiting, chest pain, lung damage, twitching, muscle spasms, in coordination, weakness, numbness, headache, dizziness, drowsiness, confusion, hallucinations, convulsions, blood disorders, heart failure, kidney failure, collapse, unconsciousness, coma and death.	Diesel machinery	Flammable. Poisonous.		
Carbon dioxide gas		Gas Liquid	Inhalation Skin and/or eye contact	Over exposure when inhaled may cause excitation and depression of the central nervous system. Carbon dioxide displaces oxygen which cause a fall in blood pressure. Eye contact	Blasting operations Mine fires Diesel machinery	Colourless, odourless, and tasteless. Could be a liquid under pressure.	OEL = 9000 mg/m³ STEL = 54000 mg/m³	124-38-9

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				may cause a stinging sensation and inhalation may effect vision. Skin contact may cause frostbite.				

HEG Identification : UNDERGROUND WORKSHOPS (18)

Activity Description	
Activity Area Code	
Occupations	Code
Auto electrician	40319
Diesel mechanic	40477
Diesel mech: apprentice	40478
Diesel mech: chargehand	40476
Diesel mech: forman	40475
Fitter	40432
Fitter: apprentice	40433
Fitter: chargehand	40431
Fitter: forman	40430
Fitter & turner	40428

Occupations	Code
Fitter & turner: apprentice	40429
Fitter & turner: chargehand	40427
Fitter & turner: forman	40426
Fitter: operative Gr.1	40434
Fitter: operative Gr.2	40435
Fitter: worker	40436
Mechanical eng. worker	40520
Mechanical forman	40599
Mechanical tradesman	40520
Welder	40456

Chemicals Involved

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Dust		Dust	Inhalation or eye contact	Coughing & mild irritation. Eye contact may result in tears and mild irritation to the eyes.	Blasting, scraping, tipping, drilling, transport, travelling, spillage.	Finely divided solid matter.	OEL = 1mg/m ³	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Ammonia	24	Gas	inhalation, ingestion (solution), skin and/or eye contact (solution/liquid)	Corrosive gas - may be fatal if inhaled. Lung injury. Severe respiratory tract irritant. Irritating to the nose and throat. Mildly irritating to moist skin - blisters may occur.	Blasting operations	Colourless gas with a sharp, pungent, suffocating, intensely irritating odour. Colourless liquid under pressure but can decompose at high temperature to form very flammable hydrogen and toxic nitrogen dioxide.	OEL = 17mg/m³ STEL = 24mg/m³	7664-41-7
Silica Dust (respirable)	522	Dust	inhalation, skin and/or eye contact	Coughing and mild irritation. Skin contact may result in granulomas. Silicosis may occur with prolonged exposure. Carcinogen.	Blasting, scraping, tipping, drilling, transport, travelling, spillage.	Colourless to white, green, purple or black crystals. Odourless.	OEL = 0.1 mg/m³	14808-60-7

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Diesel fumes		Mist Vapour	Inhalation	Carcinogen	Diesel machinery	Colourless oily liquid. May burn if strongly heated.	NO2- OEL = 5mg/m3 STEL = 9mg/m3 SO2-OEL = 5mg/m3 STEL = 13mg/m3 NO OEL = 30mg/m3 STEL = 45mg/m3 CO OEL = 55mg/m3 DIESEL PARTICULATE MATTER OEL = ?	
Carbon oil	43	Liquid Vapour	inhalation, ingestion (solution), skin and/or eye contact (solution/liquid)	Harmful when inhaled or swallowed. Central nervous system depressant. It causes headache, nausea, dizziness, drowsiness, and confusion. It may cause blood and bone marrow effects. Aspiration hazard. Prolonged exposure may result in dermatitis. Carcinogen & Mutagen.	Engineering operations	Clear and colourless liquid. Aromatic hydrocarbon odour. Vapour is heavier than air, thus might spread long distances. Liquid can float on water, thus might spread fire. Decompose at high temperature and forming toxic gases.	Toluene- OEL = 188mg/m3 STEL = 560mg/m3 Tetrachloroethylene -OEL = 335mg/m3 STEL = 1000mg/m3 EthylBenzene- OEL = 435 STEL = 545mg/m3 Xylene-OEL = 435 STEL = 650mg/m3	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Degreaser		Gas Mist	Inhalation, skin and/or eye contact	May cause pain and irritation to the skin and eyes. Inhalation may cause headache, dizziness, anaesthesia, and unconsciousness. Repeated exposure may cause kidney and liver effects. Pulmonary irritation may occur and dermatitis may result from repeated exposure.	Engineering operations	Colourless liquid with a irritating odour. It is slightly soluble in water. Corrosive.	Not applicable	
Mineral oil	450	Gas Mist	Inhalation, skin and/or eye contact	Skin, eye and lung irritation.	Engineering operations	Colourless to light brown liquid. It is flammable.	OEL = 5 mg/m ³ STEL = 10 mg/m ³	
Grease	298	Fluid	Inhalation Skin	Mild skin and eye irritation. Inhalation of smoke contaminated with grease may cause throat irritation, coughing and a tightness in chest. Lungs may become irritated from fluorine components.	Engineering operations	White dense and viscous fluid	Not applicable	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Welding fumes	598	Fumes	Inhalation	<i>Metal fume fever:</i> Muscle pains Shivering Chest tightness Feverishness	Welding operations		OEL = 5 mg/m ³	
Aerosol Paint		Liquid Vapour Fumes Mist	Inhalation Skin and/or eye contact Ingestion	May cause skin and eye irritation. When inhaled or ingested person may suffer from severe respiratory distress as well as central nervous system depression. Prolonged and/or repeated skin contact may cause dermatitis.	Marking off	Various colours Flammable	Not applicable	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Electroclean		Liquid Gas	Inhalation Skin and/or eye contact Ingestion	Skin and eye irritation may occur while inhalation may cause acute irritation and respiratory effects. Excess inhalation may cause dizziness, giddiness and nausea. Diliberate inhalation may be fatal. Repeated exposure may cause permanent central nervous system damage. Irreversible effects to the liver and kidneys may result. Ingestion causes nausea, cramps, vomiting and diarrhea.	Engineering operations	Colourless liquid with a hydrocarbon odour. Flammable.	Toluene-OEL = 188mg/m3 STEL = 560mg/m3 Tetrachloroethylene-OEL = 335mg/m3 STEL = 1000mg/m3 EthylBenzene-OEL = 435 STEL = 545mg/m3 Xylene-OEL = 435 STEL = 650mg/m3 Hydrocarbons (Nonane)-OEL = 1049mg/m3	
Quick start		Liquid Vapour Mist	Inhalation Skin and/or eye contact	Inhalation may cause dizziness, strong anesthesia, intoxication and unconsciousness. Skin contact may cause irritation and defatting of the skin.	Engineering operations	Pale yellow liquid to clear liquid. It has a strong ethereal odour. It evaporates quickly and leaves a slight lubricant residue. Extremely Flammable.	None available	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Loctite		Gas Past	Inhalation Skin and/or eye contact Ingestion	Ingestion may cause delayed effects on the blood, gastrointestinal, nervous and reproductive system. Skin contact may result in dermatitis. Carcinogen.	Engineering operations	White paste and black paste with a mild odour.	Aluminum Hydroxide-OEL=? TitaniumDioxide-OEL = 10mg/m3	
Wynn's Green Cleaner		Gas Smoke Mist	Inhalation Skin and/or eye contact Ingestion	Skin contact may result in absorption of harmful amounts which may result in central nervous system depression. Eye contact may cause irritation. Inhalation of the product may cause nose, throat and respiratory tract irritation as well as central nervous system depression. Irritation to the digestive tract and red blood hemolysis when swallowed. It may cause dizziness, headache, nausea, vomiting and incoordination.	Engineering operations	Green liquid with a characteristic odour. Flammable.	Not applicable	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Rubber solvent		Liquid Mist Vapour	Inhalation Skin and/or eye contact Ingestion	It may cause moderate skin irritation, defatting and dermatitis. Inhalation may cause dizziness, headache and unconsciousness. Ingestion cause vomiting, nausea and diarrhea. Inhalation may cause bronchopneumonia and Pulmonary edema.	Engineering operations	Flammable liquid with a mild odour.	None available	
Anti rust		Liquid Mist Gas	Inhalation Skin and/or eye contact Ingestion	It may cause burns in the eyes and on the skin when contact occurs. It may also be corrosive to the eyes. Inhalation may cause irritation to the respiratory tachea.	Engineering operations	Colourless limphid liquid. It is very syrupy with no odour.	Phosphoric Acids- OEL = 1mg/m3 STEL = 3mg/m3	
Ammonium nitrate		Liquid Gas Mist	Inhalation Skin and/or eye contact Ingestion	Skin and eye contact may cause dryness and irritation. Inhalation may cause a sore throat, coughing and a shortness of breath. Ingestion may cause dizziness, cramps, vomiting, blood disorders, weakness and depression.	Blasting operations	White to cream in colour, but odourless.	None available	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Metal Powder		Dust	Inhalation Skin and/or eye contact	Fumes generated may be dangerous. Dryness and irritation of the throat, nose, eyes, and lungs may occur. Dizziness and nausea may result. May be a carcinogen.	Blasting operations	Odourless metallic grey powder.	None available	
Copper metal	154/155	Dust Vapour Fumes	Inhalation Skin and/or eye contact Ingestion	Is a mechanical irritant when in eye which may cause severe corneal damage. When ingested it may cause intense abdominal pain. Inhalation may cause metal fume fever, headache, a metallic taste in mouth, cough, thirst, shortness of breath, fever, pain in the legs and chest. May discolour the skin.	Blasting operations	Bright reddish, lustrous metal in the form of foil, wire or turnings. Odourless.	OEL = 1 mg/m³ STEL = 2 mg/m³	7440-50-8
Nitrocellulose		Dust Gas	Inhalation Skin and/or eye contact	Skin and eye contact may cause irritation. Inhalation may cause narcosis, weakness, drowsiness and unconsciousness.	Blasting operations	Alcohol odour.	None available	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Tin	567/568	Dust Fumes	Inhalation Skin and/or eye contact Ingestion	Skin and eye contact may cause mechanical irritation. Inhalation may cause fatigue and anaemia. Central nervous system damage, nasal inflammation and kidney disfunction may occur. It may also cause headache, nausea, muscular pain and possible liver damage.	Blasting operations	Silver-grey metal that's odourless. Various shapes and sizes.	OEL = 2 mg/m³ STEL = 4 mg/m³	
Citric acid		Dust	Inhalation Skin and/or eye contact	Skin and eye contact may cause a slight irritation. If inhaled irritation may occur.	Blasting operations	Powder with no known odour. Colourless crystals.	None available	
Gold reference		Liquid Mist	Inhalation Skin and/or eye contact Ingestion	Skin and eye contact may cause irritation, burns, blisters, watering, conjunctivitis and dermatitis. Inhalation may also cause irritation of the eyes, nose, throat, and upper respiratory tract, coughing and choking. Over exposure may lead to ulceration of the oral and nasal mucosa. Ingestion may cause	Blasting operations	Clear, yellow liquid with a slight hydrochloric acid odour.	None available	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				burns to the mouth, throat, oesophagus and stomach. It may also cause nausea and vomiting.				
Iron	348	Dust Fumes Mist	Inhalation Skin and/or eye contact Ingestion	It may cause mild irritation to the respiratory tract when inhaled. Large doses ingested may cause gastrointestinal disturbances. Skin and eye contact may cause irritation.	Blasting operations	White crystals with no odour.	OEL = 5 mg/m STEL = 10 mg/m3	1309-37-1
Activated charcoal		Dust	Inhalation Skin and/or eye contact Ingestion	If inhaled it may cause respiratory tract and cardiovascular effects. When ingested it may cause mild irritation to the gastrointestinal tract. Skin and eye contact may cause redness.	Blasting operations	Fine black powder that's odourless. Flammable	None available	
Polyethylene		Dust Vapours	Inhalation Skin and/or eye contact Ingestion	Eye contact may result in irritation or corneal injury due to mechanical action.	Blasting operations	No odour.	None available	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Potassium nitrate		Dust Fumes	Inhalation Eye contact	Eye contact may cause mild irritation and may burn. Dust may be irritating when inhaled. Symptoms like weakness, depression, headache, mental impairment, dizziness, abdominal cramps, vomiting, bloody diarrhoea, convulsions and collapse may occur.	Blasting operations	White to buff crystals. No odour.	None available	
Polycarbonate		Dust Fumes	Inhalation Skin and/or eye contact Ingestion	Eye contact may cause irritation and corneal injury due to mechanical action. Prolonged exposure to skin may cause irritation due to mechanical irritation. Dust inhaled may cause irritation to the upper respiratory tract.	Blasting operations	Milky white or coloured solid with a mild odour.	None available	
Silicon dioxide		Dust Gas Mist	Inhalation Skin and/or eye contact Ingestion	It is slightly irritating to the skin, and mildly irritating to the eyes. Inhalation may result in upper respiratory irritation and emphysema. Repeated exposure may result in	Blasting operations	Clear to cloudy liquid. It is odourless.	OEL = 10mg/m ³	7440-21-3

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				lung changes.				
Quartz	521	Dust	Inhalation Skin and/or eye contact Ingestion	Skin and eye contact may cause mechanical irritation. Inhalation of dust may cause irritation of the respiratory tract.	Blasting operations	White pellets with no odour.	OEL = 0.1 mg/m3	14808-60-7
Isocyanine	356	Gas Mist	Inhalation Skin and/or eye contact Ingestion	Skin and eye contact may cause irritation. Ingestion will cause adverse health effects. Inhalation will cause irritation of the respiratory tract. It may result in asthma-like spasms of the bronchial tubes and difficulty in breathing. People with a history of respiratory disease or hyper sensitivity should not be exposed to this product.	Blasting operations	Brown	OEL = 0.02 mg/m3	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Potassium perchlorate		Dust	Inhalation Skin and/or eye contact Ingestion Absorption through skin	Inhalation of the product may cause irritation to the respiratory tract, coughing, shortness of breath and pulmonary edema. Ingestion may cause irritation to the mucous membranes and may result in vomiting, nausea, fever and rushes. Skin may turn blue due to an oxygen deficiency. Red blood cells may be broken down which will result in kidney damage. It may also effect the bone marrow. Skin and eye contact may cause irritation resulting in redness, itching and pain.	Blasting operations	White odourless powder. It is flammable and a strong oxidizer.	None available	
PH Powder		Dust	Inhalation Eye contact	Irritation to the respiratory system when inhaled. Eye contact can result in corneal damage or blindness. Inflammation of the eye is characterized by redness, watering and	Toilet product	White powder consisting of a combination of alkali's.	None available	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				itching.				
Portabloo		Liquid Mist Vapour	Inhalation Skin and/or eye contact	The product is harmful with skin contact and will cause burns and irritation. Inhalation may cause dizziness and shortness of breath.	Toilet product	Translucent blue liquid with a mild amine odour.	None available	
Mono blue					Toilet product		None available	
Stripper		Liquid Vapour Mist	Inhalation Skin and/or eye contact Ingestion		Engineering operations	Clear to yellow-brown liquid.	Not applicable	
Turpentine		Liquid Vapour Mist	Inhalation Skin and/or eye contact Ingestion	It may cause skin irritation, dermatitis or chemical burns. The liquid can penetrate the skin to cause systemic effects. Contact with the eyes may cause conjunctivitis or corneal burns. Ingestion may cause nausea, serious illness or death. If inhaled it may produce irritation, headache,	Engineering operations	Clear, colourless liquid with a pungent odour. Flammable.	OEL = 560 mg/m3 STEL = 840 mg/m3	8006-64-2

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				dizziness, chest pain, pulmonary edema, cyanosis, narcosis and rapid heart rate.				
Carbon monoxide		Gas	Inhalation Skin and/or eye contact	Skin and eye contact may cause frostbite. Systemic toxicity may cause visual disturbances. Inhalation May cause adverse central nervous system, cardiovascular, respiratory, kidney and liver effects. These effects may include suffocation, discoloured skin, dilated pupils, hearing loss, nausea, vomiting, chest pain, lung damage, twitching, muscle spasms, in coordination, weakness, numbness, headache, dizziness, drowsiness, confusion, hallucinations, convulsions, blood disorders, heart failure,	Blasting operations Mine fires Diesel machinery	Colourless, odourless and tasteless. Flammable. Poisonous.	OEL = 55 mg/m³ STEL = 100 ppm	630-08-0

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				kidney failure, collapse, unconsciousness, coma and death.				
Carbon dioxide gas		Gas Liquid	Inhalation Skin and/or eye contact	Over exposure when inhaled may cause excitation and depression of the central nervous system. Carbon dioxide displaces oxygen which cause a fall in blood pressure. Eye contact may cause a stinging sensation and inhalation may effect vision. Skin contact may cause frostbite.	Blasting operations Mine fires Diesel machinery	Colourless, odourless, and tasteless. Could be a liquid under pressure.	OEL = 9000 mg/m3 STEL = 54000 mg/m3	124-38-9

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Caustic soda		Liquid Mist Vapour	Inhalation Skin and/or eye contact Ingestion	Skin contact may cause burns, frequently causing deep ulceration's and ultimate scarring. It is extremely hazardous when in skin contact. Eye contact may cause server burns and possible blindness. Inhalation of the product may cause damage to the upper respiratory tract and lungs. It is very hangerous in case of inhalation. When ingested it may be corrosive to the gastrointestinal tract.		Clear to slightly turbid colourless. It is odourless.	Sodium Hydroxide- STEL = 2mg/m3	
Silicon Grease		Vapour	Inhalation Skin and/or eye contact Ingestion	Eye contact may result in temporary discomfort. Allergic conditions may occur.	Engineering operations	White, clear, black or yellow in colour and with very little odour. Past-like.	None available	
Sulphuric acid		Liquid Mist Aerosol Vapour	Inhalation Skin and/or eye contact Ingestion	Inhalation may cause a burning sensation, coughing and laboured breathing. It is a corrosive substance. Eye contact may cause redness, pain and deep	Battery Bays	Colourless, oily hygroscopic liquid with no odour. It's a strong acid.	OEL = 1 mg/m3 STEL = 3 mg/m3	7664-93-9

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				burns. Ingestion can cause abdominal pain, burning sensation and collapse.				
Hydrogen		Gas Vapour	Inhalation Skin and/or eye contact	Inhalation may cause dizziness, asphyxia, laboured breathing and unconsciousness. Skin contact may cause frostbite. Inhalation may cause a high voice and suffocation.	Flammable gas Drilling intersections Battery Bays	Odourless, colourless compressed liquefied gas. Extremely flammable.	STEL = 1.4%	1333-74-0
Galvanized carbon steel		Dust Fumes	Inhalation Skin and/or eye contact	Metal fever may occur. Eye contact may cause irritation. Siderosis may occur from prolonged exposure. Skin contact may cause irritation and dermatitis. Some metals are carcinogenic.	Welding operations	Silver-grey metallic steel.	Metals	
Galvanized metal primer		Liquid Smoke Fumes	Inhalation Skin and/or eye contact Skin absorption Ingestion	Skin and eye contact may cause irritation and inflammation. Over exposure may cause headache, dizziness, drowsiness, coughing and irritation of the respiratory tract. Ingestion may cause	Welding operations	White liquid with a petroleum odour. (Rust paint)	Metals	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				nausea, vomiting and irritation. Repeated exposure to xylene may increase risk of injury o the kidneys, liver and the respiratory tract.				

HEG Identification : ROVING UNDERGROUND (17)

Activity Description Activity Area Code					
Occupations	Code	Occupations	Code	Occupations	Code
Air & water services team leader	21507	Environmental superintendent	51002	Occupational hygienist	70121
Air & water services worker	21508	Filter operator/worker	30302	Refrigeration engineer	40412
Air quality analyst		Filter team leader	30301	Refrigeration mechanic	40413
Boiler attendant	40803	Firemaster	80201	Refrigeration plant operator	40415
Boilermaker: operative aide Gr. 2	40451	First aid attendant	70802	Refrigeration plant team leader	40414
Boilermaker: operative Gr. 1	40450	General engineering supervisor	40002	Rigger & ropeman	40508
Cable joiner	40343	General manager	101	Rigger & ropeman worker	40511
Carpenter	40621	Geological management	50100	Rigger & ropeman: apprentice	40509
Cementation supervisor	21601	Geological observer	50109	Rigger & ropeman: chargehand	40507
Cementation worker	21699	Geological technician	50108	Rigger & ropeman: forman	40506
Chairlift operator	21307	Geological worker	50199	Rigger aide	40510
Compressor attendant	40804	Geologist	50101	Rock mechanic engineer	50301
Compressor driver		Haulage rail transport worker	21099	Rock mechanic management	50300
Contractor outside	49902	Haulage team leader	21001	Rock mechanics officer	50302
Diamond drill team leader	50111	Industrial engineering officer	50704	Safety/loss control auditor	50802
Diamond drill worker	50112	Instrument mechanic	40325	Safety/loss control manager	50800
Diamond driller	50110	Instrument technician	40322	Safety/loss control observer	50803
Diesel mechanic	40477	Junior engineer (civil engineer)	40602	Safety/loss control officer	50801
Diesel mechanic: apprentice	40478	Junior engineer (electrical engineer)	40302	Safety/loss control worker	50899
Diesel mechanic: chargehand	40476	Junior engineer (mechanical engineer)	40402	Salvage & reclamation worker	29907
Diesel mechanic: foreman	40475	Learner miner	20309	Sanitation worker	40904
Electrical chargehand	40341	Learner official (assay chemistry)	50409	Section manager	20001
Electrical eng. Worker	40399	Learner official (electrical eng.)	40303	Survey (mine)	50202
Electrical engineer	40301	Learner official (engineering)	40206	Shift boss	20302
Electrician	40314	Learner official (geology)	50113	Shotcrete worker	20804

Electrician: aide	40317	Learner official (mechanical eng.)	40403	Spannerman	20405
Electrician: apprentice	40315	Learner official (metallurgy)	30105	Strata control observer	50304
Electrician: chargehand	40313	Learner official (mining)	20202	Strata control officer	50303
Electrician: foreman	40312	Mechanical engineering worker	40599	Student (engineering)	49993
Electronic technician	40311	Mechanical forman	40520	Student (geology)	50193
Engineer	40201	Machinery inspector		Survey worker	50299
Engineering assistant	40205	Meshing and lacing team leader	20803	Trainer	29998
Engineering foreman	40004	Meshing and lacing worker	20804	Training officer	60301
Engineering team leader	49901	Mine construction team leader	21510	Transport worker	81399
Environmental assistant	51004	Mine construction worker	21599	Winding engine driver	21301
Environmental construction worker	51007	Mine overseer	20002	Work study observer	50707
Environmental engineer	51001	Mine police	80103	Work study officer	50706
Environmental observer	51005	Miner general	20305		
Environmental officer	51003	Mining engineer	20201		

Chemicals Involved

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Dust		Dust	Inhalation or eye contact	Coughing & mild irritation. Eye contact may result in tears and mild irritation to the eyes.	Blasting, scraping, tipping, drilling, transport, travelling, spillage.	Finely divided solid matter.	OEL = 1mg/m³	
Silica Dust (respirable)	522	Dust	inhalation, skin and/or eye contact	Coughing and mild irritation. Skin contact may result in granulomas. Silicosis may occur with	Blasting, scraping, tipping, drilling, transport,	Colourless to white, green, purple or black crystals. Odourless.	OEL = 0.1mg/m³	14808-60-7

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				prolonged exposure. Carcinogen.	travelling, spillage.			
Ammonia	24	Gas	inhalation, ingestion (solution), skin and/or eye contact (solution/liquid)	Corrosive gas - may be fatal if inhaled. Lung injury. Severe respiratory tract irritant. Irritating to the nose and throat. Mildly irritating to moist skin - blisters may occur.	Blasting operations	Colourless gas with a sharp, pungent, suffocating, intensely irritating odour. Colourless liquid under pressure but can decompose at high temperature to form very flammable hydrogen and toxic nitrogen dioxide.	OEL = 17 mg/m³ STEL = 24mg/m³	7664-41-7

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Diesel fumes		Mist Vapour	Inhalation	Carcinogen	Diesel machinery	Colourless oily liquid. May burn if strongly heated.	NO2- OEL = 5mg/m3 STEL = 9mg/m3 SO2-OEL = 5mg/m3 STEL = 13mg/m3 NO OEL = 30mg/m3 STEL = 45mg/m3 CO OEL = 55mg/m3 DIESEL PARTICULATE MATTER OEL = ?	
Carbon oil	43	Liquid Vapour	inhalation, ingestion (solution), skin and/or eye contact (solution/liquid)	Harmful when inhaled or swallowed. Central nervous system depressant. It causes headache, nausea, dizziness, drowsiness, and confusion. It may cause blood and bone marrow effects. Aspiration hazard. Prolonged exposure may result in dermatitis. Carcinogen & Mutagen.	Engineering operations	Clear and colourless liquid. Aromatic hydrocarbon odour. Vapour is heavier than air, thus might spread long distances. Liquid can float on water, thus might spread fire. Decompose at high temperature and forming toxic gases.	Toluene- OEL = 188mg/m3 STEL = 560mg/m3 Tetrachloroethylene -OEL = 335mg/m3 STEL = 1000mg/m3 EthylBenzene- OEL = 435 STEL = 545mg/m3 Xylene-OEL = 435 STEL = 650mg/m3	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Degreaser		Gas Mist	Inhalation, skin and/or eye contact	May cause pain and irritation to the skin and eyes. Inhalation may cause headache, dizziness, anaesthesia, and unconsciousness. Repeated exposure may cause kidney and liver effects. Pulmonary irritation may occur and dermatitis may result from repeated exposure.	Engineering operations	Colourless liquid with a irritating odour. It is slightly soluble in water. Corrosive.	Not applicable	
Mineral oil	450	Gas Mist	Inhalation, skin and/or eye contact	Skin, eye and lung irritation.	Engineering operations	Colourless to light brown liquid. It is flammable.	OEL = 5 mg/m ³ STEL = 10 mg/m ³	
Grease	298	Fluid	Inhalation Skin	Mild skin and eye irritation. Inhalation of smoke contaminated with grease may cause throat irritation, coughing and a tightness in chest. Lungs may become irritated from fluorine components.	Engineering operations	White dense and viscous fluid	Not applicable	
Welding fumes	598	Fumes	Inhalation	<i>Metal fume fever:</i> Muscle pains Shivering Chest tightness	Welding operations		OEL = 5 mg/m ³	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				Feverishness				
Aerosol Paint		Liquid Vapour Fumes Mist	Inhalation Skin and/or eye contact Ingestion	May cause skin and eye irritation. When inhaled or ingested person may suffer from severe respiratory distress as well as central nervous system depression. Prolonged and/or repeated skin contact may cause dermatitis.	Marking off	Various colours Flammable	Not applicable	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
White wash		Liquid Vapour Mist Dust	Inhalation Skin and/or eye contact Ingestion	May cause skin and eye, nose and throat irritation. Harmful if inhaled. Aspiration hazard when swallowed. With chronic exposure central nervous system disorders like weakness, loss of co-ordination, fatigue, confusion and blurred vision may occur. Liver abnormalities as well as kidney, lung spleen and eye damage may occur. Cardiac effect on some persons.	For fire retardant application	Ammonia-like odour Flammable	<u>Titanium dioxide-</u> OEL = 10mg/m3 <u>Calcium</u> <u>Carbonate-</u> OEL = 10mg/m3 <u>Propylene glycol-</u> OEL = 470mg/m3 <u>Dimethylene</u> <u>Glycol-OEL = ?</u> <u>Xylene-</u> OEL = 435mg/m3 STEL = 650mg/m3 <u>Acetone-</u> OEL = 1780mg/m3 STEL = 3560mg/m3 <u>Ethyl Benzene-</u> OEL = 435mg/m3 STEL = 545mg/m3 <u>Toluene-</u> OEL = 188mg/m3 STEL = 560mg/m3 <u>Tetrachloroethylene</u> -OEL = 335mg/m3 STEL = 1000mg/m3	
Ammonium nitrate		Liquid Gas Mist	Inhalation Skin and/or eye contact Ingestion	Skin and eye contact may cause dryness and irritation. Inhalation may cause a sore throat, coughing and a shortness of breath. Ingestion may	Blasting operations	White to cream in colour, but odourless.	Not applicable	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				cause dizziness, cramps, vomiting, blood disorders, weakness and depression.				
Metal Powder		Dust	Inhalation Skin and/or eye contact	Fumes generated may be dangerous. Dryness and irritation of the throat, nose, eyes, and lungs may occur. Dizziness and nausea may result. May be a carcinogen.	Blasting operations	Odourless metallic grey powder.	Not applicable	
Copper metal	154/155	Dust Vapour Fumes	Inhalation Skin and/or eye contact Ingestion	Is a mechanical irritant when in eye which may cause severe corneal damage. When ingested it may cause intense abdominal pain. Inhalation may cause metal fume fever, headache, a metallic taste in mouth, cough, thirst, shortness of breath, fever, pain in the legs and chest. May discolour the skin.	Blasting operations	Bright reddish, lustrous metal in the form of foil, wire or turnings. Odourless.	OEL = 1 mg/m³ STEL = 2 mg/m³	7440-50-8
Nitrocellulose		Dust Gas	Inhalation Skin and/or eye contact	Skin and eye contact may cause irritation. Inhalation may cause narcosis, weakness,	Blasting operations	Alcohol odour.	Not applicable	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				drowsiness and unconsciousness.				
Tin	567/568	Dust Fumes	Inhalation Skin and/or eye contact Ingestion	Skin and eye contact may cause mechanical irritation. Inhalation may cause fatigue and anaemia. Central nervous system damage, nasal inflammation and kidney disfunction may occur. It may also cause headache, nausea, muscular pain and possible liver damage.	Blasting operations	Silver-grey metal that's odourless. Various shapes and sizes.	OEL = 2 mg/m3 STEL = 4 mg/m3	
Citric acid		Dust	Inhalation Skin and/or eye contact	Skin and eye contact may cause a slight irritation. If inhaled irritation may occur.	Blasting operations	Powder with no known odour. Colourless crystals.	Not applicable	
Gold reference		Liquid Mist	Inhalation Skin and/or eye contact Ingestion	Skin and eye contact may cause irritation, burns, blisters, watering, conjunctivitis and dermatitis. Inhalation may also cause irritation of the eyes, nose, throat, and upper respiratory tract, coughing and choking. Over exposure may lead	Blasting operations	Clear, yellow liquid with a slight hydrochloric acid odour.	Not applicable	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				to ulceration of the oral and nasal mucosa. Ingestion may cause burns to the mouth, throat, oesophagus and stomach. It may also cause nausea and vomiting.				
Iron	348	Dust Fumes Mist	Inhalation Skin and/or eye contact Ingestion	It may cause mild irritation to the respiratory tract when inhaled. Large doses ingested may cause gastrointestinal disturbances. Skin and eye contact may cause irritation.	Blasting operations	White crystals with no odour.	OEL = 5 mg/m STEL = 10 mg/m³	1309-37-1
Activated charcoal		Dust	Inhalation Skin and/or eye contact Ingestion	If inhaled it may cause respiratory tract and cardiovascular effects. When ingested it may cause mild irritation to the gastrointestinal tract. Skin and eye contact may cause redness.	Blasting operations	Fine black powder that's odourless. Flammable	Not applicable	
Polyethylene		Dust Vapours	Inhalation Skin and/or eye contact Ingestion	Eye contact may result in irritation or corneal injury due to mechanical action.	Blasting operations	No odour.	Not applicable	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Potassium nitrate		Dust Fumes	Inhalation Eye contact	Eye contact may cause mild irritation and may burn. Dust may be irritating when inhaled. Symptoms like weakness, depression, headache, mental impairment, dizziness, abdominal cramps, vomiting, bloody diarrhoea, convulsions and collapse may occur.	Blasting operations	White to buff crystals. No odour.	Not applicable	
Polycarbonate		Dust Fumes	Inhalation Skin and/or eye contact Ingestion	Eye contact may cause irritation and corneal injury due to mechanical action. Prolonged exposure to skin may cause irritation due to mechanical irritation. Dust inhaled may cause irritation to the upper respiratory tract.	Blasting operations	Milky white or coloured solid with a mild odour.	Not applicable	
Silicon dioxide		Dust Gas Mist	Inhalation Skin and/or eye contact Ingestion	It is slightly irritating to the skin, and mildly irritating to the eyes. Inhalation may result in upper respiratory irritation and emphysema. Repeated exposure may result in	Blasting operations	Clear to cloudy liquid. It is odourless.	OEL = 10mg/m ³	7440-21-3

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				lung changes.				
Quartz	521	Dust	Inhalation Skin and/or eye contact Ingestion	Skin and eye contact may cause mechanical irritation. Inhalation of dust may cause irritation of the respiratory tract.	Blasting operations	White pellets with no odour.	OEL = 0.1 mg/m3	14808-60-7
Isocyanine	356	Gas Mist	Inhalation Skin and/or eye contact Ingestion	Skin and eye contact may cause irritation. Ingestion will cause adverse health effects. Inhalation will cause irritation of the respiratory tract. It may result in asthma-like spasms of the bronchial tubes and difficulty in breathing. People with a history of respiratory disease or hyper sensitivity should not be exposed to this product.	Blasting operations	Brown	OEL = 0.02 mg/m3	
Potassium perchlorate		Dust	Inhalation Skin and/or eye contact Ingestion Absorption through skin	Inhalation of the product may cause irritation to the respiratory tract, coughing, shortness of breath and pulmonary edema. Ingestion may cause irritation to the	Blasting operations	White odourless powder. It is flammable and a strong oxidizer.	Not applicable	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				mucous membranes and may result in vomiting, nausea, fever and rushes. Skin may turn blue due to an oxygen deficiency. Red blood cells may be broken down which will result in kidney damage. It may also effect the bone marrow. Skin and eye contact may cause irritation resulting in redness, itching and pain.				
Wood dust	600/601	Dust	Inhalation Skin and/or eye contact	Harmful when inhaled or swallowed. It may cause eye and skin irritation. Prolonged exposure to the eye may cause conjunctivitis or allergic dermatitis. Prolonged exposure may also lead to inflammation of the nasal passage, lung iseases or asthma. Wood dust is a fire and explosion hazard when exposed to heat.	Installation of wooden support	Wood particles of various size produced by any manual or mechanical cutting, chipping, sawing or sanding.	OEL = 5 mg/m3 (Hard & Soft wood) STEL = 10 mg/m3 (Soft wood)	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Soudal foam		Foam Mist	Inhalation Skin and/or eye contact	The product may be irritating to skin, eyes and the respiratory system.	Vent sealing and tamping of holes.	Foam	None available	
Carbon monoxide		Gas	Inhalation Skin and/or eye contact	Skin and eye contact may cause frostbite. Systemic toxicity may cause visual disturbances. Inhalation May cause adverse central nervous system, cardiovascular, respiratory, kidney and liver effects. These effects may include suffocation, discoloured skin, dilated pupils, hearing loss, nausea, vomiting, chest pain, lung damage, twitching, muscle spasms, in coordination, weakness, numbness, headache, dizziness, drowsiness, confusion, hallucinations, convulsions, blood disorders, heart failure, kidney failure, collapse, unconsciousness, coma	Blasting operations Mine fires Diesel machinery	Colourless, odourless and tasteless. Flammable. Poisonous.	OEL = 55 mg/m ³ STEL = 100 ppm	630-08-0

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				and death.				
Carbon dioxide gas		Gas Liquid	Inhalation Skin and/or eye contact	Over exposure when inhaled may cause excitation and depression of the central nervous system. Carbon dioxide displaces oxygen which cause a fall in blood pressure. Eye contact may cause a stinging sensation and inhalation may effect vision. Skin contact may cause frostbite.	Blasting operations Mine fires Diesel machinery	Colourless, odourless, and tasteless. Could be a liquid under pressure.	OEL = 9000 mg/m³ STEL = 54000 mg/m³	124-38-9
Glue Epoxy Resin		Liquid Vapour Mist	Inhalation Skin and/or eye contact	Skin and eye contact will cause irritation. Inhalation of the product will cause respiratory tract irritation. Ingestion may cause adverse health effects.	Backfill products Vent curtaining	Brown liquid with a faint odour. It is corrosive.	<u>Phenol-</u> OEL = 19mg/m³ STEL = 38mg/m³ <u>Formaldehyde-</u> OEL = 2.5mg/m³ STEL = 2.5mg/m³ <u>Sodium Hydroxide-</u> STEL = 2mg/m³ Amine-OEL = ?	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
PH Powder		Dust	Inhalation Eye contact	Irritation to the respiratory system when inhaled. Eye contact can result in corneal damage or blindness. Inflammation of the eye is characterized by redness, watering and itching.	Toilet product	White powder consisting of a combination of alkali's.	Not applicable	
Portabloo		Liquid Mist Vapour	Inhalation Skin and/or eye contact	The product is harmful with skin contact and will cause burns and irritation. Inhalation may cause dizziness and shortness of breath.	Toilet product	Translucent blue liquid with a mild amine odour.	Not applicable	
PRLC 40		Liquid Fumes Gas	Inhalation Skin and/or eye contact Ingestion	This product may cause respiratory tract, skin and eye irritation. It may cause a shortness of breath as well as nose bleeds. Ingestion may cause nausea. Direct contact may cause irritation, redness, pain, erythema, flustering, exfoliation, ulceration, necrosis and scaring.	Batch plant operations	Pink liquid that's odourless.	Not applicable	
SP 100		Liquid Fumes	Inhalation Skin and/or eye	It is irritating to the eyes and skin and may be	Batch plant operations	Clear brown liquid with blan	Not applicable	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
		Vapour	contact Ingestion	harmful if swallowed. Vapour may be an irritant to the mucous membranes and respiratory tract.		odour. Flammable		
PRPL 25		Liquid Dust Vapour Mist	Inhalation Skin and/or eye contact Ingestion	Swallowing of the product may irritate the mouth, throat and stomach causing pain, nausea and vomiting. If it is inhaled it may cause irritation to the upper respiratory tract causing a sore throat, coughing or breathing difficulties.	Batch plant operations	Dark brown liquid with a slight non-distinct odour. Flammable	Amine-OEL = ?	
Meyco SA 160		Liquid Mist	Inhalation Skin and/or eye contact	It may cause skin and eye irritation.	Batch plant operations	White to beige liquid.	Not applicable	
Meyco TCC 735		Liquid Mist Vapour	Inhalation Skin and/or eye contact Ingestion		Batch plant operations	White liquid with a low odour.	Paraffin-OEL = 2mg/m³ STEL = 6mg/m³	
Myco TCC 766		Liquid Aerosol Mist	Inhalation Skin and/or eye contact Ingestion	May be irritating to the skin and eyes.	Batch plant operations	Dark brown liquid with no odour.	Not applicable	
Polyheed SG		Liquid Mist Gas	Inhalation Skin and/or eye contact	It may cause irritation to the skin and eyes. Inhalation dangerous if	Batch plant operations	Brown liquid with a wood resin odour.	Not applicable	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
			Ingestion	in contact with acid because toxic gasses form.				
DELVO Stabilizer 10		Liquid Mist	Inhalation Skin and/or eye contact Ingestion	Skin and eye irritation may occur with burning to the eyes.	Batch plant operations	Light pink liquid with a slightly acidic odour. It reacts with oxidants and alkaline compounds.	Hydrochloric Acid- STEL=7mg/m3	
Plaster/Gypsum		Dust	Inhalation Skin and/or eye contact Ingestion	May cause irritation of the upper respiratory tract. Skin and eye contact may cause burning, irritation and hardening. If ingested it may cause obstruction.	Sealing of vent walls, timber treatment for fire prevention.	Light coloured to white powder. Slightly soluble.	OEL = 10 mg/m3	26499-65-0
Mono blue Vent Seal		Liquid	Inhalation Skin and/or eye contact	High airborne concentration may cause drowsiness and lethargy. Skin and eye contact may cause temporary irritation.	Vent sealing	Comp. A: Brown liquid Comp. B: Red viscous liquid with amine odour.	Not applicable	
Helium		Gas	Inhalation Skin and/or eye contact	Inhalation causes a high voice. Skin contact may cause frostbite and eye contact may cause blurred vision, deep	Drill intersections	Colourless, odourless. When refrigerated it forms a liquefied gas.	Not applicable	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				burns and pain.				
Portland cement	120/121	Dust	Inhalation Skin and/or eye contact Ingestion	No serious harm when dry. Inhalation may cause irritation or inflammation. Wet cement may cause serious burns, eyes may be irritated and chemical burns as well as blindness may occur. Prolonged exposure may cause silicosis. Irritation of the moist mucous membranes, nose, throat and upper respiratory tract. It may contain traces of substances that's listed as carcinogenic.	Batch plant operations Concrete mixing	Light grey powder.	OEL = 10 mg/m3	65997-15-1
Methane rich gas	296	Liquid Gas	Inhalation Skin and/or eye contact Ingestion	Inhalation may cause central nervous system effects. Headaches, nausea, dizziness and a loss of balance and coordination may occur. Unconsciousness, coma and respiratory failure as well as death may be	Flammable gas Drilling Intersections	Colourless, odourless. Flammable.	STEL = 1,4%	74--82-8

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				results of exposure.				
Silent Seal		Vapour Liquid	Inhalation Skin and/or eye contact Ingestion	Inhalation reduces oxygen available. It irritates the mucous membranes, cause tightness in chest, coughing, asthma-like sensitivity, dizziness, headache, lethargy, heart irregularities and it may lead to bronchitis or pulmonary edema. Skin contact may cause irritation, reddening, swelling and dermatitis. Eye contact may cause irritation and physical damage. Ingestion of the product may cause irritation to mucous membranes, the mouth and digestive tract.	Vent sealing	Comp. A: Amber to brown liquid. Slightly musty odour. Insoluble in water. Comp. B: Dark brown with yellow undertone viscous liquid with fluorocarbon and amine odour.	Not applicable	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Caustic soda		Liquid Mist Vapour	Inhalation Skin and/or eye contact Ingestion	Skin contact may cause burns, frequently causing deep ulcerations and ultimate scarring. It is extremely hazardous when in skin contact. Eye contact may cause severer burns and possible blindness. Inhalation of the product may cause damage to the upper respiratory tract and lungs. It is very hangerous in case of inhalation. When ingested it may be corrosive to the gastrointestinal tract.		Clear to slightly turbid colourless. It is odourless.	Sodium Hydroxide- STEL = 2mg/m3	
Silicon Grease		Vapour	Inhalation Skin and/or eye contact Ingestion	Eye contact may result in temporary discomfort. Allergic conditions may occur.	Engineering operations	White, clear, black or yellow in colour and with very little odour. Past-like.	Not applicable	
Sulphuric acid		Liquid Mist Aerosol Vapour	Inhalation Skin and/or eye contact Ingestion	Inhalation may cause a burning sensation, coughing and laboured breathing. It is a corrosive substance. Eye contact may cause redness, pain and deep	Battery Bays	Colourless, oily hygroscopic liquid with no odour. It's a strong acid.	OEL = 1 mg/m3 STEL = 3 mg/m3	7664-93-9

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				burns. Ingestion can cause abdominal pain, burning sensation and collapse.				
Hydrogen		Gas Vapour	Inhalation Skin and/or eye contact	Inhalation may cause dizziness, asphyxia, laboured breathing and unconsciousness. Skin contact may cause frostbite. Inhalation may cause a high voice and suffocation.	Flammable gas Drilling intersections Battery Bays	Odourless, colourless compressed liquefied gas. Extremely flammable.	STEL = 1.4%	1333-74-0
Galvanized carbon steel		Dust Fumes	Inhalation Skin and/or eye contact	Metal fever may occur. Eye contact may cause irritation. Siderosis may occur from prolonged exposure. Skin contact may cause irritation and dermatitis. Some metals are carcinogenic.	Welding operations	Silver-grey metallic steel.	Metals	
Galvanized metal primer		Liquid Smoke Fumes	Inhalation Skin and/or eye contact Skin absorption Ingestion	Skin and eye contact may cause irritation and inflammation. Over exposure may cause headache, dizziness, drowsiness, coughing and irritation of the respiratory tract. Ingestion may cause	Welding operations	White liquid with a petroleum odour. (Rust paint)	Metals	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				nausea, vomiting and irritation. Repeated exposure to xylene may increase risk of injury to the kidneys, liver and the respiratory tract.				
Stripper		Liquid Vapour Mist	Inhalation Skin and/or eye contact Ingestion		Engineering operations	Clear to yellow-brown liquid.	Not applicable	
Turpentine		Liquid Vapour Mist	Inhalation Skin and/or eye contact Ingestion	It may cause skin irritation, dermatitis or chemical burns. The liquid can penetrate the skin to cause systemic effects. Contact with the eyes may cause conjunctivitis or corneal burns. Ingestion may cause nausea, serious illness or death. If inhaled it may produce irritation, headache, dizziness, chest pain, pulmonary edema, cyanosis, narcosis and rapid heart rate.	Engineering operations	Clear, colourless liquid with a pungent odour. Flammable.	OEL = 560 mg/m³ STEL = 840 mg/m³	8006-64-2
Zanetex HE 2000		Liquid Gas	Inhalation Skin and/or eye	Irritation to the eyes.	Chemical dust suppression	Dark brown liquid with a	Not applicable	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
			contact Ingestion			mollasis odour.		
Flocculent		Liquid Dust			Water treatment		Ammonium salt- OEL = ?	
Lead	366	Dust Aerosol Fumes	Inhalation Ingestion	Inhalation may cause abdominal cramps, drowsiness, headache and nausea, vomiting weakness, wheezing, pallor, collapse and hemoglobinuria. Exposure of pregnant women and children to dust should be prevented. Ingestion may cause abdominal cramps. Exposure may result in death.	Blasting operations	Bluish-white or silvery grey solid in various forms. Turn tarnished on exposure to air. Flammable.	OEL = 0.15 mg/m3	7439-92-1
Dichlorodifluoromethane	134	Gas Vapour	Inhalation Skin and/or eye contact	Skin contact may cause frostbite and defating and dryness of the skin. Eye contact may cause irritation, discomfort, tearing, or blurring of vision. With inhalation it may cause temporary central nervous system depression, dizziness, headache, confusion,	Fridge plant	Clear, colourless liquid with a slightly ethereal odour.	OEL = 4950 mg/m3 STEL = 6200 mg/m3	75-71-8

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				incoordination and a loss of consciousness. Temporary alteration of the hearts electrical activity, irregular pulse, palpitations and inadequate circulation.				
Fluorotrichloromethane	299	Liquid Vapour Mist	Inhalation Skin and/or eye contact Ingestion	Contact may cause frostbite and severer corneal injury. Inhalation may cause dizziness, nausea, vomiting, disorientation, confusion, narcosis and incoordination. High concentrations may cause suffocation. Asphyxiate. Cardiac arrhythmias or arrest due to sensitisation of the heart to adrenaline or nor-adrenaline.	Fridge plant	Colourless liquid/vapour with a slightly ethereal odour.	OEL = 5600 mg/m3 STEL = 7000 mg/m3	75-69-4
Hydraulic Fluid		Liquid Mist Vapour	Inhalation Skin and/or eye contact Ingestion	It is mildly irritating to the skin and eyes. Inhalation may result in mild irritation of the upper respiratory tract. This product is slightly toxic when swallowed.	LHD machinery Engineering operations	Amber lubricating liquid. It has a hydrocarbon odour. Is oxidating.	Not applicable	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Electroclean		Liquid Gas	Inhalation Skin and/or eye contact Ingestion	Skin and eye irritation may occur while inhalation may cause acute irritation and respiratory effects. Excess inhalation may cause dizziness, giddiness and nausea. Diliberate inhalation may be fatal. Repeated exposure may cause permanent central nervous system damage. Irreversible effects to the liver and kidneys may result. Ingestion causes nausea, cramps, vomiting and diarrhea.	Engineering operations	Colourless liquid with a hydrocarbon odour. Flammable.	Toluene-OEL = 188mg/m3 STEL = 560mg/m3 Tetrachloroethylene-OEL = 335mg/m3 STEL = 1000mg/m3 EthylBenzene-OEL = 435 STEL = 545mg/m3 Xylene-OEL = 435 STEL = 650mg/m3 Hydrocarbons (Nonane)-OEL = 1049mg/m3	
Quick start		Liquid Vapour Mist	Inhalation Skin and/or eye contact	Inhalation may cause dizziness, strong anesthesia, intoxication and unconsciousness. Skin contact may cause irritation and defatting of the skin.	Engineering operations	Pale yellow liquid to clear liquid. It has a strong ethereal odour. It evaporates quickly and leaves a slight lubricant residue. Extremely Flammable.	Not applicable	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Loctite		Gas Past	Inhalation Skin and/or eye contact Ingestion	Ingestion may cause delayed effects on the blood, gastrointestinal, nervous and reproductive system. Skin contact may result in dermatitis. Carcinogen.	Engineering operations	White paste and black paste with a mild odour.	Aluminum Hydroxide-OEL=? TitaniumDioxide-OEL = 10mg/m3	
Wynn's Green Cleaner		Gas Smoke Mist	Inhalation Skin and/or eye contact Ingestion	Skin contact may result in absorption of harmful amounts which may result in central nervous system depression. Eye contact may causes irritation. Inhalation of the product may cause nose, throat and respiratory tract irritation as well as central nervous system depression. Irritation to the digestive tract and red blood hemolysis when swallowed. It may cause dizziness, headache, nausea, vomiting and incoordination.	Engineering operations	Green liquid with a characteristic odour. Flammable.	Not applicable	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Rubber solvent		Liquid Mist Vapour	Inhalation Skin and/or eye contact Ingestion	It may cause moderate skin irritation, defatting and dermatitis. Inhalation may cause dizziness, headache and unconsciousness. Ingestion cause vomiting, nausea and diarrhea. Inhalation may cause bronchopneumonia and Pulmonary edema.	Engineering operations	Flammable liquid with a mild odour.	Not applicable	
Anti rust		Liquid Mist Gas	Inhalation Skin and/or eye contact Ingestion	It may cause burns in the eyes and on the skin when contact occurs. It may also be corrosive to the eyes. Inhalation may cause irritation to the respiratory tachea.	Engineering operations	Colourless limphid liquid. It is very syrupy with no odour.	Phosphoric Acids- OEL = 1mg/m3 STEL = 3mg/m3	
Hydrogen		Gas Vapour	Inhalation Skin and/or eye contact	Inhalation may cause dizziness, asphixia, laboured breathing and unconsciousness. Skin contact may cause frostbite. Inhalation may cause a high voice and suffocation.	Flammable gas Drilling intersections Battery Bays	Odourless, colourless compressed liquefied gas. Extremely flammable.	STEL = 1.4%	1333-74-0
Chlorine	123	Dust Vapour	Inhalation Skin and/or eye contact	Inhalation may causes irritation to the nose mouth, throat and lungs.	Water treatment Fridge plant	White to amber in colour with a pungent chlorine	OEL = 1.5 mg/m3 STEL = 3 mg/m3	7782-50-5

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				It may also cause burns to the respiratory tract, shortness of breath, wheezing, choking, chest pain and even permanent lung damage. Eye contact may cause severe irritation and burns. It may also cause impairment of vision and corneal damage. Skin contact may result in irritation, burns, redness, swelling and scab formation. Ingestion of the product may cause irritation, burns to the gastrointestinal tract, nausea, vomiting, diarrhea, abdominal pain and bleeding.		odour.		
Zanetex HE 2000		Liquid Gas	Inhalation Skin and/or eye contact Ingestion	Irritation to the eyes.	Chemical dust suppression	Dark brown liquid with a mollasis odour.	Not applicable	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
BCH tablets		Dust Fume Mist	Inhalation Skin and/or eye contact Ingestion	Extremely hazardous in case of eye contact because it is corrosive and may cause blindness and irritation. Hazardous in case of skin contact because it is corrosive and may be irritating, cause inflammation, blistering and redding. Hazardous when inhaled because of corrosive properties. Inhalation will cause irritation to the gastro-intestinal & respiratory tract, cause burning, sneezing and coughing.	Water treatment	Off-white solid with a chlorine-like odour. It may be combustible at high temperature.	Not applicable	
Dispersal		Liquid Mist	Inhalation Skin and/or eye contact Ingestion	It may cause irritation to the skin and eyes. Inflammation, watering and redding of the eyes may occur, Skin contact may result in inflammation, itching, scaling, redding and blisters may form. The product is toxic to blood, the liver and the kidneys.	Water treatment	Colourless liquid.	Not applicable	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
FN 217		Liquid Vapour	Inhalation Skin and/or eye contact Ingestion	It may be irritating to the eyes and skin. The skin may be sensitizing to the product and inflammation is characterised by itching, scaling, redding and blistering.	Water treatment	Colourless to slight yellow liquid.	Not applicable	
Aluminum gel		Dust Vapour	Inhalation Skin and/or eye contact Ingestion	It may cause irritation to the skin and/ or eyes. It may be harmful to the respiratory tract when inhaled repeatedly.	Water treatment	Green solid.	Not applicable	
SAX 831		Dust	Inhalation Skin and/or eye contact Ingestion	This product is corrosive thus very hazardous when in skin or eye contact. It may cause blindness, corneal damage, inflammation, redding, watering of the eyes, itching and blistering. Extremely hazardous when inhaled. Inhalation of the dust will cause irritation to the gastro-intestinal and respiratory tract, burning, sneezing and coughing. Very hazardous in case of	Water treatment	White solid.	Not applicable	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				ingestion for it may cause burns to the mouth, throat and stomach. Ingestion may be fatal.				
ST 40		Liquid Gas Fume Vapour Spray Mist	Inhalation Skin and/or eye contact Ingestion	The product may cause serious damage to the eyes and severer burns to the skin, mouth, throat and stomach. Inhalation may be harmful.	Water treatment	Yellow to amber liquid with no odour.	Not applicable	

HEG Identification : **CHRUSHING (20)**

Activity Description	
Activity Area Code	
Occupations	Code
Chrusher attendant	30207

**Chemicals
Involved**

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Dust		Dust	Inhalation or eye contact	Coughing & mild irritation. Eye contact may result in tears and mild irritation to the eyes.	Blasting, scraping, tipping, drilling, transport, travelling, spillage.	Finely divided solid matter.	OEL = 1mg/m ³	
Ammonia	24	Gas	inhalation, ingestion (solution), skin and/or eye contact (solution/liquid)	Corrosive gas - may be fatal if inhaled. Lung injury. Severe respiratory tract irritant. Irritating to the nose and throat. Mildly irritating to moist skin - blisters may occur.	Blasting operations	Colourless gas with a sharp, pungent, suffocating, intensely irritating odour. Colourless liquid under pressure but can	OEL = 17 mg/m ³ STEL = 24mg/m ³	7664-41-7

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
						decompose at high temperature to form very flammable hydrogen and toxic nitrogen dioxide.		
Silica Dust (respirable)	522	Dust	inhalation, skin and/or eye contact	Coughing and mild irritation. Skin contact may result in granulomas. Silicosis may occur with prolonged exposure. Carcinogen.	Blasting, scraping, tipping, drilling, transport, travelling, spillage.	Colourless to white, green, purple or black crystals. Odourless.	OEL = 0.1 mg/m³	14808-60-7
Carbon monoxide		Gas	Inhalation Skin and/or eye contact	Skin and eye contact may cause frostbite. Systemic toxicity may cause visual disturbances. Inhalation May cause adverse central nervous system, cardiovascular, respiratory, kidney and liver effects. These effects may include suffocation, discoloured skin, dilated pupils, hearing loss, nausea, vomiting, chest pain, lung damage,	Blasting operations Mine fires Diesel machinery	Colourless, odourless and tasteless. Flammable. Poisonous.	OEL = 55 mg/m³ STEL = 100 ppm	630-08-0

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				twitching, muscle spasms, in coordination, weakness, numbness, headache, dizziness, drowsiness, confusion, hallucinations, convulsions, blood disorders, heart failure, kidney failure, collapse, unconsciousness, coma and death.				

HEG Identification : STOPING (8)

Activity Description			
Activity Area Code			
Occupations	Code	Occupations	Code
Auquajet operator	21406	Sampler	50203
Backfill worker	20805	Scraper winch bell operator	20302
Blaster: Underground metal	20501	Scraper winch driver	20901
Blasting worker	20599	Shotblast operator	40526
Driller: Jackhammer	20402	Spannerman	20405
Double drum hoist operator		Stone packer	29904
Drilling worker	20499	Stope team leader	20311
Equiper	21504	Stope team worker	20702
Hydraulic prop worker	20801	Stoper	20304
Miner's assistant	20504	Sweeper	29903
Monorail winch operator	21308	Winch transport team leader	40525
Monorope winch operator	21309	Winch transporter	40524
Multi task worker	20704		
Night shift cleaner	20308		
Rock support worker	20899		

Chemicals Involved

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Dust		Dust	Inhalation or eye contact	Coughing & mild irritation. Eye contact may result in tears and mild irritation to the	Blasting, scraping, tipping, drilling,	Finely divided solid matter.	OEL = 1mg/m	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				eyes.	transport, travelling, spillage.			
Silica Dust (respirable)	522	Dust	inhalation, skin and/or eye contact	Coughing and mild irritation. Skin contact may result in granulomas. Silicosis may occur with prolonged exposure. Carcinogenic.	Blasting, scraping, tipping, drilling, transport, travelling, spillage.	Colourless to white, green, purple or black crystals. Odourless.	OEL = 0.1 mg/m³	14808-60-7
Ammonia	24	Gas	inhalation, ingestion (solution), skin and/or eye contact (solution/liquid)	Corrosive gas - may be fatal if inhaled. Lung injury. Severe respiratory tract irritant. Irritating to the nose and throat. Mildly irritating to moist skin - blisters may occur.	Blasting operations	Colourless gas with a sharp, pungent, suffocating, intensely irritating odour. Colourless liquid under pressure but can decompose at high temperature to form very flammable hydrogen and toxic nitrogen dioxide.	OEL = 17 mg/m³ STEL = 24mg/m³	7664-41-7

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Diesel fumes		Mist Vapour	Inhalation	Carcinogen	Diesel machinery	Colourless oily liquid. May burn if strongly heated.	NO2- OEL = 5mg/m3 STEL = 9mg/m3 SO2-OEL = 5mg/m3 STEL = 13mg/m3 NO OEL = 30mg/m3 STEL = 45mg/m3 CO OEL = 55mg/m3 DIESEL PARTICULATE MATTER OEL = ?	
Carbon oil	43	Liquid Vapour	inhalation, ingestion (solution), skin and/or eye contact (solution/liquid)	Harmful when inhaled or swallowed. Central nervous system depressant. It causes headache, nausea, dizziness, drowsiness, and confusion. It may cause blood and bone marrow effects. Aspiration hazard. Prolonged exposure may result in dermatitis. Carcinogen & Mutagen.	Engineering operations	Clear and colourless liquid. Aromatic hydrocarbon odour. Vapour is heavier than air, thus might spread long distances. Liquid can float on water, thus might spread fire. Decompose at high temperature and forming toxic gases.	Toluene- OEL = 188mg/m3 STEL = 560mg/m3 Tetrachloroethylene -OEL = 335mg/m3 STEL = 1000mg/m3 EthylBenzene- OEL = 435 STEL = 545mg/m3 Xylene-OEL = 435 STEL = 650mg/m3	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Degreaser		Gas Mist	Inhalation, skin and/or eye contact	May cause pain and irritation to the skin and eyes. Inhalation may cause headache, dizziness, anaesthesia, and unconsciousness. Repeated exposure may cause kidney and liver effects. Pulmonary irritation may occur and dermatitis may result from repeated exposure.	Engineering operations	Colourless liquid with a irritating odour. It is slightly soluble in water. Corrosive.	Not applicable	
Mineral oil	450	Gas Mist	Inhalation, skin and/or eye contact	Skin, eye and lung irritation.	Engineering operations	Colourless to light brown liquid. It is flammable.	OEL = 5 mg/m ³ STEL = 10 mg/m ³	
Grease	298	Fluid	Inhalation Skin	Mild skin and eye irritation. Inhalation of smoke contaminated with grease may cause throat irritation, coughing and a tightness in chest. Lungs may become irritated from fluorine components.	Engineering operations	White dense and viscous fluid	Not applicable	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Welding fumes	598	Fumes	Inhalation	<i>Metal fume fever:</i> Muscle pains Shivering Chest tightness Feverishness	Welding operations		OEL = 5 mg/m3	
Aerosol Paint		Liquid Vapour Fumes Mist	Inhalation Skin and/or eye contact Ingestion	May cause skin and eye irritation. When inhaled or ingested person may suffer from severe respiratory distress as well as central nervous system depression. Prolonged and/or repeated skin contact may cause dermatitis.	Marking off	Various colours Flammable	Not applicable	
Methane rich gas	296	Liquid Gas	Inhalation Skin and/or eye contact Ingestion	Inhalation may cause central nervous system effects. Headaches, nausea, dizziness and a loss of balance and coordination may occur. Unconsciousness, coma and respiratory failure as well as death may be results of exposure.	Flammable gas Drilling Intersections	Colourless, odourless. Flammable.	STEL = 1,4%	74--82-8

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
White wash		Liquid Vapour Mist Dust	Inhalation Skin and/or eye contact Ingestion	May cause skin and eye, nose and throat irritation. Harmful if inhaled. Aspiration hazard when swallowed. With chronic exposure central nervous system disorders like weakness, loss of co-ordination, fatigue, confusion and blurred vision may occur. Liver abnormalities as well as kidney, lung spleen and eye damage may occur. Cardiac effect on some persons.	For fire retardant application	Ammonia-like odour Flammable	<u>Titanium dioxide-</u> OEL = 10mg/m3 <u>Calcium</u> <u>Carbonate-</u> OEL = 10mg/m3 <u>Propylene glycol-</u> OEL = 470mg/m3 <u>Dimethylene</u> <u>Glycol-OEL = ?</u> <u>Xylene-</u> OEL = 435mg/m3 STEL = 650mg/m3 <u>Acetone-</u> OEL = 1780mg/m3 STEL = 3560mg/m3 <u>Ethyl Benzene-</u> OEL = 435mg/m3 STEL = 545mg/m3 <u>Toluene-</u> OEL = 188mg/m3 STEL = 560mg/m3 <u>Tetrachloroethylene</u> -OEL = 335mg/m3 STEL = 1000mg/m3	
Ammonium nitrate		Liquid Gas Mist	Inhalation Skin and/or eye contact Ingestion	Skin and eye contact may cause dryness and irritation. Inhalation may cause a sore throat, coughing and a shortness of breath. Ingestion may	Blasting operations	White to cream in colour, but odourless.	Not applicable	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				cause dizziness, cramps, vomiting, blood disorders, weakness and depression.				
Metal Powder		Dust	Inhalation Skin and/or eye contact	Fumes generated may be dangerous. Dryness and irritation of the throat, nose, eyes, and lungs may occur. Dizziness and nausea may result. May be a carcinogen.	Blasting operations	Odourless metallic grey powder.	Not applicable	
Copper metal	154/155	Dust Vapour Fumes	Inhalation Skin and/or eye contact Ingestion	Is a mechanical irritant when in eye which may cause severe corneal damage. When ingested it may cause intense abdominal pain. Inhalation may cause metal fume fever, headache, a metallic taste in mouth, cough, thirst, shortness of breath, fever, pain in the legs and chest. May discolour the skin.	Blasting operations	Bright reddish, lustrous metal in the form of foil, wire or turnings. Odourless.	OEL = 1 mg/m³ STEL = 2 mg/m³	7440-50-8
Nitrocellulose		Dust Gas	Inhalation Skin and/or eye contact	Skin and eye contact may cause irritation. Inhalation may cause narcosis, weakness,	Blasting operations	Alcohol odour.	Not applicable	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				drowsiness and unconsciousness.				
Tin	567/568	Dust Fumes	Inhalation Skin and/or eye contact Ingestion	Skin and eye contact may cause mechanical irritation. Inhalation may cause fatigue and anaemia. Central nervous system damage, nasal inflammation and kidney disfunction may occur. It may also cause headache, nausea, muscular pain and possible liver damage.	Blasting operations	Silver-grey metal that's odourless. Various shapes and sizes.	OEL = 2 mg/m³ STEL = 4 mg/m³	
Citric acid		Dust	Inhalation Skin and/or eye contact	Skin and eye contact may cause a slight irritation. If inhaled irritation may occur.	Blasting operations	Powder with no known odour. Colourless crystals.	Not applicable	
Gold reference		Liquid Mist	Inhalation Skin and/or eye contact Ingestion	Skin and eye contact may cause irritation, burns, blisters, watering, conjunctivitis and dermatitis. Inhalation may also cause irritation of the eyes, nose, throat, and upper respiratory tract, coughing and choking. Over exposure may lead	Blasting operations	Clear, yellow liquid with a slight hydrochloric acid odour.	Not applicable	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				to ulceration of the oral and nasal mucosa. Ingestion may cause burns to the mouth, throat, oesophagus and stomach. It may also cause nausea and vomiting.				
Iron	348	Dust Fumes Mist	Inhalation Skin and/or eye contact Ingestion	It may cause mild irritation to the respiratory tract when inhaled. Large doses ingested may cause gastrointestinal disturbances. Skin and eye contact may cause irritation.	Blasting operations	White crystals with no odour.	OEL = 5 mg/m STEL = 10 mg/m³	1309-37-1
Activated charcoal		Dust	Inhalation Skin and/or eye contact Ingestion	If inhaled it may cause respiratory tract and cardiovascular effects. When ingested it may cause mild irritation to the gastrointestinal tract. Skin and eye contact may cause redness.	Blasting operations	Fine black powder that's odourless. Flammable	Not applicable	
Polyethylene		Dust Vapours	Inhalation Skin and/or eye contact Ingestion	Eye contact may result in irritation or corneal injury due to mechanical action.	Blasting operations	No odour.	Not applicable	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Potassium nitrate		Dust Fumes	Inhalation Eye contact	Eye contact may cause mild irritation and may burn. Dust may be irritating when inhaled. Symptoms like weakness, depression, headache, mental impairment, dizziness, abdominal cramps, vomiting, bloody diarrhoea, convulsions and collapse may occur.	Blasting operations	White to buff crystals. No odour.	Not applicable	
Polycarbonate		Dust Fumes	Inhalation Skin and/or eye contact Ingestion	Eye contact may cause irritation and corneal injury due to mechanical action. Prolonged exposure to skin may cause irritation due to mechanical irritation. Dust inhaled may cause irritation to the upper respiratory tract.	Blasting operations	Milky white or coloured solid with a mild odour.	Not applicable	
Silicon dioxide		Dust Gas Mist	Inhalation Skin and/or eye contact Ingestion	It is slightly irritating to the skin, and mildly irritating to the eyes. Inhalation may result in upper respiratory irritation and emphysema. Repeated exposure may result in	Blasting operations	Clear to cloudy liquid. It is odourless.	OEL = 10mg/m³	7440-21-3

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				lung changes.				
Quartz	521	Dust	Inhalation Skin and/or eye contact Ingestion	Skin and eye contact may cause mechanical irritation. Inhalation of dust may cause irritation of the respiratory tract.	Blasting operations	White pellets with no odour.	OEL = 0.1 mg/m3	14808-60-7
Isocyanine	356	Gas Mist	Inhalation Skin and/or eye contact Ingestion	Skin and eye contact may cause irritation. Ingestion will cause adverse health effects. Inhalation will cause irritation of the respiratory tract. It may result in asthma-like spasms of the bronchial tubes and difficulty in breathing. People with a history of respiratory disease or hyper sensitivity should not be exposed to this product.	Blasting operations	Brown	OEL = 0.02 mg/m3	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Potassium perchlorate		Dust	Inhalation Skin and/or eye contact Ingestion Absorption through skin	Inhalation of the product may cause irritation to the respiratory tract, coughing, shortness of breath and pulmonary edema. Ingestion may cause irritation to the mucous membranes and may result in vomiting, nausea, fever and rushes. Skin may turn blue due to an oxygen deficiency. Red blood cells may be broken down which will result in kidney damage. It may also effect the bone marrow. Skin and eye contact may cause irritation resulting in redness, itching and pain.	Blasting operations	White odourless powder. It is flammable and a strong oxidizer.	Not applicable	
Wood dust	600/601	Dust	Inhalation Skin and/or eye contact	Harmful when inhaled or swallowed. It may cause eye and skin irritation. Prolonged exposure to the eye may cause conjunctivitis or allergic dermatitis. Prolonged exposure may	Installation of wooden support	Wood particles of various size produced by any manual or mechanical cutting, chipping, sawing or sanding.	OEL = 5 mg/m ³ (Hard & Soft wood) STEL = 10 mg/m ³ (Soft wood)	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				also lead to inflammation of the nasal passage, lung iseases or asthma. Wood dust is a fire and explosion hazard when exposed to heat.				
Glue Epoxy Resin		Liquid Vapour Mist	Inhalation Skin and/or eye contact	Skin and eye contact will cause irritation. Inhalation of the product will cause respiratory tract irritation. Ingestion may cause adverse health effects.	Backfill products Vent curtaining	Brown liquid with a faint odour. It is corrosive.	Phenol- OEL = 19mg/m3 STEL = 38mg/m3 Formaldehyde- OEL = 2.5mg/m3 STEL = 2.5mg/m3 Sodium Hydroxide- STEL = 2mg/m3 Amine-OEL = ?	
Soudal foam		Foam Mist	Inhalation Skin and/or eye contact	The product may be irritating to skin, eyes and the respiratory system.	Vent sealing and tamping of holes.	Foam	Not applicable	
Carbon monoxide		Gas	Inhalation Skin and/or eye contact	Skin and eye contact may cause frostbite. Systemic toxicity may cause visual disturbances. Inhalation May cause adverse central nervous system, cardiovascular, respiratory, kidney and	Blasting operations Mine fires Diesel machinery	Colourless, odourless and tasteless. Flammable. Poisonous.	OEL = 55 mg/m3 STEL = 100 ppm	630-08-0

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				liver effects. These effects may include suffocation, discoloured skin, dilated pupils, hearing loss, nausea, vomiting, chest pain, lung damage, twitching, muscle spasms, in coordination, weakness, numbness, headache, dizziness, drowsiness, confusion, hallucinations, convulsions, blood disorders, heart failure, kidney failure, collapse, unconsciousness, coma and death.				
Carbon dioxide gas		Gas Liquid	Inhalation Skin and/or eye contact	Over exposure when inhaled may cause excitation and depression of the central nervous system. Carbon dioxide displaces oxygen which cause a fall in blood pressure. Eye contact may cause a stinging sensation and inhalation may effect vision. Skin contact may	Blasting operations Mine fires Diesel machinery	Colourless, odourless, and tasteless. Could be a liquid under pressure.	OEL = 9000 mg/m³ STEL = 54000 mg/m³	124-38-9

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				cause frostbite.				
Mono blue							Not applicable	
PH Powder		Dust	Inhalation Eye contact	Irritation to the respiratory system when inhaled. Eye contact can result in corneal damage or blindness. Inflammation of the eye is characterized by redness, watering and itching.	Toilet product	White powder consisting of a combination of alkali's.	Not applicable	
Portabloo		Liquid Mist Vapour	Inhalation Skin and/or eye contact	The product is harmful with skin contact and will cause burns and irritation. Inhalation may cause dizziness and shortness of breath.	Toilet product	Translucent blue liquid with a mild amine odour.	Not applicable	
Mono blue							Not applicable	
Vent Seal		Liquid	Inhalation Skin and/or eye contact	High airborne concentration may cause drowsiness and lethargy. Skin and eye contact may cause temporary irritation.	Vent sealing	Comp. A: Brown liquid Comp. B: Red viscous liquid with amine odour.	Not applicable	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Helium		Gas	Inhalation Skin and/or eye contact	Inhalation causes a high voice. Skin contact may cause frostbite and eye contact may cause blurred vision, deep burns and pain.	Drill intersections	Colourless, odourless. When refrigerated it forms a liquefied gas.	Not applicable	
Portland cement	120/121	Dust	Inhalation Skin and/or eye contact Ingestion	No serious harm when dry. Inhalation may cause irritation or inflammation. Wet cement may cause serious burns, eyes may be irritated and chemical burns as well as blindness may occur. Prolonged exposure may cause silicosis. Irritation of the moist mucous membranes, nose, throat and upper respiratory tract. It may contain traces of substances that's listed as carcinogenic.	Batch plant operations Concrete mixing	Light grey powder.	OEL = 10 mg/m³	65997-15-1

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Silent Seal		Vapour Liquid	Inhalation Skin and/or eye contact Ingestion	Inhalation reduces oxygen available. It irritates the mucous membranes, cause tightness in chest, coughing, asthma-like sensitivity, dizziness, headache, lethargy, heart irregularations and it may lead to bronchitis or pulmonary edema. Skin contact may cause irritation, redding, swelling and dermatitis. Eye contact may cause irritation and physical damage. Ingestion of the product may cause irritation to mucous membranes, the mouth and digestive tract.	Vent sealing	Comp. A: Amber to brown liquid. Slightly musty odour. Insoluble in water. Comp. B: Dark brown with yellow undertone viscous liquid with fluorocarbon and amine odour.	Not applicable	

HEG Identification : SHAFT & SERVICES (16)

Activity Description			
Activity Area Code			
Occupations	Code	Occupations	Code
Handy man	21504	Rigger and ropeman worker	40511
Hoist driver	21302	Settler attendant	
Hoisting worker	21399	Shaft foreman	20301
Onsetter	21304	Shaft timberman worker	21503
Pump team leader	40531	Shaft timberman	21502
Pump worker	40532	Shovel operator	21105
Rigger aide	40510		
Rigger and ropeman	40508		
Rigger and ropeman apprentice	40509		
Rigger and ropeman chargehand	40507		
Rigger and ropeman foreman	40506		

Chemicals Involved

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Dust		Dust	Inhalation or eye contact	Coughing & mild irritation. Eye contact may result in tears and mild irritation to the eyes.	Blasting, scraping, tipping, drilling, transport, travelling, spillage.	Finely divided solid matter.	OEL = 1mg/m ³	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Silica Dust (respirable)	522	Dust	inhalation, skin and/or eye contact	Coughing and mild irritation. Skin contact may result in granulomas. Silicosis may occur with prolonged exposure. Carcinogen.	Blasting, scraping, tipping, drilling, transport, travelling, spillage.	Colourless to white, green, purple or black crystals. Odourless.	OEL = 0.1 mg/m³	14808-60-7
Diesel fumes		Mist Vapour	Inhalation	Carcinogen	Diesel machinery	Colourless oily liquid. May burn if strongly heated.	NO₂- OEL = 5mg/m³ STEL = 9mg/m³ SO₂-OEL = 5mg/m³ STEL = 13mg/m³ NO OEL = 30mg/m³ STEL = 45mg/m³ CO OEL = 55mg/m³ DIESEL PARTICULATE MATTER OEL = ?	
PH Powder		Dust	Inhalation Eye contact	Irritation to the respiratory system when inhaled. Eye contact can result in corneal damage or blindness. Inflammation of the eye is characterized by redness, watering and itching.	Toilet product	White powder consisting of a combination of alkali's.	Not applicable	

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
Portabloo		Liquid Mist Vapour	Inhalation Skin and/or eye contact	The product is harmful with skin contact and will cause burns and irritation. Inhalation may cause dizziness and shortness of breath.	Toilet product	Translucent blue liquid with a mild amine odour.	Not applicable	
Mono blue							Not applicable	
Flocculent		Liquid Dust			Water treatment		Ammonium salt- OEL = ?	
Chlorine	123	Dust Vapour	Inhalation Skin and/or eye contact Ingestion	Inhalation of chlorine may irritate the nose, throat, mouth and lungs. It may cause burns to the respiratory tract, causing shortness of breath, wheezing, choking, chest pain and even permanent damage to the lungs. Eye contact causes severe irritation and burns. It may cause impairment of vision and corneal damage. Skin contact may cause irritation, burns, redness, swelling and scab formation. Ingestion may cause irritation and	Fridge plant Water treatment	White to amber in colour with a pungent chlorine odour.	OEL = 1,5 mg/m ³ STEL = 3 mg/m ³	7782-50-5

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				burns to the gastrointestinal tract, nausea, vomiting, diarrhea, abdominal pain and bleeding.				
Carbon monoxide		Gas	Inhalation Skin and/or eye contact	Skin and eye contact may cause frostbite. Systemic toxicity may cause visual disturbances. Inhalation May cause adverse central nervous system, cardiovascular, respiratory, kidney and liver effects. These effects may include suffocation, discoloured skin, dilated pupils, hearing loss, nausea, vomiting, chest pain, lung damage, twitching, muscle spasms, in coordination, weakness, numbness, headache, dizziness, drowsiness, confusion,	Blasting operations Mine fires Diesel machinery	Colourless, odourless and tasteless. Flammable. Poisonous.	OEL = 55 mg/m³ STEL = 100 ppm	630-08-0

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				hallucinations, convulsions, blood disorders, heart failure, kidney failure, collapse, unconsciousness, coma and death.				
Carbon dioxide gas		Gas Liquid	Inhalation Skin and/or eye contact	Over exposure when inhaled may cause excitation and depression of the central nervous system. Carbon dioxide displaces oxygen which cause a fall in blood pressure. Eye contact may cause a stinging sensation and inhalation may effect vision. Skin contact may cause frostbite.	Blasting operations Mine fires Diesel machinery	Colourless, odourless, and tasteless. Could be a liquid under pressure.	OEL = 9000 mg/m³ STEL = 54000 mg/m³	124-38-9
Zanetex HE 2000		Liquid Gas	Inhalation Skin and/or eye contact Ingestion	Irritation to the eyes.	Chemical dust suppression	Dark brown liquid with a mollasis odour.	Not applicable	
Portland cement	120/121	Dust	Inhalation Skin and/or eye contact Ingestion	No serious harm when dry. Inhalation may cause irritation or inflammation. Wet cement may cause	Batch plant operations Concrete mixing	Light grey powder.	OEL = 10 mg/m³	65997-15-1

Pollutant Name	Pollutant Code	Nature	Possible Exposure Pathways	Health Effects	Source	Physical Description	Exposure Limits	CAS Number
				serious burns, eyes may be irritated and chemical burns as well as blindness may occur. Prolonged exposure may cause silicoses. Irritation of the moist mucous membranes, nose, throat and upper respiratory tract. It may contain traces of substances that's listed as carcinogenic.				

ANNEXURE 3

AIRBORNE POLLUTANTS WITH AN EXISTING DATABASE

The following Airborne Pollutants were not included in the monitoring program, since data already exists:

- Blasting fumes
- Diesel fumes
- Soudal foam
- Dust/Silica

Blasting Fume Analysis Report



Prepared by: Dries Labuschagne
Technical Assistant – Occupational Environment
23 November 2000

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1) **Introduction:**

Mintek has undertaken a project for “Project AUTEK” to determine the feasibility of testing gold catalysts for the removal of Carbon Monoxide in the mining environment. The motivation behind this is to possibly remove pollutants from used air and re-circulate that air which would result in a reduction of fresh air being introduced and hence the infrastructure required.

ITASCA Laboratories was approached for the analyzing of blasting fume samples and in turn accepted the challenge. They would also make use of NECSA Laboratories for the analyzing of NO_x and SO_x samples. It was decided that the sampling would be done at Great Noligwa Mine.

All safety aspects were taken into consideration including, methane, exposure to smoke and gases, changes in the ventilation system, etc. It was inevitable to take the samples inside the contaminated end and it was agreed that the Proto teams would do this.

A meeting was held with ITASCA Laboratories and NECSA Laboratories to discuss the sampling strategies. As this was an unusual request, the laboratories had to make some alterations to their current sampling instruments. Another meeting was called involving the Section Environmental Officer and the Proto Liaison Officer of Great Noligwa Mine to assess all possible safety and risk aspects.

The sampling took place on Wednesday, 18 October 2000 with some interesting results, which are explained in more detail in this report. The Great Noligwa team really went out of their way to give assistance in every way possible.

2) **Strategy:**

Sampling:

To obtain accurate results from the samples, a sampling time of at least sixty minutes was required. After some debate whether to install a vent seal or to switch off the fan, it was decided to keep the end unventilated for a period of one hour. With no airflow, it was expected that the highest concentration of pollutants will be close to the face blasted, and that the sampling will take place as close as possible to the face. All the sampling instruments were to be assembled on top of a flat car and pushed inside the end. Temperatures, Barometric pressure and “spot” samples would also be taken inside the end during this period.

Safety:

All the relevant persons were notified beforehand including the Department of Minerals and Energy. Due to the complexity of the instrumentation, one of the ITASCA representatives had to go down with the Proto team. He was to stay in fresh air at all times and a procedure drawn up for in the case of an emergency. A life sustaining refuge bay was to be identified. He also required training on a self-contained self-rescuer, which he would take down and use in an emergency situation. Communication lines had to be established in fresh air close to the sampling area and the fan re-starting procedure had to be adhered to. Methanometers and Carbon Monoxide warning devices were to be taken with. The WEM Department visited the selected site

beforehand to ensure that no re-circulation of air will take place and contaminate the area and that the refuge bay is life sustaining.

Samples:

The following pollutants were identified for analysis:

NO_x; SO₂; SO₃; O₂; N₂; C₁-C₄; H₂; He; CO; CO₂. SF₆ tracer gas would be released just after the blast to determine the dilution effect. The samples would be taken over a period of sixty minutes and contained in iceboxes to prevent the Nitrous fumes from diluting through the sampling bottles.

Spot samples would also be taken every five minutes. A continuous Carbon Monoxide, Oxygen and Methane monitor was also to be set up. A list of the type and amount of explosives was to be made available to the laboratories.

Explosives:

100 Sticks of Powergel @ 112g/stick and 50kg of low density Anflex would be used to charge the end and 50 X 2,4m Durafuse 6D detonators with 30m Dura Cord (ignitor cord) to detonate the explosives.

3) Sampling:

The exercise took place on Wednesday, 18 October 2000. After the ITASCA representative received training on the use of a self-contained self-rescuer, a briefing session was held with the two Proto teams. The procedure for taking the samples was drawn up by ITASCA and explained to the Proto team captains. Instructions were given and two sets of plans of the area drawn up for the Proto teams to take underground.

On their way to the selected site, all walls in the ventilation district were checked for leakage and sealed to avoid any contamination of the area. The compressed air in the refuge bay was opened in case the ITASCA representative had to be withdrawn. On reaching the site, the sampling trains were assembled, flow rates checked, calibrated and put on a flat car.

The Proto members ensured that all personnel were withdrawn from the area.

It was of extreme importance that the time of blast is in line with the blasting times of the upper levels as not to expose anyone to blasting fumes. After the fan had been switched off, the blast was initiated and everyone evacuated to fresh air awaiting the blast. A period of twenty minutes was given after the last round went off before the Proto team proceeded into the end with the flat car, lifeline and other instruments. Only three Proto members went inside the end with the other members staying in fresh air as a back up.

The pumps were started on all the continuous instruments and “spot samples”, temperatures and barometric pressures were taken every five minutes for a sixty-minute period. Once completed the fan was re-started as per the fan re-starting Procedure and another set of “spot samples” was taken for fifteen minutes to determine the dilution effect.

After all the samples had been taken, the flow rates were checked and everyone proceeded to the station.

During this whole exercise, the Control room on surface was manned at all times by Production, Proto, WEM and Mining Office members. There was frequent communication from underground reporting on the progress and all events were recorded in writing.

4) Results:

Visibility:

The visibility after the blast ranged from 1m to 3m. A HUND Tyndalometer was used to measure the dust concentrations but unfortunately exceeded its' range and no results could be obtained. It was remarked that the low visibility could be due to the high amount of dust and not so much the smoke.

Environment:

The wet-bulb temperature increased from 28,5°C to 34,5°C in less than 60 minutes after the ventilation flow had been stopped. The dry-bulb temperature had a slight increase of 1,0°C (to 35°C) and the Barometric pressure varied between 1095 and 1096mbar.

NOx and SOx:

The concentration of NOx was measured at 212,4mg/m³ (approximately 113ppm) and SOx NIL.

Atmosphere background:

The atmosphere before the blast contained traces of CO₂ (735,5ppm), CO (49,1ppm), CH₄ (4ppm) and H₂ (21ppm). The CO concentration was higher than expected in normal ventilation air.

Atmosphere blast fumes:

Carbon Monoxide – increased from 49,1ppm to 115ppm.

Carbon Dioxide – increased from 735,5ppm to 5,7%.

Oxygen – decreased by 1%.

Methane – increased from 4ppm to 125,7ppm.

Hydrogen – increased from 21ppm to 792ppm.

Nitrous oxide – measured at 42ppm.

The combined flammable gases of Hydrogen, Carbon Monoxide, Ethylene and Hydrocarbons total approximately 0,1%, which is well below the lower explosive limit.

The final report as drawn up by ATASCA is appended “ACOOK ITASCA NOV2000”

5) Conclusion:

A few unforeseen problems were encountered during the sampling survey. Tracer gas was released prior to the blast to evaluate the dilution by increasing air concentrations of the NOx and SOx samples. However, due to the size of the development end measuring at 4430m³ and the concussion of the blast being greater than anticipated, the volume of tracer gas released was too low. This did not affect the accuracy of the results.

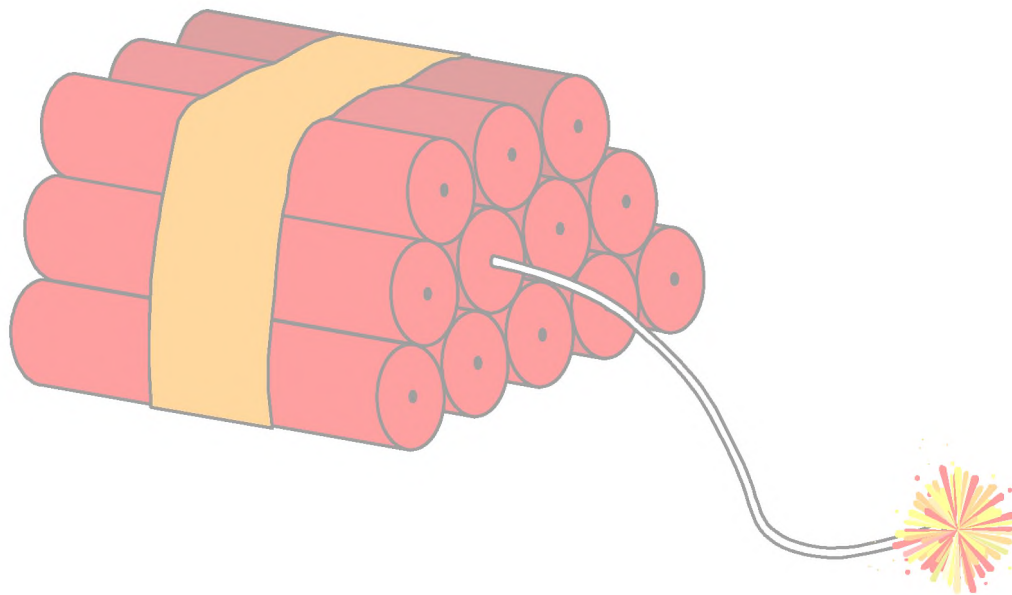
Some NOx and SOx sample solution fluid was lost due to pressure differences between 50 Station and surface. This also did not affect the accuracy of results, but transport procedures will have to be re-evaluated in future to minimise this loss.

As this was a first of its kind, the total procedure went exceptionally well. A lot of time and effort went into the exercise and the Staff from Great Nologwa gave their full support and co-operation. ITASCA and NECSA had to modify their instrumentation and executed the exercise professionally.

A great deal of appreciation goes out to all involved.

Anglogold

SA Region – O-ESH Office



BRANDRILL EXPLOSIVES REPORT

28 MARCH 2002

Prepared by: Dries Labuschagne
Technical Assistant – Occupational Environment



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1. Executive Summary

The main purpose of the exercise was to determine the different types and amount of airborne pollutants released from the “Brandrill” cartridge explosives.

Two gas samples were taken and analysed in order to do a simulation on any number of holes. The exercise can be seen as a huge success with accurate results obtained.

2. Sampling methodology

For the laboratories to obtain adequate gas samples, the airflow in the selected panel had to be reduced to the minimum. The intake side of the stope was sealed off by a Proto team who also assisted in the execution of the exercise.

Two samples were taken during blasting of 2 holes and 30 holes. Tracer gas was released before each blast to determine the dilution effect. The sampling equipment was positioned in the gully up dip of the face see **Diagram 1**.

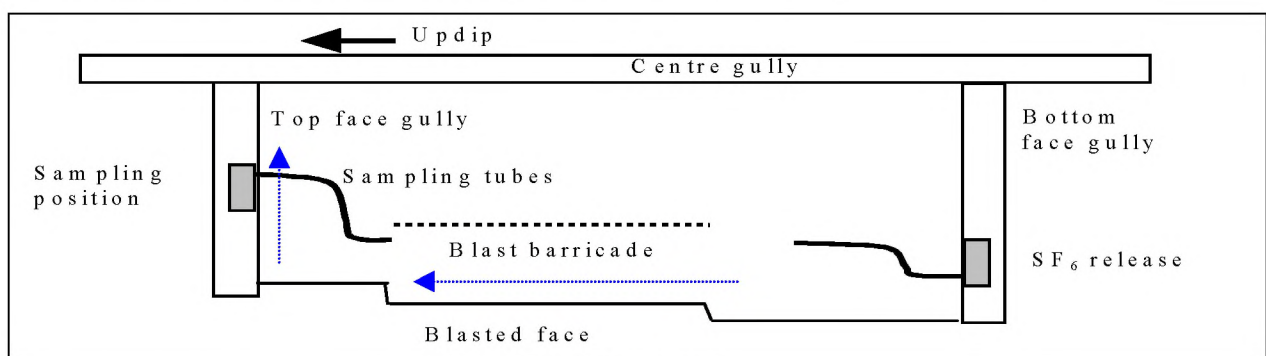


Diagram 1

A period of twenty minutes was used for sampling after each blast. On completion of the sampling, NECSA laboratories carried out the analysis. ITASCA laboratories, who co-ordinated the whole process underground, also made use of on-site multi-gas detection and recording instrumentation.

The dust test was performed during February 2002. A total of six gravimetric sampling pumps, 3 total and 3 respirable, were placed at the return side of the panel. The sampling time was 13 minutes and a time weighted average (8 hours) was calculated from the results.

3. Sampling results

The sampling results showed low gas concentrations as can be seen in **Table 1 and 2** below. The only gases detected that exceeded the Occupational exposure limit were NO_x and CO. The concentration for NO_x was measured as 187,3 mg/m³ and Carbon Monoxide 960ppm or 1100mg/m³. As CO was the highest pollutant identified, the calculations are based on its readings.

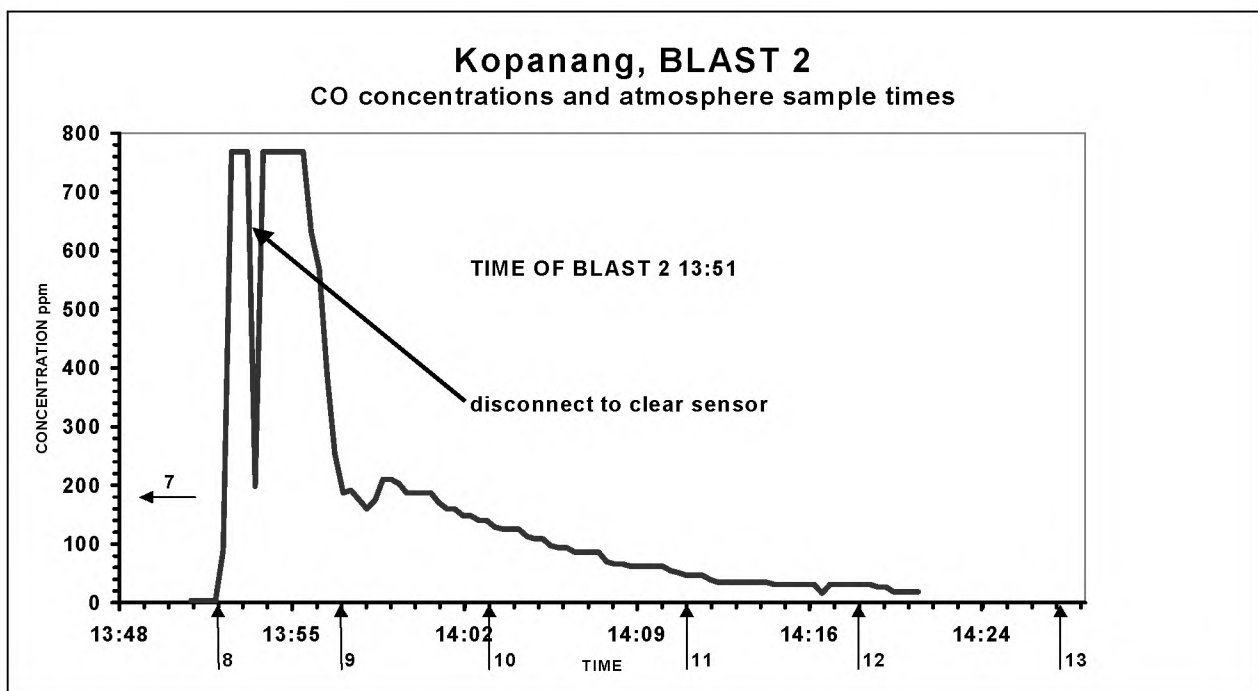
Note: the Occupational exposure limit for CO = 25ppm.

Sample	O ₂ (% v/v)	N ₂ (% v/v)	H ₂ (ul/l)	CO (ul/l)	CO ₂ (ul/l)	CH ₄ (ul/l)	C _x H _y (ul/l)	SF ₆ (ul/l)
1	21.8 ± 0.4	81.8 ± 0.5	8 ± 1	< 1	502 ± 12	1 ± 1	< 1	< 1
9	20.2 ± 0.1	75.7 ± 1.0	< 1	92 ± 5	1910 ± 23	10 ± 1	5 ± 1	4379 ± 10
13	21.2 ± 0.2	79.7 ± 0.1	< 1	< 1	855 ± 7	3 ± 1	< 1	< 1
3								812 ± 112
6								148 ± 17
7								< 1
12								93 ± 1

Table 1 Atmosphere analyses

Sample	NO _x (mg/sample)	No _x (mg/m ³)	SO _x (mg/sample)	SO _x (mg/m ³)
Blast 1	0,91	70,0	< 0,8	< 15
Blast 2	2,81	187,3	< 0,8	< 15

Table 2 NO_x and SO_x concentrations



The dust results show a highest concentration of total dust as 0,493 mg/m³ (legal limit 10 mg/m³) and respirable 0,088mg/m³ (legal limit 1 mg/m³) with a total of 26 holes blasted as depicted in **Table 3** below.

Sample		Sampling Time	Sample filter Mass		Reference Filter Mass		Sample Volume	Correction Factor	Sample Mass	Corrected Sample mass	Concentration	TWA 8 hour
			Before	After	Before	After						
Number	Type	(min)	(mg)	(mg)	(mg)	(mg)	(m ³)		(mg)	(mg)	(mg/m ³)	(mg/m ³)
P 258	Total	13	47.19	47.43	45.93	45.99	0.0247	-0.06	0.24	0.3	12.146	0.329
P 259	Total	13	46.74	46.98	45.93	45.99	0.0247	-0.06	0.24	0.3	12.146	0.329
P 260	Total	13	47.07	47.46	45.93	45.99	0.0247	-0.06	0.39	0.45	18.219	0.493
M 221	Resp	13	17.34	17.37	17.33	17.33	0.0247	0	0.03	0.03	1.215	0.033
M 217	Resp	13	18.91	18.96	17.33	17.33	0.0247	0	0.05	0.05	2.024	0.055
M 216	Resp	13	17.57	17.65	17.33	17.33	0.0247	0	0.08	0.08	3.239	0.088

Table 3

4. Interpretation of results

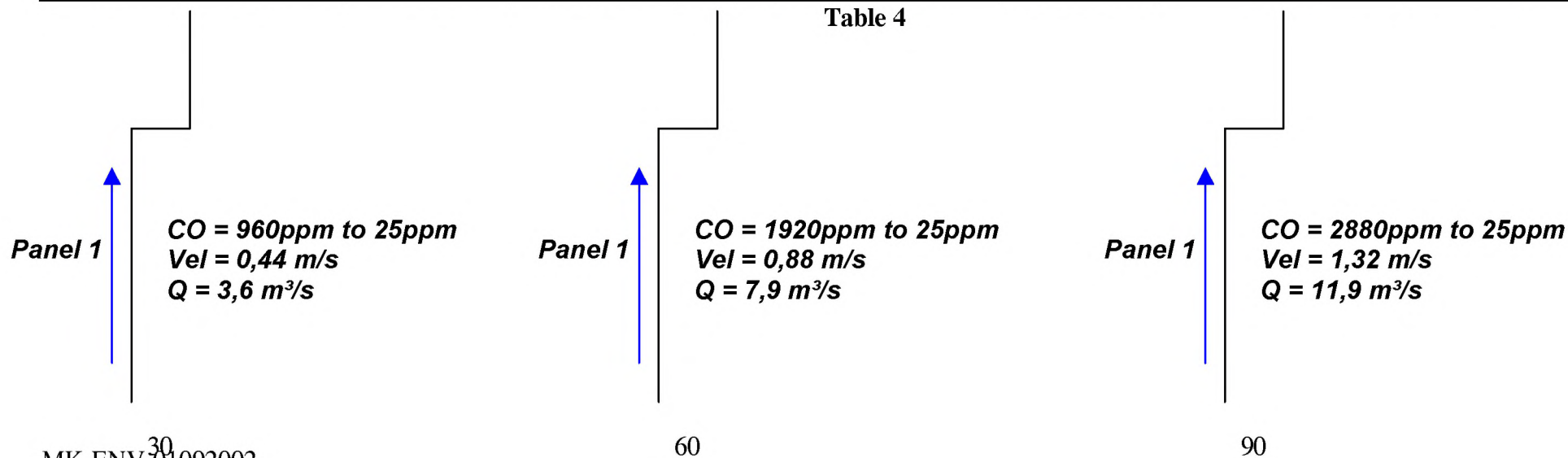
4.1 Air volume required per panel

The amount of fresh air required to dilute the CO concentration to below the Occupational exposure limit of 25ppm is 3,6 m³/s for every 30 holes per panel blasted and 11,9 m³/s for 90 holes per panel blasted as depicted in **Table 4** and **Diagram A**.

Dilution required **per panel** for Carbon Monoxide fumes to reach Occupational Exposure Limit of 25ppm. (Calculation Appendix A).

No of Holes	Concentration Ppm	Concentration mg/m ³	Concentration kg/m ³	Area m ²	Velocity m/s	Quantity m ³ /s	Gas flow rate kg/s	Fresh air required / panel m ³ /s	Fresh air required m/s
		weight x ppm	G	l x h		area x velocity	kg/m ³ x m ³ /s	Q = Q1 x 10 ⁶ - Q1	m ³ /s / area
		24,45	1000000					MAC - N	
1	32	37	0.000037	9	0,01	0.09	0.000003330	0.1332	0.01
2	65	74	0.000074	9	0,01	0.09	0.000006660	0.2664	0.03
10	320	367	0.000367	9	0,01	0.09	0.000033030	1.3212	0.15
20	640	733	0.000733	9	0,01	0.09	0.000065970	2.6387	0.29
30	960	1100	0.0011	9	0,01	0.09	0.000099000	3.9599	0.44
40	1280	1466	0.001466	9	0,01	0.09	0.000131940	5.2775	0.59
50	1600	1833	0.001833	9	0,01	0.09	0.000164970	6.5986	0.73
60	1920	2200	0.0022	9	0,01	0.09	0.000198000	7.9198	0.88
70	2240	2566	0.002566	9	0,01	0.09	0.000230940	9.2374	1.03
80	2560	2932	0.002932	9	0,01	0.09	0.000263880	10.5549	1.17
90	2880	3299	0.003299	9	0,01	0.09	0.000296910	11.8761	1.32
100	3200	3666	0.003666	9	0,01	0.09	0.000329940	13.1973	1.47

Table 4



4.2 Air volume required for multi panels (30 holes)

The amount of fresh air required to dilute the CO concentration for **30 holes** per panel on 4 panels in series to below the Occupational exposure limit of 25ppm is depicted in **Table 5** and **Diagram B. (Calculation Appendix A).**

	No of Holes	Concentration Ppm	Concentration mg/m ³	Concentration kg/m ³	Area m ²	Velocity m/s	Quantity m ³ /s	Gas flow rate Kg/s	Fresh air required / panel m ³ /s	Fresh air required m/s		
			weight x ppm	g	l x h		area x velocity	kg/m ³ x m ³ /s	Q = Q1 x 10 ⁶ MAC - N	m ³ /s / area	Vel	Qty
			24,45	1000000								
Panel 1	30	960	1100	0.0011	9	0,01	0.09	0.000099	3.96	0.44	0.44	3.96
Panel 2	30	985	1128	0.001128	9	0,01	0.09	0.00010152	4.061	0.45	0.89	8.02
Panel 3	30	985	1128	0.001128	9	0,01	0.09	0.00010152	4.061	0.45	1.34	12.08
Panel 4	30	985	1128	0.001128	9	0,01	0.09	0.00010152	4.061	0.45	1.79	16.14
Panel 5	30	985	1128	0.001128	9	0,01	0.09	0.00010152	4.061	0.45	2.24	20.20

Table 5

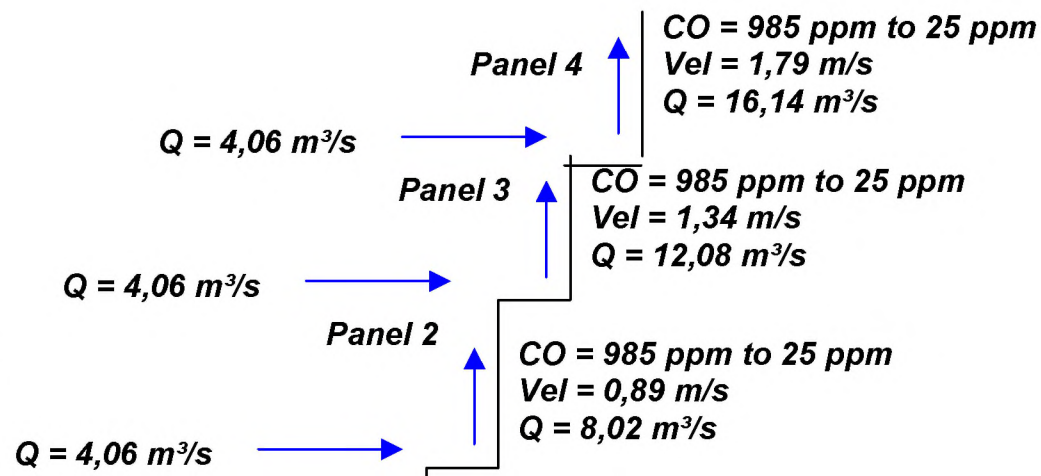


Diagram B

4.3 Air volume required for multi panels (60 holes)

The amount of fresh air required to dilute the CO concentration for **60 holes** per panel on 4 panels in series to below the Occupational exposure limit of 25ppm is depicted in **Table 6** and **Diagram C. (Calculation Appendix A).**

	No of Holes	Concentration Ppm	Concentration mg/m ³	Concentration kg/m ³	Area m ²	Velocity m/s	Quantity m ³ /s	Gas flow rate kg/s	Fresh air required / panel m ³ /s	Fresh air required m/s		
			weight x ppm	g	l x h		area x velocity	kg/m ³ x m ³ /s	Q = Q1 x 10 ⁶ MAC - N	m ³ /s / area	Vel	Qty
			24,45	1000000								
Panel 1	60	1920	2200	0.0022	9	0,01	0.09	0.000198	7.7198	0.86	0.86	7.72
Panel 2	60	1945	2228	0.002228	9	0,01	0.09	0.00020052	8.0206	0.89	1.75	15.74
Panel 3	60	1945	2228	0.002228	9	0,01	0.09	0.00020052	8.0206	0.89	2.64	23.76
Panel 4	60	1945	2228	0.002228	9	0,01	0.09	0.00020052	8.0206	0.89	3.53	31.78
Panel 5	60	1945	2228	0.002228	9	0,01	0.09	0.00020052	8.0206	0.89	4.42	39.80

Table 5

CO = 1945ppm to 25ppm

Vel = 3,53 m/s

Q = 31,78 m³/s

Diagram C

Q = 8,02 m³/s

Panel 3

CO = 1945ppm to 25ppm

Vel = 2,64 m/s

Q = 23,76 m³/s

Q = 8,02 m³/s

Panel 2

CO = 1945ppm to 25ppm

Vel = 1,75 m/s

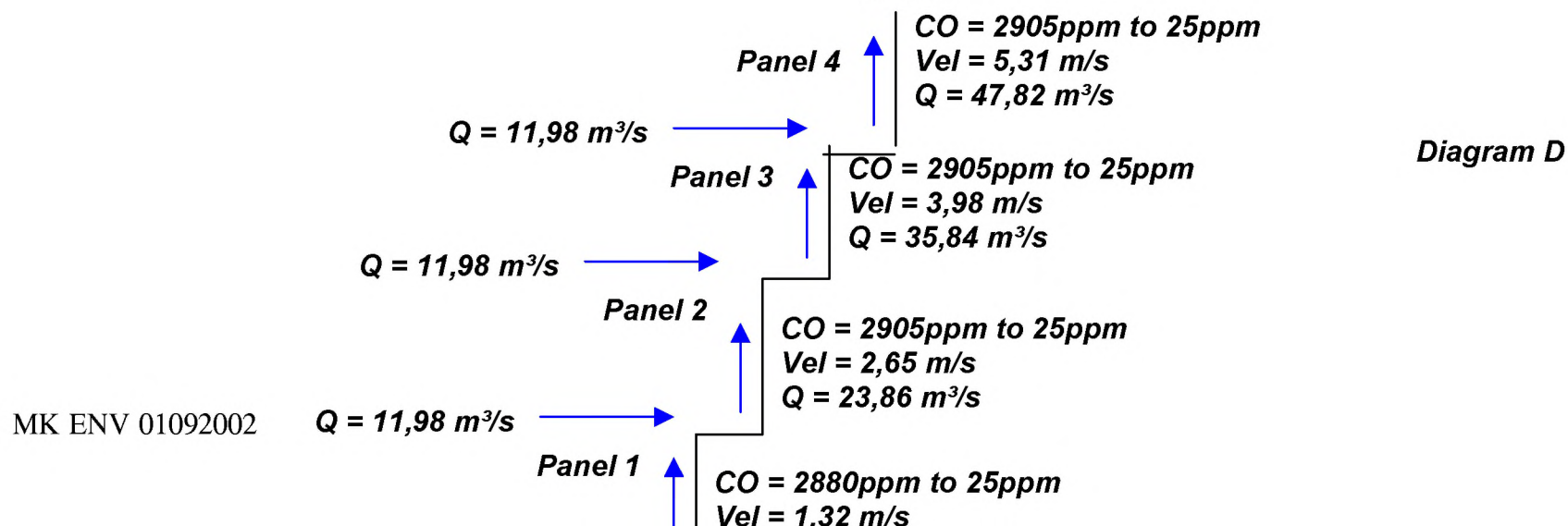
Q = 15,74 m³/s

Air volume required for multi panels (90 holes)

The amount of fresh air required to dilute the CO concentration for **90 holes** per panel on 4 panels in series to below the Occupational exposure limit of 25ppm is depicted in **Table 7** and **Diagram D**. (Calculation Appendix A).

	No of Holes	Concentration on Ppm	Concentration on mg/m³	Concentration on kg/m³	Area m²	Velocity m/s	Quantity m³/s	Gas flow rate kg/s	Fresh air required / panel m³/s	Fresh air required m/s		
			weight x ppm	g	l x h		area x velocity	kg/m³ x m³/s	Q = Q1 x 10 ⁶	m³/s / area	Vel	Qty
			24,45	1000000					MAC - N			
	Panel 1	90	2880	3299	0.003299	9	0,01	0.09	0.00029691	11.876	1.32	1.32
Panel 2	90	2905	3328	0.003328	9	0,01	0.09	0.00029952	11.981	1.33	2.65	23.86
Panel 3	90	2905	3328	0.003328	9	0,01	0.09	0.00029952	11.981	1.33	3.98	35.84
Panel 4	90	2905	3328	0.003328	9	0,01	0.09	0.00029952	11.981	1.33	5.31	47.82
Panel 5	90	2905	3328	0.003328	9	0,01	0.09	0.00029952	11.981	1.33	6.64	59.80

Table 7



5. Recommendations

The results show unacceptably high levels of No_x and CO and it would be recommended that continuous monitors be put in place at each panel. A robot system should be considered to work in conjunction with these monitors. Personal CO and Oxygen monitors must be issued to each panel.

Air measurements on the air velocities must be done on a frequent basis and high discipline would be required on the maintenance of in-stope ventilation controls.

As can be seen, an air quantity of $48\text{m}^3/\text{s}$ would be required to work 4 panels simultaneously when blasting 90 holes on a panel. The practicality of this situation might not be viable and serious consideration could be given to modifying mining layouts to reduce re-use of air and resultant occupational exposures.

If the required velocities cannot be obtained for dilution, all personnel on the upstream side of the panel blasted will have to be withdrawn during the blast.

It is extremely important to complete the dust assessment to determine the effect of the dust on the ventilation required.

6. References

8. Appendices

Appendix A

Calculations

NO_x concentration

$$= 187,3 \text{ mg/m}^3$$

$$= 0,0001873 \text{ kg/m}^3$$

Velocity

$$= 0,01 \text{ m/s}$$

Area

$$= 1 \text{ m}^2$$

Quantity

$$= \text{velocity} \times \text{area}$$

$$= 0,01 \times 1$$

$$= 0,01 \text{ m}^3/\text{s}$$

Gas flow rate

$$= \text{concentration} \times \text{quantity}$$

$$= 0,0001873 \times 0,01$$

$$= 0,000001873 \text{ kg/s}$$

Fresh air required

$$Q = \frac{Q_1 \times 10^6}{\text{MAC} - N} - Q_1$$

Q = fresh air required

Q₁ = gas flow rate (kg/s)

MAC = maximum allowable gas concentration after mixing (ppm)

N = gas in normal air (ppm)

$$Q = \frac{0,000001873 \times 10^6}{50 - 0} - 0,000001873$$

$$Q = 0,0375 \text{ m}^3/\text{s} \times \text{area}$$

Q = 0,0375m/s fresh air required for dilution of Nitrous Oxides

CO concentration

$$= 800 \text{ ppm}$$

TLV to ppm

$$= (\text{TLV}) \times 24,45$$

MK ENV 01092002

molecular weight

ppm to TLV
= molecular weight x ppm

24,45

= 28,01 x 800

24,45

= 916,5 mg/m³

= 0,0009165 kg/m³

Velocity
= 0,01m/s

Area
= 1m²

Quantity
= velocity x area
= 0,01 x 1
= 0,01m³/s

Gas flow rate
= concentration x quantity
= 0,0009165 x 0,01
= 0,000009165 kg/s

Fresh air required

$Q = \frac{Q1 \times 10^6}{MAC - N} - Q1$

Q = fresh air required
Q1 = gas flow rate (kg/s)
MAC = maximum allowable gas concentration after mixing (ppm)
N = gas in normal air (ppm)

$Q = \frac{0,000009165 \times 10^6}{25 - 0} - 0,000009165$

Q = 0,367 m³/s x area

Q = 0,367m/s fresh air required for dilution of Carbon Monoxide should the concentration be 800ppm.

DIESEL FUMES

Project Summary : GEN 010

Project Title:	Control of diesel exhaust in underground workings 269p.		
Author(s):	H Haase, A D Unsted and C Denysschen	Agency:	CSIR: Mining Technology
Report Date:	03/95	Related Projects:	
Category:	Generic	Applied Research	Occupational Health

Summary

This project produced nine reports covering the following subject areas

- Health effects of exposure to diesel exhaust emissions
- Diesel exhaust pollution, monitoring and design criteria

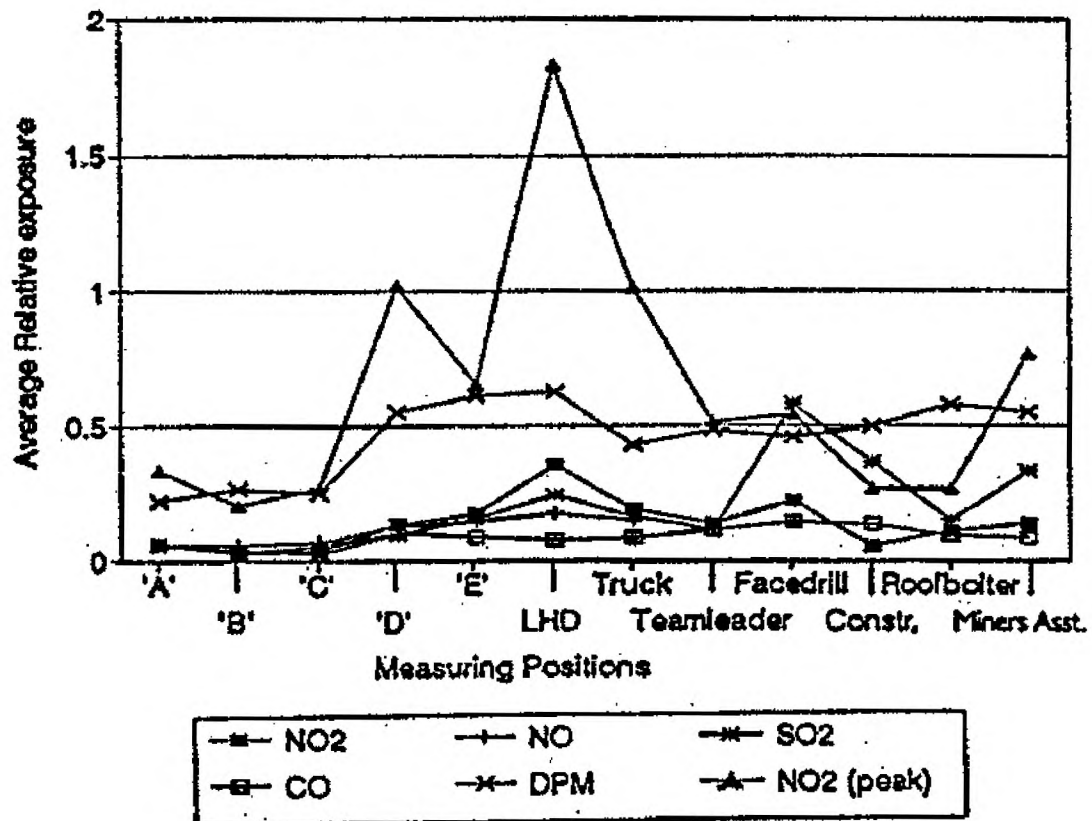


FIGURE 1 Example of average relative exposure levels

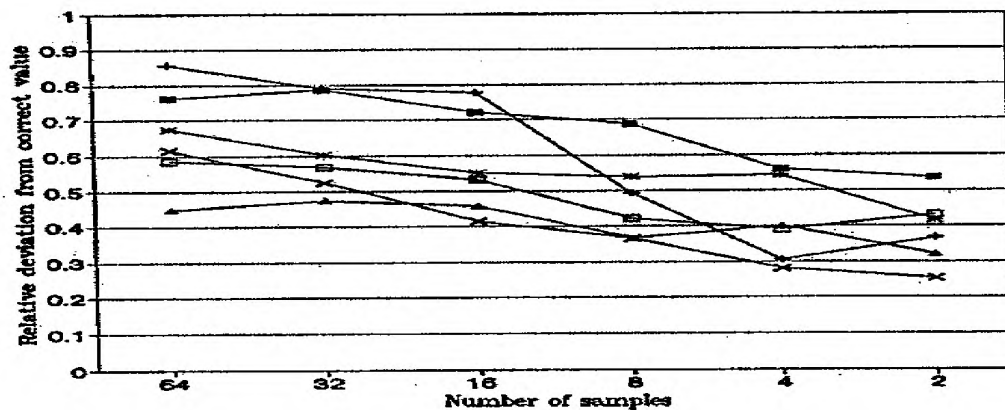


FIGURE 2 Correlation of spot sampling to continuously measured peak exposures for 6 cases as a function of the spot sampling frequency

- Engineering solutions to NO₂ exposure problems
 - Pollutant monitoring methodology for diesel particulate matter
 - Engineering options for the control of diesel engine emissions
 - Results from exposure measurements in S A mines,
- Part 1: T rackless underground gold mining operation using bord and pillar extraction methods; Part 2: Deep-level narrow stope mine using LHDs in roadways; Part 3: Haulage level using diesel engine powered locomotives.
- Comparison of exhaust emissions of an underground mining diesel engine before and after refurbishing.

Several key aspects concerning pollution control strategies were investigated such as critical pollutants, exposure measurements and instrumentation, suitable measuring strategies, ventilation design methods for pollution dilution, and several others.

Conclusions

The critical pollutants are NO₂ (peak exposures) and diesel particulate matter (DPM) (time averaged exposures) (see Fig. 1).

DPM emissions are sensitive to engine maintenance.

The ceiling exposure limit for NO₂ requires continuous monitoring. Spot sampling is not suitable for peak exposure identification (see Fig. 2). Only electro-chemical cells are suitable, but are problematic. They also require testgas which tends to be unreliable.

DPM can be conveniently measured with gravimetric dust samplers.

Drivers of diesel powered vehicles experience the highest exposure levels.

Locations of highest exposures are dead-end headings or areas with air velocities lower than vehicle velocities.

A cost effective strategy would be to measure driver exposure only. The common practice of measuring at return airways does not produce 'representative' correlations.

Existing design methods for pollution dilution are too simplistic to ensure safe exposure levels in cases of complicated ventilation layouts or dead-end headings. Only well planned measuring strategies can provide a safeguard against overexposure.

SOUDAL FOAM

Anglogold Corporate Office Mining



SOUDAL MINING FOAM

Prepared by: JA Labuschagne
Technical Assistant – Occupational Environment

Date – 17 December 1999

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Toxicity Tests	6
Flammability Tests	7
AMPLATS Project Report	8

Introduction:

A new product, Soudal Mining Foam, which main component is Polyurethane, was under discussion at a Free State Standards Meeting. The main application will be for tamping of holes after charged up. The decision to make use of the product was deferred until comments are received from Corporate office.

Summary:

The Anglogold Recommended controls for high risk areas (No. 25) – Class 1 Organic materials (Products containing safe quantities of organic materials e.g. PUR Polymers) has the following requirements:

Fire performance characteristics – must be self-extinguishing, will not propagate flame, emits little smoke and gases when exposed to external flame.

Must pass the NES713 toxicity test, i.e. must have an index of not greater than 5,0.

Must pass an appropriate full-scale burn test.

Different tests, involving four different institutions, were conducted on the above product for toxicity and fire performance characteristics with mixed results. The flame spread and flammability results as well as the toxicity index are within the set standards. All the specimens introduced to the fire tests extinguished automatically within one second. The smoke toxicity index did not go higher than 2,4.

The concerning factor is the results on the Diphenylmethane 4,4'-diisocyanate(MDI) and Toluene diisocyanate(TDI) chemical tests. The results were much higher than the suggested limits as set out in the Regulations for hazardous chemical substances of the OSH Act 85 of 1993 (TWA of MDI=0,02mg/m³). Paragraph 33 states that the exposure limits do not apply to mines.

The limits set in the book by ACGIHs, TLVs and BEIs are even lower than those of the OSH Act (TWA for MDI&TDI=0,005ppm/mg/m³).

No traces of MDI or TDI could be found during testing in the training centre and laboratory.

During the underground tests, MDI levels as high as 0,079 and TDI levels of 0,066mg/m³ were measured during tamping with Soudal foam.

The CSIR explain that this could result from the fact that Isocyanates contain highly reactive Nitrogen Carbon Oxygen groups which react with Hydroxyl groups of Polyols to form Polymers. Even higher readings were obtained during the filling of holes with explosives.

Unfortunately no tests were conducted on paints and explosives and the measured MDI and TDI levels can not relate to the foam product used.

A broken down summary of the tests is included in the report.

AMPLATS introduced the product on trial with the following findings:

MK ENV 01092002

It is fast and effective, tamps up to 150 holes per can, it is not labour intensive, 4c per can cheaper than conventional tamping, no intensive training involved, an average of 10cm improvement in face advance per blast.

Conclusions:

From the findings the product does not prove to be a health or fire hazard. The results on the tests conducted on flammability and toxicity are well within the standards.

The findings from AMPLATS are very positive in the sense of time and cost saving and possible increase in production. Bambanani mine is currently doing a risk assessment on the product and once completed the report must be forwarded to this office.

Should the decision favour the introduction of the product in the mines, certain special precautions will have to be adhered to such as:

- Adequate training for the users on the correct use of the product;
- Correct PPE to be applied, i.e. gloves, safety goggles, respirators;
- The transporting and storage should be similar to those on spray paint products, e.g. store in lockable steel cabinets;
- Empty containers should not be left underground.

Since the tests conducted revealed high readings on MDI and TDI prior to the use of the product, it is recommended that chemical tests be performed on spray paints and explosives.

MDI & TDI Tests:

The CSIR – Division of Water, Environment and Forestry Technology obtained a list of chemicals used in the Soudal Mining foam. Two chemicals namely, Diphenylmethane 4,4’diisocyanate(MDI) and Toluene diisocyanate(TDI) were found during the formulation analysis.

AECI and NCOH were approached to do chemical tests on these products.

The tests were conducted against the suggested limits as set out in the Regulations for hazardous chemical substances of the OSH Act 85 of 1993 (**TWA of MDI=0,02mg/m³**). Paragraph 33 states that the exposure limits do not apply to mines.

The limits set in the book by ACGIHs, TLVs and BEIs are even lower than those of the OSH Act (**TWA for MDI&TDI=0,005ppm/mg/m³**).

Two methods were used for determining MDI and TDI levels, Impinger and cassette. No traces of MDI or TDI could be found during testing in the training centre and laboratory on surface.

During the underground tests, the impinger method revealed a concentration of 0,04mg/m³. Tabulated below are the results from the chemcassette sampling.

	MDI (mg/m³)	TDI (mg/m³)
Control Room	0,17	0,054
Drilling Holes	0,17	0,054
Filling holes with explosives	0,125	0,095
Tamping holes with mining foam	0,079	0,066

MDI levels as high as 0,079 and TDI levels of 0,066mg/m³ were measured during tamping with Soudal foam.

The CSIR explain that this could result from the fact that Isocyanates contain highly reactive Nitrogen Carbon Oxygen groups which react with Hydroxyl groups of Polyols to form Polymers. Even higher readings were obtained during the filling of holes with explosives.

Unfortunately no tests were conducted on paints and explosives and the measured MDI and TDI levels can not relate to the foam product used.

Toxicity Tests:

The toxicity analysis on the mining foam product was conducted by the SABS against the following concentrations in ppm:

Carbon dioxide	-	100 000
Carbon Monoxide	-	4 000
Nitrogen Oxides	-	250
Hydrogen Cyanide	-	150

The test was carried out in accordance with the Naval Engineering Standard 713 with the following results:

Sample Identification	Toxic gas factor				Smoke Toxicity Index
	Carbon Dioxide	Carbon Monoxide	Nitrogen Oxides	Hydrogen Cyanide	
Mining foam fresh	-	1,4	0,3	0,5	2,2
Mining foam after 3 hours	0,1	1,4	0,3	0,6	2,4

Smoke toxicity values:

- 0-3 Low smoke toxicity material
- 3-5 Intermediate smoke toxicity material
- >5 High smoke toxicity material

None of the following gases also tested for were detected: Hydrogen Chloride, Hydrogen Sulfide, Sulfur Dioxide and Ammonia.

Flammability Tests:

The flammability and flame spread tests were conducted by the SABS.

The test to establish flammability of the sample was conducted in accordance with SABS SM891 “Flammability of aerosols (flame projection test)” with the following results:

Spray ignited	Flame projection mm	Self supporting flame
No	Nil	No

The sample tested to “UL94:1985 – Standard for tests for flammability of plastic materials for parts in devices and appliances” test was performed with the following results:

Specimen No.	Flaming duration (s)	Dripping	Flaming to holder
1	1	No	No
2	1	No	No
3	1	No	No
4	1	No	No
5	1	No	No

All of the samples extinguished automatically within 1 second.

AMPLATS Project Report:

The product was introduced to AMPLATS for a trial period with the following comments:

- 1) A very fast and effective way of tamping
- 2) Tamps up to 35cm in depth effectively
- 3) Tamps up to 150 holes per can
- 4) Not labour intensive
- 5) Take up to 8 min. to tamp a panel of 35 meters
- 6) Cut cost up to 4c per can cheaper than conventional tamping
- 7) Multiple uses underground
- 8) Seal ventilation pipes and use it as ventilation pipe gaskets
- 9) No fire hazard
- 10) No wastage of tamping and preparations of tamping
- 11) No intensive training involved on the job training is needed
- 12) Strict control over issues of full cans on return of empty cans at distribution point
- 13) More time for charging up operations
- 14) In case of misfires a copper scraper must be used to remove the tamping
- 15) There is an average of 10cm improvement in advance per blast
- 16) It is user friendly and non-toxic
- 17) No errors in the application of this type of tamping is possible.

RESPIRABLE DUST

Although not specifically evaluated during this process, exposure to respirable dust will be controlled and monitored as per the process described in the Mandatory Code of Practice for an Occupational Hygiene Programme on personal exposure to Airborne Pollutants (Annexure 1).

ANNEXURE 4
AIRBORNE POLLUTANTS NOT LISTED AS HAZARDOUS ON NIOSH
DATABASE

Airborne Pollutants identified not to be listed on the NIOSH database to be hazardous were the following:

- Hydrogen
- Helium
- Grease
- Hydraulic Fluid
- Silicon Grease
- Monobloo
- Portabloo
- PH Powder
- Zenatex
- PRLC 40*
- SP 100*
- MYCO SA 160*
- MYCO TCC 766*
- Polyheed SG*

Note:

- * Batch Plant Chemicals

ANNEXURE 5
AIRBORNE POLLUTANTS TO BE EVALUATED DURING NEXT REVISION
OF THE COP

Airborne Pollutants to be measured during the next revision of the COP:

- Fridge Plant Chemicals
- Caustic Soda
- Wynns Green Clean
- Paint Stripper
- Quick Start
- Rubber Solvent
- Aluminium Dust
- Vent Seal
- Silent Seal

The above-mentioned airborne pollutants were either not available for measurement or the media for the measurement thereof were not readily available.

ANNEXURE 6
WORKING MEMBERS OF COMMITTEE

The Committee consisted of the following members:

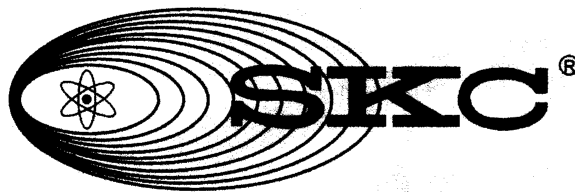
Full Name	<i>Affiliation/s</i>
J Dekker	Anglogold Corporate Office
T van Dyk	Moab Khotsong
J van Niekerk	Moab Khotsong
J Havenga	Great Noligwa
M Symons	Kopanang
C Somers	Tau Lekoa
F Cloete	Savuka
B Rawlins	Tau Tona
H van der Walt	Tau Tona
J Mackenzie	Mponeng
E Newberry	Mponeng

ANNEXURE 7
ANALYSIS REPORT

Analytical Report for AngloGold Moab Mine

Report No. E121/2002

2002/09/09



The Worlds Finest Air Sampling Products

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TEST REPORT

Date of Report: 2002/09/09
Report Number: E121/2002
Contact Person: Johann J Gräbe
Telephone Number: (011) 873-3881 / 873-0833

Client: AngloGold – Moab Mine
Telephone Number: (018) 478-1775
Fax Number: (018) 478-1641
E-mail Address: tvandyk@anglogold.com

Purchase Order Number: SR49290
Completion Date Requested: ASAP
Description of Analysis: Variation

Samples Received by: Johann J Gräbe
Date Received: 2002/08/15
Description of Samples: Badges, Filters & Tubes
Condition of Samples: Good

Analytical Method: Refer to Quotation QUJ00069

■ ■ ■ ■ ■ ■ ■ ■ ■ ■

* BDL = Below Detection Limit

Analysis done by: E. Cowley
Protechnik Laboratory

This report compiled by: Johann J Gräbe
SKC South Africa

Date of Completion: 2002/09/09

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Based upon NIOSH 1500/1501, the following compounds were specifically tested for:

1,1,1-trichloroethane	1,2-dichloropropane	1,4-dioxane
Methyl isobutyl ketone (Mibk)	2-methylpentane	Ethyl acetate
Methyl ethyl ketone(Mek)	3- methylpentane	Ethyl benzene
2,4,4-trimethylpentane	Trichloroethylene	Toluene
Carbon tetrachloride	Tetrachloroethylene	Pyridine
1,2,3-trimethyl benzene(123-TMB)	2-butoxyethanol	Cyclohexane
1,2,4-trimethyl benzene(124-TMB)	Cyclohexanone	Benzene
1,3,5-trimethyl benzene(135-TMB)	n-butyl acetate	Chloroform
N-Heptane	n-hexane	Xylene

Table 1 – Volatile Organic Compounds – results in mg/m³

See attached spreadsheet – Pages 7-12

DETECTION LIMITS (LOD) (µg)

COMPOUND	LOD(µg)	COMPOUND	LOD(µg)
1,1,1-trichloroethane	1.84	1,2-dichloropropane	0.80
Methyl isobutyl ketone (Mibk)	0.52	2-methylpentane	0.53
Methyl ethyl ketone(Mek)	3.89	3- methylpentane	0.74
2,4,4-trimethylpentane	0.44	Trichloroethylene	1.21
Carbon tetrachloride	5.03	tetrachloroethylene	2.16
1,2,3-trimethyl benzene(123-TMB)	0.64	2-butoxyethanol	0.59
1,2,4-trimethyl benzene(124-TMB)	0.72	cyclohexanone	0.95
1,3,5-trimethyl benzene(135-TMB)	0.68	n-butyl acetate	0.59
N-Heptane	0.54	n-hexane	0.43
1,4-dioxane	0.61	ethyl acetate	3.59
Ethyl benzene	0.58	toluene	0.71
Pyridine	0.65	cyclohexane	0.52
Chloroform	4.39	xylene	0.62
Benzene	1.59		

Note : Detection limits for all other compounds = 1.0 µg

Table 2 – GC-analysis and Degreaser

The samples were extracted with methanol and analysed on a GC-MS with a mid polar column. No organic compounds could be detected.

Table 3 –Amines - results in mg/m³

SAMPLE NUMBER	AMINES
Si (4)	0.0034
Si (7)	0.0043
Si (10)	0.0010

Table 4 – Weighing of PVC filter – results in mg/m³

SAMPLE NUMBER	WOOD DUST
GLA-1	

Table 5 – Inorganic acids – results in mg/m³

SAMPLE	HF	HCl	H ₃ PO ₄	HBr	HNO ₃	H ₂ SO ₄
Si – 1 (Back)	-	-	-	-	-	0.0196
Si – 1 (Front)	-	-	-	-	-	0.0228
Si – 2 (Back)	-	-	BDL	-	-	-
Si – 2 (Front)	-	-	0.0067	-	-	-
Si – 3 (Back)	BDL	0.0245	BDL	BDL	BDL	0.0152
Si – 3 (Front)	BDL	0.0069	BDL	BDL	BDL	BDL

Detection Limits

Analyte	Microgram per sample
HF	0.37
HCl	0.31
H ₃ PO ₄	0.35
HBr	0.70
HNO ₃	0.65
H ₂ SO ₄	0.53

Table 6 –Ammonium salt – results in mg/m³

SAMPLE NUMBER	AMMONIUM SALT
Si – 8 (Back)	0.00069
Si – 8 (Front)	0.00460

Table 7 – Chlorine – results in mg/m³

SAMPLE NUMBER	CHLORINE
9006-1 (Back)	BDL
9006-1 (Front)	BDL

LOD_{Cl} = 0.31 µg/sample

Table 8 – Phenol, Cresol and Formaldehyde – results in mg/m³

SAMPLE NUMBER	PHENOL	CRESOL	FORMALDEHYDE
XAD7-2	-	-	BDL
XAD2-1	BDL	BDL	-

LOD_{Formaldehyde} = 3 µg

Compound	XAD-2 (mg/m ³)
Toluene	13.44
Ethylbenzene	3.17
Xylene	26.14
Hydrocarbons	3648.48
Tetrachloroethylene	453.27
Benzene Derivatives	1669.67

Table 9 – Paraffin Wax

The samples were analysed according to NIOSH Method 5026 for mineral oil mist. Paraffin wax could not be detected.

Detection limit = 50 µg

Table 10 – Turpentine – results in mg/m³

SAMPLE NUMBER	TURPENTINE
GN-17	BDL

It is recommended that organic compounds be sampled on charcoal sampling media.

TABLE 11	Al	Ca	Cd	Fe	K	Mg	Mn	Na	Pb	Si	Ti	Zn
Sample No.	mg/m ³	mg/m ³	mg/m ³	mg/m ³	mg/m ³	mg/m ³	mg/m ³	mg/m ³	mg/m ³	mg/m ³	mg/m ³	mg/m ³
GN-1	BDL	BDL	BDL	2.6380	BDL	BDL	BDL	0.6697	BDL	BDL	BDL	BDL
GN-2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
GN-3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
GN-4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
GN-5	0.0118	0.0662	BDL	0.1144	BDL	BDL	BDL	0.0117	BDL	BDL	BDL	0.0492
GN-5.2	0.0224	0.2114	0.2114	0.2306	BDL	BDL	BDL	0.0148	BDL	BDL	BDL	0.1016
GN-6	0.0742	BDL	BDL	8.1635	0.9799	BDL	1.7183	0.4205	0.3602	0.1256	1.0914	47.2580
GN-10	BDL	0.2753	BDL	BDL	BDL	0.0217	BDL	0.0025	BDL	BDL	BDL	BDL
GN-11	BDL	0.1765	BDL	BDL	BDL	0.0908	BDL	BDL	BDL	BDL	BDL	BDL
GN-12	BDL	0.0407	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
GN-13	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
GN-14	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.0035	BDL	BDL	BDL	BDL
GN-15	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
GN-16	0.0014	BDL	BDL	0.0087	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
GLA-2	0.0061	0.1598	BDL	BDL	BDL	BDL	BDL	0.0064	BDL	BDL	BDL	BDL
TF-2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Detection Limit = 1.0 ug

TABLE 11	Al	Ca	Cd	Fe	K	Mg	Mn	Na	Pb	Si	Ti	Zn
Sample No.	mg/m ³	mg/m ³	mg/m ³	mg/m ³	mg/m ³	mg/m ³	mg/m ³	mg/m ³	mg/m ³	mg/m ³	mg/m ³	mg/m ³
GN-1	BDL	BDL	BDL	2.6390	BDL	BDL	BDL	0.6697	BDL	BDL	BDL	BDL
GN-2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
GN-3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
GN-4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
GN-5	0.0118	0.0662	BDL	0.1144	BDL	BDL	BDL	0.0117	BDL	BDL	BDL	0.0492
GN-5.2	0.0224	0.2114	0.2114	0.2306	BDL	BDL	BDL	0.0148	BDL	BDL	BDL	0.1016
GN-6	0.0742	BDL	BDL	8.1635	0.9799	BDL	1.7183	0.4205	0.3602	0.1256	1.0914	47.2580
GN-10	BDL	0.2753	BDL	BDL	BDL	0.0217	BDL	0.0025	BDL	BDL	BDL	BDL
GN-11	BDL	0.1765	BDL	BDL	BDL	0.0908	BDL	BDL	BDL	BDL	BDL	BDL
GN-12	BDL	0.0407	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
GN-13	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
GN-14	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.0035	BDL	BDL	BDL	BDL
GN-15	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
GN-16	0.0014	BDL	BDL	0.0087	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
GLA-2	0.0061	0.1598	BDL	BDL	BDL	BDL	BDL	0.0064	BDL	BDL	BDL	BDL
TF-2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Detection Limit = 1.0 ug

G.A.B.I.E BADGE RESULTS

Date: 2002/09/09

Badge No: 6861				
COMPOUND (VOC's)	mg/m3	TWA Conc. (ppm)	HCS OEL/TLV (ppm)	POLLUTANT AQI
Toluene	0.08	0.021	50	0.00042
Ethylbenzene	0.01	0.003	100	0.00003
Xylene	0.07	0.016	100	0.00016
Total AQI				0.00061

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G.A.B.I.E BADGE RESULTS

Date: 2002/09/09

Badge No: 6863				
COMPOUND (VOC's)	mg/m3	TWA Conc. (ppm)	HCS OEL/TLV (ppm)	POLLUTANT AQI
Toluene	4.83	1.299	50	0.02598
Tetrachloroethylene	2299.08	338.630	50	6.77259
Ethylbenzene	7.31	1.686	100	0.01686
Xylene	394.05	90.892	100	0.90892
Hydrocarbons (Nonane)	3090.11	590.259	200	2.95129
Total AQI				10.67564

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G.A.B.I.E BADGE RESULTS

Date: 2002/09/09

Badge No: 6864				
COMPOUND (VOC's)	mg/m3	TWA Conc. (ppm)	HCS OEL/TLV (ppm)	POLLUTANT AQI
Toluene	0.07	0.019	50	0.00038
Tetrachloroethylene	1.62	0.238	50	0.00476
Ethylbenzene	0.01	0.003	100	0.00003
Xylene	0.13	0.031	100	0.00031
Total AQI				0.00549

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G.A.B.I.E BADGE RESULTS

Date: 2002/09/09

Badge No: 6869				
COMPOUND (VOC's)	mg/m3	TWA Conc. (ppm)	HCS OEL/TLV (ppm)	POLLUTANT AQI
Toluene	0.04	0.010	50	0.00020
Tetrachloroethylene	0.53	0.077	50	0.00155
Ethylbenzene	0.01	0.002	100	0.00002
Xylene	0.06	0.015	100	0.00015
Total AQI				0.00191

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G.A.B.I.E BADGE RESULTS

Date: 2002/09/09

Badge No: 6871				
COMPOUND (VOC's)	mg/m3	TWA Conc. (ppm)	HCS OEL/TLV (ppm)	POLLUTANT AQI
Toluene	0.15	0.041	50	0.00082
Tetrachloroethylene	0.10	0.014	50	0.00029
Ethylbenzene	0.02	0.004	100	0.00004
Xylene	0.11	0.025	100	0.00025
Total AQI				0.00140

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G.A.B.I.E BADGE RESULTS

Date: 2002/09/09

Badge No: 6878				
COMPOUND (VOC's)	mg/m3	TWA Conc (ppm)	HCS OEL/TLV (ppm)	POLLUTANT AQI
Toluene	0.26	0.070	50	0.00140
Ethylbenzene	0.06	0.013	100	0.00013
Xylene	0.29	0.066	100	0.00066
Total AQI				0.00219

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ANNEXURE 8

EVALUATION RESULTS

Note:

<i>TWA</i>	<i>:</i>	<i>Time Weighted Average</i>
<i>mg/m³</i>	<i>:</i>	<i>Milligram per cubic meter</i>
<i>OEL</i>	<i>:</i>	<i>Occupational Exposure Limit</i>
<i>BDL</i>	<i>:</i>	<i>Below detection Limit</i>
<i>#</i>	<i>:</i>	<i>Short Term Exposure Limit</i>
<i>*</i>	<i>:</i>	<i>% of OEL Exceeded</i>

Airborne Pollutant Name	Individual Chemicals measured	Measurement Results TWA (mg/m ³)	Sample Reference	OEL (mg/m ³)	% of OEL	AQI
Batch Plant Chemicals: - Delvo stabilizer, - PRPL 25, - MYCO TCC 735	Hydrochloric Acids	0.004	Si-3	0.5	0.8	
	Amine	0.002	Si-4	0.05	4.0	
	Paraffin	None detected	AE-1/ AE-2	2.0	-	
Glue Epoxy Resin	Phenol	BDL	XAD-7.2	5.0	-	
	Cresol	BDL		5.0	-	
	Formaldehyde	BDL	XAD2.1	0.37#	-	
	Amine	0.0015	Si-7	0.05	3.0	
	Sodium Hydroxide	BDL	TF-2	2.0#	-	
Turpentine	Turpentine	BDL	GN-17	100ppm	-	
Portland Cement	Aluminium	0.002	GLA-2	5.0	0.04	
	Calcium	0.06		5.0	1.2	
	Cadmium	BDL		0.2	-	
	Iron	BDL		5.0	-	
	Potassium	BDL		2#	-	
	Magnesium	BDL		10.0	-	
	Manganese	BDL		1.0	-	
	Sodium	BDL		2.0	-	
	Palladium	0.0064		10.0	0.064	
	Silicon	BDL		5.0	-	
	Titanium	BDL		10.0	-	
	Zinc	BDL		5.0	-	
White Wash	Titanium	BDL	GN-10/11	10.0	-	
	Calcium	0.07		5.0	1.4	

Airborne Pollutant Name	Individual Chemicals measured	Measurement Results TWA (mg/m ³)	Sample Reference	OEL (mg/m ³)	% of OEL	AQI
	• Aluminium	BDL		5.0	-	
	• Cadmium	BDL		0.2	-	
	• Iron	BDL		5.0	-	
	• Potassium	BDL		2.0#	-	
	• Magnesium	0.006		10.0	0.06	
	• Manganese	0.02		1.0	2.0	
	• Sodium	BDL		2.0	-	
	• Palladium	0.0007		10.0	0.007	
	• Silicon	BDL		5.0	-	
	• Zinc	BDL		5.0	-	
	• Xylene	BDL	6871	1434	-	
	• Toluene	BDL		188	-	
	• Tetrachloro-ethylene	0.15		170	0.09	
	• Ethyl Benzene	0.1		434	0.02	
Calcium Chloride	• Aluminium	BDL	GN-12	5.0	-	
	• Calcium	0.015		5.0	0.3	
	• Cadmium	BDL		0.2	-	
	• Iron	BDL		5.0	-	
	• Potassium	BDL		2.0#	-	
	• Magnesium	BDL		10.0	-	
	• Manganese	BDL		1.0	-	
	• Sodium	BDL		2.0	-	
	• Palladium	BDL		10.0	-	
	• Silicon	BDL		5.0	-	
	• Titanium	BDL		10.0	-	
	• Zinc	BDL BDL		5.0	-	

Airborne Pollutant Name	Individual Chemicals measured	Measurement Results TWA (mg/m ³)	Sample Reference	OEL (mg/m ³)	% of OEL	AQI
Water Chemicals: - BCH tablets - SAX 831 - ST 40 - Chlorine	Chlorine	BDL	9006-1	0.5	-	
	Toluene	0.26	6878	188	0.14	
	Ethyl Benzene	0.06		434	0.01	
	Xylene	0.29		434	0.07	
	Aluminium	BDL	GN-13-16	5.0	-	
	Calcium	BDL		5.0	-	
	Cadmium	BDL		0.2	-	
	Iron	0.005		5.0	0.1	
	Potassium	BDL		2.0#	-	
	Magnesium	BDL		10.0	-	
	Manganese	BDL		1.0	-	
	Sodium	0.002		2.0	0.1	
	Palladium	BDL		10.0	-	
	Silicon	BDL		5.0	-	
	Titanium	BDL		10.0	-	
	Zinc	BDL		5.0	-	
Flocculent	Ammonium Salt	0.0004	Si-8	10.0	0.004	
Carbon Oil	Toluene	0.04	6869	188	0.02	
	Tetrachloro-ethylene	0.53		170	0.3	
	Ethyl Benzene	0.01		434	0.002	
	Xylene	0.06		434	0.01	
Mineral Oil	Toluene	0.08		188	0.04	
	Ethyl Benzene	0.01		434	0.002	
	Xylene	0.07		434	0.02	

Airborne Pollutant Name	Individual Chemicals measured	Measurement Results TWA (mg/m ³)	Sample Reference	OEL (mg/m ³)	% of OEL	AQI
Degreaser	Toluene	None detected	TF-1	188	-	
	Tetrachloro-ethylene	None detected		170	-	
	Ethyl Benzene	None detected		434	-	
	Xylene	None detected		434	-	
Gypsum	Calcium-Sulfate	BDL	GN-4	10.0	-	
	Calcium - Carbonate	BDL		10.0	-	
Welding Fumes	Aluminium	0.007	GN-5	5.0	0.1	
	Calcium	0.07	GN-5.2	5.0	1.4	
	Cadmium	0.07		0.2	35*	0.35
	Iron	0.08	GN-1	5.0	1.6	
	Potassium	BDL	GN-1/5/5.2	2.0#	-	
	Magnesium	BDL		10.0	-	
	Manganese	BDL		1.0	-	
	Sodium	0.005	GN-1	2.0	0.25	
	Palladium	BDL	GN-1/5/5.2	10.0	-	
	Silicon	BDL		5.0	-	
	Titanium	BDL		10.0	-	
	Zinc	1.03	GN-5.2	5.0	20.6	
Anti Rust	Phosphoric-Acid	0.007	Si-2	1.0	0.7	
Electroclean	Toluene	4.83	6863	188	2.6	
	Tetrachloro-ethylene	2299		170	1352*	13.52
	Ethyl Benzene	7.31		434	1.7	
	Xylene	394		434	90.8*	0.9
	Hydrocarbons(Nonane)	3090		1049	295*	2.95

Airborne Pollutant Name	Individual Chemicals measured	Measurement Results TWA (mg/m ³)	Sample Reference	OEL (mg/m ³)	% of OEL	AQI
Wood Dust	Inhalable dust	0.359	GLA-1	5.0	7.2	
Loctite	Aluminium - hydroxide	BDL	GN-2	10.0	-	
	Titanium - dioxide	BDL	GN-3	10.0	-	
	Toluene	0.07	6864	188	0.04	
	Tetrachloro-ethylene	1.62		170	0.95	
	Ethyl Benzene	0.01		434	0.002	
	Xylene	0.13		434	0.03	
Galvanized Carbon Steel	Aluminium	0.003	GN-6	5.0	0.06	
	Calcium	BDL		5.0	-	
	Cadmium	BDL		0.2	-	
	Iron	BDL		5.0	-	
	Potassium	0.34		2.0#	17*	0.17
	Magnesium	0.04		10.0	0.4	
	Manganese	BDL		1.0	-	
	Sodium	0.07		2.0	3.5	
	Palladium	0.02		10.0	0.2	
	Silicon	0.015		5.0	0.3	
	Titanium	0.005		10.0	0.05	
	Zinc	1.97		5.0	39.4*	0.39
Sulphuric Acid	Sulphuric Acid	0.011	Si-1	1.0	1.1	