Similar Exposure Groups (SEGs) and the importance of clearly defining them

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ABSTRACT

When identifying similar exposure groups (SEGs) it is important that they are validated using statistical analysis. For the data to be comparable, the SEG must also be consistent across an industry. This paper will discuss why it is important to be clear and consistent when identifying and classifying SEGs and how different organizations apply codes for this purpose. Occupational hygiene data should be collected and categorized in a form that can be statistically analysed. The data should provide information to pin-point unacceptable exposures whilst allowing trending.

Grouping the SEG in a consistent manner will enable the data to be useful for epidemiology. When establishing an Occupational Exposure database it is imperative that all SEGs be correctly defined. This paper will identify shortcomings in some coding schemes currently used.

1. INTRODUCTION

The Occupational Exposure Strategy Manual published by the US National Institute of Occupational Safety and Health (NIOSH) in 1977 provided a system for occupational hygiene sampling and statistical analysis. NIOSH still refers to this manual on the internet which can be found at the following Web address http://www.cdc.gov/niosh/docs/77-173/

This manual refers to random sampling of a “homogenous risk group of workers”. The sampling approach was designed to sample a sub-group of an adequate size where there was a high probability where at least one worker with a high exposure was identified if one existed.

The original authors of the abovementioned manual note that:

> ***In all cases one must avoid the trap of falling into a numbers game and keep in proper perspective of what the data represent in relation to what the worker is exposed to.***

It is common to encounter problems when defining SEGs for use in a monitoring program, particularly when the definition is based on historical data. Shortcomings of sampling programs may include;

- data that may have been grouped inappropriately;
- the use of samples that may be invalid or not representative of exposure, eg insufficient sample time, a focus on worst case exposure, sampling only on day shift;
- failure to identify and evaluate the effectiveness of controls;
- failure to identify a job correctly due to a person doing multiple jobs in one shift;
- failure to sample in such a way that all possible exposures are likely to be covered, eg intensive sampling over one week as opposed to random sampling over an extended period.

There are many models and papers that describe processes that can be employed to define a SEG and similarly there is much guidance material on the recording of sample data for monitoring programs.

This paper aims to provide the reader with some insight into the process and associated pitfalls, so that he or she may avoid, or at least minimize, the impact of these, but also promote the collection of sampling data in a manner that is uniform and detailed enough to enable future manipulation for re-evaluation and study.

2. WHAT ARE SIMILAR EXPOSURE GROUPS (SEG) AND WHY ARE THEY USEFUL?

A Similar Exposure Group (SEG), also know a Homogenous Exposure Group (HEG) can be defined as:

> *a group of workers having the same general exposure profile for the agent(s) being studied because of the similarity and frequency of the tasks they perform, the materials and processes with which they work and the similarity of the way they perform the tasks*. (Mulhausen et al, 1998)

The value in using a properly defined SEG lies in the ability to use data from a relatively small sample of the exposed population, to predict the likely exposures of that population as a whole. That data may also be pooled with other data sets representing the same SEG from other workplaces. This can provide industry with an estimate of the level of risk for a particular SEG across the industry.

There are significant savings in resources that can be achieved through planning a well designed risk based ongoing monitoring program. This approach requires fewer samples to be collected, and at the same time, allows the use of a range of statistical tools to evaluate our confidence in the collected data. The purpose of a monitoring program should always be to identify unacceptable exposures as soon as possible so that further controls are expedited. At some point a conscious decision must be made whether it is more appropriate to direct resources at more sampling, or, to change the focus to controlling the exposure.

3. STEPS TO DEFINE SEG

Steps that should be employed to define a SEG for a monitoring program include:

1. Observation;
2. Sampling;
3. Confirmation of SEG by statistical analysis;
4. Review and redefining of the SEG where necessary.

Defining SEGs by Observation

Defining a SEG by observation, requires that the Occupational Hygienist use their experience to interpret information about the activity performed, agents used / generated, workplace environment, controls used, and worker techniques. There are numerous strategies that can be used when defining SEG by observation and some of those identified in the literature include:

- Classification by task and environmental agent;
- Classification by task, process, and environmental agent;
- Classification by task, process, job classification (description), and environmental agent;
- Classification by work teams; and
- Classification by non-repetitive work tasks or jobs. (Mulhausen et al, 2006)

The common approach to classifying a SEG is by task, process, job classification (description) and environmental agent.

In order to get the maximum value through observation and ensure correct SEG classification the accurate recording of sample information is critical. Tasks should be listed along with the time of day and task duration. Controls should also be identified along with a description and perhaps testing to evaluate control effectiveness. For example smoke tubes and an anemometer can be used to assess ventilation.

If the method is available, real time monitoring is an invaluable diagnostic tool, to complement long term monitoring and identify the main sources of exposure.

SEGs should not only be identified by observation. There may be considerable variability in exposure due to differences in work techniques, differences in exposure concentrations during the shift, differences in exposure from shift to shift, and differences due to random variations in sampling and analysis. Statistical analysis will enable the variability of exposures to be analysed.

Defining SEG by Sampling

The sampling approach to defining a SEG relies on the review of previously collected data to classify the workforce. It is necessary that there is a sufficient number of samples collected and that there is some degree of statistical confidence in the data. In some instances a number of samples will be collected with the express purpose of using that data to define a SEG, however in many cases the data used is somewhat historical in nature.

Defining a SEG using historical sampling data is fraught with difficultly, particularly where monitoring records are poor and the information collected about the sampling environment is sparse.

Defining a SEG by Observation and Sampling

A combined observation and sampling approach is the most practical method of defining a SEG. It can make use of relatively small sets of data, supplemented with information obtained through direct observation of the process and other related factors.

Confirming a SEG by statistical analysis

Once sufficient data is collected, statistical analysis will confirm whether or not the group of workers are in fact representative of a SEG and if results from these workers can be used to assess the exposure for the whole SEG.

An approach documented by Spear 2004, utilises statistical analysis to confirm that the SEG has been correctly defined. This step is often omitted from a sampling program, sometimes to the detriment of the sampling data collected.

Spear notes that random sampling is considered more objective than worst-case and that an assessment can be carried out with a known level of confidence. Spear's process is used to validate that a SEG has in fact been accurately identified.

Spear implies that for the assessment to be scientific, defendable and non-subjective – the data must be collected following the steps in Table 1.

Table 1. Exposure profiling.

Step	
1	Identify the SEG to profile. The key point is to select the SEG so that there is minimum variation.
2	Randomly select workers and time periods within the SEG selected for the study.
3	Measure exposures.
4	Carry out descriptive statistical analysis.
5	Determine if the data fits a lognormal or normal distribution.
6	Calculate the parametric statistics.
7	Make a decision on acceptability of the exposure profile, eg by considering the geometric standard deviation (should be less than 2).
8	Redefine the SEG if necessary.

4. REALWORLD APPROACHES TO DEFINING A SEG

The South African Department of Minerals and Energy have a South African Mines Occupational Hygiene Programme (SAMOHP). This programme specifies a sequential series of steps to determine a SEG and the use of an extensive coding system to identify the mine (assigned by DME), main commodity, activity area, occupation and pollutant. There is also a requirement that each mine site reports the number of persons employed per occupation.

The Codebook for the SAMOHP can be found at:

http://www.dme.gov.za/pdfs/mhs/occupational_health/samohp_codebook.pdf

This method is briefly summarised in Table 2.

Table 2. Sequential methodology for the determination of SEG classification bands.

Step	
1	Sub-divide the mine into sampling areas.
2	Subdivide the sampling areas into **Activity Areas** using provided activity codes.
3	Ensure that adequate measurements are taken or that sufficient data already exists.
4	Compare data (measured or historical) from each **Activity Area** with occupational exposure limit (OEL) values.
5	For a single pollutant (no additive effects) a comparison is made with the OEL. Once this is done **Activity Areas** are categorized into classification bands based on extent of exposure.
6	For multiple pollutants with combined effects, assess exposure against OEL using the combined effect equation. Once this is done **Activity Areas** are categorized into classification bands based on extent of exposure.

Source: South African Mines Occupational Hygiene Programme (SAMOHP), Codebook. Directorate: Occupational Hygiene, Department of Minerals and Energy (2002).

The Western Australian Government, Department of Consumer and Employment Protection (DOCEP) have a contaminant system known as CONTAM which is applicable to exposure monitoring programs in mining. The WA Government uses this system to assess the efficiency of management programs aimed at controlling airborne dust and other airborne contaminants.

The CONTAM system also uses a coding system that incorporates occupation, contaminant, drilling method, equipment and location. The codes are applied and linked to each collected sample result in the database. The CONTAM system procedures can be accessed via the following website:

http://www.docep.wa.gov.au/resourcesSafety/PDF/Publications/index.htm

While there are obvious differences in these programs, neither model requires that the data is reviewed or evaluated to ensure that the SEG identified is correctly defined.

5. CONSISTENT SEG CLASSIFICATION AND DATA RECORDING

The application of consistent and systematic methods of SEG classification / coding and data recording has numerous advantages. Not only does it allow confident comparison between new data and other historical data collected within a workplace, it also allows that same comparison to be performed across an organisation, a region or even an entire industry, to facilitate benchmarking and identification of best practices and technologies to control exposures.

Both CONTAM and SAMOHP code the information in different ways. Table 3 compares what information is collected and coded under SAMOHP and CONTAM.

Table 3. Comparison of CONTAM and SAMOHP codes.

Element coded	SAMOHP	CONTAM
DME Mine Code The four digit code of the mine assigned by the Minerals Bureau or DOCEP.	√	√
Commodity – The main commodity being produced by the mine (ie Gold AU).	√	
Activity Code (ie conventional mining coal, stoping)	√	
Occupation code (ie. driver bulldozer)	√	√
Pollutant code / Contaminant code (ie. quartz)	√	√
Drilling method codes (ie RC drilling)		√
Sampling equipment codes (ie IOM) with acceptable flow rate (ie 2.0 L/min)		√
Location codes (ie treatment plant processing)		√

A comparison was performed of the codes used by the CONTAM and the SAMOHP models, alongside Australian and New Zealand Standard Industrial Classification (ANZSIC) and Australian and New Zealand Standard Classification of Occupations (ANZSCO), and is provided in appendix i, for Job Types specific to the Queensland Mining industry.

A review of the ANZSCO codes reveals that for a number of job types the coding assigned is too general such as: Labourers/Construction and Mining Labourers/Construction and Mining Labourers/ Mining Support Worker (8/82/8219/821914). Grouping the workers in this manner will reduce the statistical power to pin-point the more at risk SEG. In addition, for a number of Queensland mining job types the category assigned from CONTAM and SAMOHP wasn't clear.

Across an industry it is important that validated SEGs are identified with the same name (code). While appendix i highlights some limitations, by ensuring that a consistent approach to sampling and data recording is followed, the CONTAM and SAMOHP systems enable these two jurisdictions to monitor the industry's performance as a whole and in turn make informed decisions about appropriate interventions. Appendix i also compares Queensland Mining suggested job types with ANZSCO, SAMOHP and

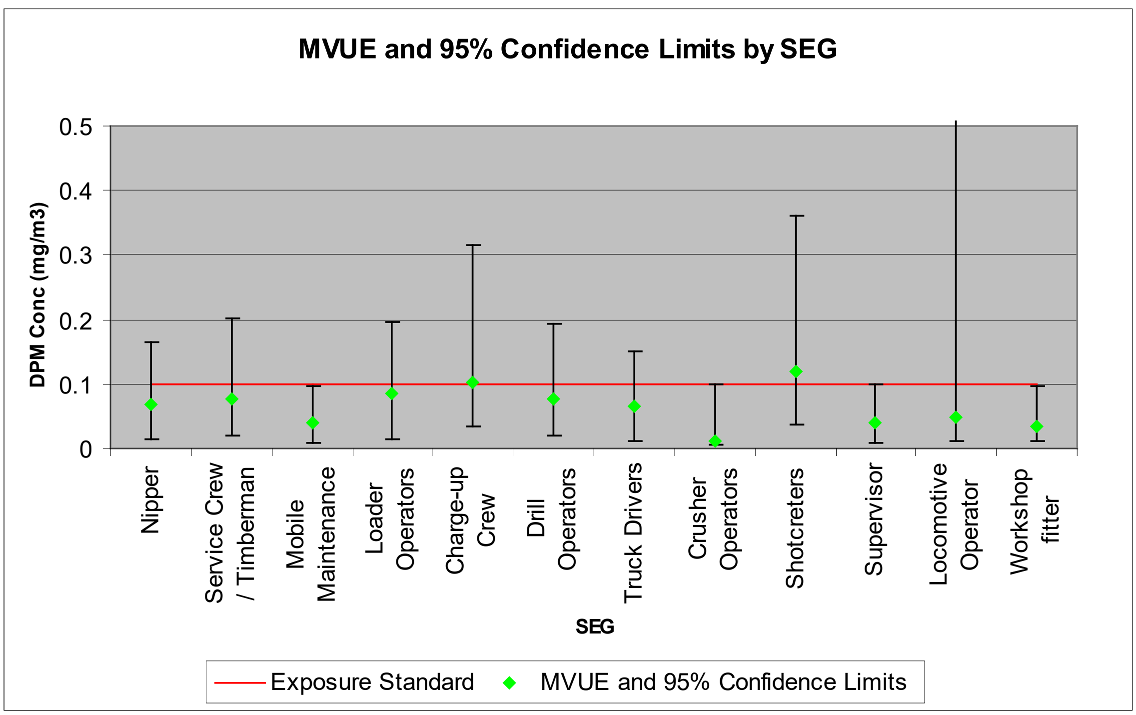
CONTAM codes. The suggested job types for Queensland Mining will undergo further review through collaboration between Government and Industry.

While in most states and territories of Australia, these types of monitoring systems are non existent, there are some industry leaders that are have initiated projects at a corporate level to synchronise SEG and the way data is collected. This will enable comparisons to be made within and between sites and will encourage consistency in the collection of information.

Further to this, and possibly more importantly, it is essential that the description of the SEG is clearly documented, and kept with the data for later reference. While the workers and activities that define your SEG may be clear to you during the monitoring program, this may well not be the case several years later when you find yourself reviewing this data.

Figure 1 below shows an example of sampling data measured across an industry using a number of common SEGs.

Figure 1. Diesel particulate (measured as EC) for SEG at selected metalliferous mines in Queensland.



6. WHAT SHOULD WE RECORD WHEN SAMPLING?

It is often the case that there is a large set of data one is trying to analyse, however due to inconsistencies in the sampling methodology or a lack of detail in the sampling information collected, many samples are rendered useless. In these instances, it is also very difficult to apply professional judgment where limited descriptive information is provided for each personal result. Assigning SEG retrospectively in these situations is usually heavily reliant on statistical analysis, however where sufficient information is collected about each sample, this can be used to assist in validating decisions made using professional judgement. To this end, the following is a list of the type of factors and variables that one should be aware of and make note of during the sampling process to facilitate future review. The more information you collect during sampling and observation, the better, as this information is critical to ongoing assessment and analysis.

Table 4 details the type of data that should be collected and provides some insight into the level of detail required.

Table 4. Information to be recorded.

Process factors related to primary contaminant	Environmental	Temporally associated	Behavioural	Incidental	Sampling
Process type and operation	Meteorological	Contaminant build up from morning to afternoon	Worker job practices, movements, habits	Spills due to falls, punctures, tears, corrosion etc.	Methods
Chemical composition	Age, size and physical layout of plant	Clearance due to air flushing and dilution during non working hours	Worker training	Equipment maintenance or lack thereof	Potential interferences
Physical state and quantity – can use COSHH descriptors	Job category e.g. responsibilities, work operations, work areas, time spent on each task in each area	Cyclical process operations	Worker attitudes	Unexpected equipment failure/ spills	Full or partial shift sampling
Rate of operation, potential exposure frequency and duration.		Work shift	Management and supervisory attitudes		Exposure criteria or OEL
Energy conditions including temperature / pressure.		Season	Presence of exposure measurement equipment, occupational hygiene personnel or supervisory personnel.		
Degree of automation.		Year / decade			
Emissions from adjacent operations.					
Airflow patterns around workers.					
Heating and ventilation airflows.					

Exposure control methods.					
Effectiveness of controls – ie capture velocities.					

7. PITFALLS WHEN DEFINING A SEG

Within some industries it can be difficult to make decisions about work groups who rotate between multiple job types (and potentially SEGs) on a random basis within single shifts.

Approaches for dealing with this include.

- Assign the worker to the dominant SEG based on time spent or intensity of exposure.
- Group the workers that are being rotated into a higher level "generic group". For example, in an underground coal mine, where workers are rotated between shearer drivers, chocks, main-gate operator these workers may be grouped into a similar exposure group defined as "Long-wall Operators".

Uniform rotations are easier to deal with. Where rotation is uniform and permanent you may be able to re-define the SEG. Some Queensland coal mines have assigned SEG based on permanent rotation within a crew (ie. Long wall permanent and Long wall rotating crew).

In some instances you may have a relatively well defined SEG supported by statistical analysis, however, in other situations there may be one worker within a SEG that may consistently receive exposures far in excess of others within the same SEG. Intervention by observing this worker's work practice and implementing specific controls may be necessary to avoid redefining the entire SEG. If it is obvious that this worker is doing something differently to other workers the data can be reassessed (censored) without the results from this worker being included. It is imperative that the reason for this exposure be identified and remedied, and that the worker's exposure is controlled through individual training or dedicated controls or, in extreme cases, removal from that activity.

Using historical data for decision making

When defining SEGs for future monitoring programs using historical data there are a number of things to consider, these are detailed in Table 5.

Table 5. Points to consider when assessing historical information

1	Primarily where the existing data is more than 12 months old, there is the potential that new technology has been introduced to the workplace or that methods of work have changed. Where this has occurred, some observation and application of professional judgement is required to establish the applicability of the data.

2	Clear documentation of the SEG description will assist in ensuring that appropriate SEG codes or categories are allocated to samples, and facilitate their comparison.
3	What was the method that was used to collect the data and what was the duration of the sampling period (ie. full / partial shift sampling).
4	Has monitoring included all exposures and tasks during a shift (ie. Clean-up at the start and finish of a shift, travel to and from the face).
5	The time period over which the data was collected. If the data was collected on day shift only or if the data was sampled in one time period that may not be representative of overall exposure.

8. SEG REVIEW

One of the most critical steps in the monitoring program process is the review process. Workplaces are ever changing places, and as these changes occur the exposures of workers may also change. Given this, it is essential that SEGs are regularly reviewed throughout the monitoring process to ensure that that are correctly defined and continue to be so.

It may be the case that as a dataset grows, it is apparent that the SEG was incorrectly defined from the outset and that some interrogation of the data is required to redefine that exposure group. SEGs are often reviewed using statistical packages; with particular reference to the Geometric Standard Deviation (GSD) as a measure of data spread, but can also involve observational techniques. In some instances the SEG may be too generic and require splitting into a number of smaller sub-groups; however it is also possible that SEGs can be combined into a larger group where exposures are very similar. In essence, identifying and redefining SEG should be an iterative process. The important thing is to monitor and identify unacceptable exposures as soon as possible and expedite control.

When assessing sampling data using statistics to identify if a SEG is correctly defined there are two important things to consider,

- Sample Size
- Geometric Standard Deviation

Sample Size

Sample size is critical for ensuring that statistical measures are accurate. Not only will an insufficient sample size limit the ability to assess if a SEG is correctly defined, but it also increases the amount of uncertainty in the analysis of our dataset. The American Industrial Hygiene Association (2006) suggests that at least six random measurements are required to minimise this, and that a reasonable approximation of an exposure distribution is possible with 10 measurements.

Having too few measurements has the potential to skew a distribution towards a particularly high or particularly low result in the data set and can also have a significant effect on the Geometric Standard Deviation.

Geometric Standard Deviation (GSD)

The GSD is a measure of the spread of data about the mean. When reviewing SEGs, a dataset with significant spread, or a high GSD, may in fact indicate that an SEG is incorrectly defined, and that some of the samples collected belong elsewhere. However, it may also be the case that the process or exposure situation is poorly controlled, highlighting the importance of not relying on the data alone, but including observation in our review.

Generally speaking, a GSD of 1.5-2.5 is considered the range from low to medium variability for occupational exposure datasets and indicates an acceptably defined SEG. A GSD below this indicates that the data is grouped more closely together. GSDs above 2.5 indicates moderate to high variability that can be a result of a poorly defined SEG, insufficient sample numbers, or as mentioned previously, a process that is not adequately controlled. A number of results may also be below the limit of detection which may result in difficulty in parametric statistical analysis.

There is a wealth of information on statistical analysis to assess occupational exposures and the American Industrial Hygiene Association (2006), *A strategy for assessing and managing occupational exposures (third edition),* provides a detailed description and software to assist with data analysis.

The American Industrial Hygiene Association provides free of charge on line software for statistical analysis at: http://www.aiha.org/1documents/committees/EASC-IHSTAT.xls

There are also commercially available software packages like LogNorm2® that can perform a range of statistical analyses.

Bayesian statistics are now being used in occupational hygiene. Bayesian analysis allows the combination of professional knowledge and statistical analysis and can be applied with very few samples. Bayesian analysis allows the hygienist to further check the spread of data and thus assist in confirming an SEG definition.

9. CONCLUSION

This paper has highlighted the importance of assigning workers into SEGs using a systematic objective approach. The SEGs must be appropriately coded and characterized so that the exposure profile can be properly assessed. It is important that statistical analysis be carried out to confirm that the exposures are representative of a SEG and allow comparison against an occupational exposure level with a known level of confidence.

If different jurisdictions and Companies use the same SEG coding across the same industry (ie coal mining, gold mining) the information from the assessment can be used for benchmarking, epidemiological studies and will also assist in setting priorities at a national level.

10. REFERENCES

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Appendix i

Comparison of specific descriptors for activity/ location and occupation codes

Queensland Mining suggested Job Types	South African Mines Occupational Hygiene Programme (SAMOHP) Jan 2002	DOCEP March 08	ANZSIC Industry classifications	ANZSCO Occupation classifications
Open cut coal (Common terms used for job types in Queensland)	07 (activity code)	200 – 900 (location codes)	Division B Mining Sub division 11 Coal Mining 1101 Black Coal Mining	
Drag line operator	21102 drag line operator	343000 Dragline operator		7- 72 -721-7219 -721999
Rear dump operator	#	359000 Mobile plant operator		7- 72 -721-7219 -721999
Stockpile dozer	#	270 – 351000 Stockpile dozer		7- 72 -721-7212 -721213
Pre strip dozer	#	351000 dozer		7- 72 -721- 7212 -721213
Service truck	#	369000 Driver NOC		7- 72 -721- 7219 -721999
Belt service men	30205 Beltsman	821000 Belt repairer		8 - 82-821 - 8219-821914
Shovel operator	21105 Shovel Operator	359000 Mobile plant op		7 - 72 -721 - 7219 -721999
Grader operator	#	352000 Grader driver		7 - 72 – 721 -7212 - 721215
Water truck operator	#	362000 Water truck driver		7 -7 2 - 721 - 7219 - 721999
Excavator operator	#	349000 Excavation equip op		7 -7 2 - 721 - 7212 - 721214
Field maintenance	#	#		8 - 82-821 - 8219-821914
Coal haulage drivers	21109 Driver:haul truck	361000 Haulage truck driver		7 -7 2 - 721 - 7219 - 721999
Blast drilling crews	20599 Blasting worker	311000 Blast hole drill operator		7- 72 -721-7212 - ?
Overburden drilling crews	20404 Driller: open cast / large diameter	#		7- 72 -721-7212 - 712211
Shot firers	40526 Shot blast operator	#		7- 72 -721-7212 - 712213
Blast crews	20599 Blasting worker	#		7- 72 -721-7212 - ?
Exploration drillers	20499 Drilling worker	331000 Exploration driller		7- 72 -721-7212 - 712211
Open cut examiner	#	#		8 - 82-821 - 8219-?

Notes:

ANZCO:Australian and New Zealand Standard Classification of Occupations, First Edition.
(X-Major Group)-(XX- Sub-Major Group) - (XXX - Minor Group) - (XXXX -Unit Group) – (XXXXXX – Occupation)

Difficult to match code to Queensland Mining SEG

Shading indicates the same ANZCO classification – note that some classifications encompass what would be considered very different mining job types / operator groups

Queensland Mining suggested Job Types **(Common terms used for job types in Queensland)**	South African Mines Occupational Hygiene Programme (SAMOHP) Jan 2002	DOCEP March 08	ANZSIC	ANZSCO
Underground Coal	01, 02, 03 (activity code)	120 (location code)	Division B Mining Sub division 11 Coal Mining 1101 Black Coal Mining	
Chock / Shield operators	#	212000 Coal Miner UG		7 -7 2 - 721 - 7219 - 721999
Shearer operators	20603 Long wall sheerer operator	212000 Coal Miner UG		7 -7 2 - 721 - 7219 - 721999
Main gate operator	#	212000 Coal Miner UG		7 -7 2 - 721 - 7219 - 721999
Long wall Fitter	40436 Fitter: worker	#		3 - 31 - 323 - 3232 - 323211
Long wall Electrician	40314 Electrician	#		3 - 34 - 341 - 3411 - 34111
Long wall Deputy (ERZ Controller)	20399 Mine production supervisor	161000 Deputy coal		8 - 82-821 - 8219-821914
Continuous Miner Operator	29999 Mine production worker	212000 Coal miner		8 - 82-821 - 8219-821914
Development Deputy (ERZ Controller)	#	161000 Deputy		8 - 82-821 - 8219-821914
Roof Bolter	20807 Roof bolt worker	252000 Roofbolter		8 - 82-821 - 8219-821914
Cable hand	#	269000 UG Services		8 - 82-821 - 8219-821914
Shuttle car / Ram car driver	21108 Shuttle car driver	#		8 - 82-821 - 8219-821914
Outbye deputies (ERZ Controller)	20399 Mine production supervisor	161000 Deputy (coal)		8 - 82-821 - 8219-821914
Outbye Fitters / Electricians	40436, 40314 see above	#		8 - 82-821 - 8219-821914
Secondary Support	#	#		8 - 82-821 - 8219-821914
Ventilation Device Installers	#	261000 Vent occupations		8 - 82-821 - 8219-821914
Outbye Services including road maintenance	#	269000 Service occupation		8 - 82-821 - 8219-821914
Stone dust applicators	#	269000 Service occupation		8 - 82-821 - 8219-821914
Stone dust samplers	50203 Sampler	269000 Service occupation		8 - 82-821 - 8219-821914
Surface Personnel (Coal)				
CHPP operator maintainers	07 (activity code)			8 - 82-821 - 8219-821914
Workshop personnel	#	631000 Fitter		3 - 31 - 323 - 3232 - 323211
Train load out	#	#		8 - 82-821 - 8219-821914
Coal laboratory technicians	50405 Laboratory technician	441000 Lab tech		8 - 82-821 - 8219-821914
Stockpile dozer	#	351000 Bulldozer		7- 72 -721-7212 -721213
Warehouse attendants	10399 Stores worker	930000 Storemen		8 - 82-821 - 8219-821914

Queensland Mining suggested Job Types **(Common terms used for job types in Queensland)**	South African Mines Occupational Hygiene Programme (SAMOHP) Jan 2002	DOCEP March 08	ANZSIC	ANZSCO
Surface Metalliferous Mines	07 (activity code)	200 – 900 (location codes)	Division B Mining Sub division 13 Metal Ore Mining 1311 - 1319	
Supervisor	20399 Mine production supervisor	165000 Supervisor		8 - 82-821 - 8219-821914
Light vehicle driver	21499 Mine transport worker	369000 Driver NOC		7- 72 -721- 7219 -721999
Crusher operator	30207 Crusher attendant	#		8 - 82-821 - 8219-821914
Grinding operator	30210 Grinderman / pulveriser	#		8 - 82-821 - 8219-821914
Paste plant operator	#	#		8 - 82-821 - 8219-821914
Charge-up crew	20501 Blaster underground metal	320000 Charging and blasting		7- 72 -721-7212 - ?
Tippler operator	#	#		8 - 82-821 - 8219-821914
Screening plant operator	30209 Screensman	411000 Processing plant operator		8 - 82-821 - 8219-821914
Flotation operator	#	411000 Processing plant operator		8 - 82-821 - 8219-821914
Process plant operator	#	411000 Processing plant operator		8 - 82-821 - 8219-821914
Filtration plant operator	30302 Filter operator / worker	411000 Processing plant operator		8 - 82-821 - 8219-821914
Gold room operator	#	#		8 - 82-821 - 8219-821914
Loader operator	#	348000 Front end loader operator		7 - 72 - 721 -7212 - 721216
Grader operator	#	352000 Grader driver		7 - 72 - 721 -7212 - 721215
Excavator operator	#	349000 Excavation equipment operator		7 - 72 - 721 -7212 - 721214
Haul truck operator	21109 Driver haul truck	361000 Haulage truck driver		7- 72 -721- 7219 -721999
Water truck operator	#	362000 Water truck driver		7- 72 -721- 7219 -721999
RC drill rig operator	20499 Drilling worker	331000 Driller		7- 71 -712- 7122 -712211
Diamond drill operator	50110 Diamond driller	331000 Driller		7- 71 -712- 7122 -712211

Queensland Mining suggested Job Types **(Common terms used for job types in Queensland)**	South African Mines Occupational Hygiene Programme (SAMOHP) Jan 2002	DOCEP March 08	ANZSIC	ANZSCO
Underground Metalliferous Mines	08, 09, 10, 11, 12, 14, (activity codes)	100 (location code)	Division B Mining Sub division 13 Metal Ore Mining 1311 - 1319	
Jumbo driller	20401 Drill rig operator (jumbo)	#		7- 71 -712- 7122 -712211
Diamond driller	50110 Diamond driller	231000 Diamond drill operator		7- 71 -712- 7122 -712211
Air-leg driller	20499 Drilling worker	#		7- 71 -712- 7122 -712211
Shot-creter	20804 Shotcrete worker	#		8 - 82-821 - 8219-821914
Nipper	80907 light motor vehicle / car	247000 Underground personnel transport driver		7- 72 -721- 7219 -721999
Service crew production	89999 service worker	269000 Underground services occupations		8 - 82-821 - 8219-821914
Service crew development	89999 service worker	269000 Underground services occupations		8 - 82-821 - 8219-821914
Loader operator	#	242000 Mechanical bogger driver		7 - 72 - 721 -7212 - 721216
Haul truck operator	21109 Driver: haul truck	245000 Truck driver		7- 72 -721- 7219 -721999
Grader operator	#	269000 Underground services occupations		7 - 72 - 721 -7212 - 721215
Crusher operator	30207 Crusher attendant	#		8 - 82-821 - 8219-821914
Surface Personnel (Metalliferous Mines)	07 (activity code)			
Electrician	40314 Electrician	719000 Electrician NOC		3 - 34 - 341 - 3411 - 34111
Fitter	40428 Fitter and turner	631000 Fitter		3 - 31 - 323 - 3232 - 323211
Diesel Fitter	40477 Diesel mechanic	831000 Motor mechanic		3 - 31 - 323 - 3232 - 323211
Sampler	50203 Sampler	443000 Sampler		8 - 82-821 - 8219-821914
Sample Preparation	50204 Sample worker	442000 Sample preparation operator		8 - 82-821 - 8219-821914
Chemist / Technician / Metallurgist	50405 Laboratory Technician	441000 Lab technician		8 - 82-821 - 8219-821914
Rail Loading Crew	81099 Rail transport worker	Railway operator NOC		8 - 82-821 - 8219-821914
Ship Loader	#	#		8 - 82-821 - 8219-821914