

Mine Health and Safety Council



MHSC

CENTRE OF EXCELLENCE PROJECTS

***COE 180605: DEVELOP A STANDARD OPERATING
PROCEDURE (SOP) THAT WILL ASSIST IN DEVELOPING AND
IMPLEMENTING A STANDARDISED MONITORING STRATEGY
FOR RESPIRABLE CRYSTALLINE SILICA (RCS) IN THE SOUTH
AFRICAN MINING INDUSTRY (SAMI)***

Assessment tool to assess mines

No.	ITEM ASSESSED	SOURCE
MANDATORY CODES OF PRACTICES		
1	In compliance with the Airborne Pollutants Guideline (DMR 16/3/2/4-A1), is the Mandatory Code of Practice (MCOP) available?	APG
2	In compliance with the Quality Assurance Guideline (DMPR 16/3/2/4-B8), is there an MCOP available?	QAG
3	Is there a standard operating procedure for RCS available for the assessment?	QAG
ORGANISATIONAL FACTORS		
4	Does the mine have an organisational diagram to show the inter-relationships of stakeholders involved in the personal exposure monitoring of RCS?	17020 & 17025
5	If yes to Q4, does the organogram show the roles, responsibilities and reporting lines of each stakeholder?	17020 & 17025
6	Is the top management of the mine committed to impartiality? If yes, are there statements, policies, procedures and evidence available to corroborate this?	17020 & 17025
7	Are documented statements available on how to manage conflicts of interest and to ensure the objectivity of exposure monitoring activities available for the assessment? Please note: Actions emanating from the top management shall not contradict this statement.	17020 & 17025
8	Is personal exposure monitoring undertaken impartially without influence and undue pressure from any internal and external parties?	17020 & 17025
9	If a risk to impartiality is identified, how is it mitigated or eliminated on an on-going basis?	17020 & 17025
10	Which savings in terms of time, money and effort would be valued the most?	VPC
11	Rank the following risks associated with RCS exposure in order of priority: financial, social, technical	VPC
SOP IMPLEMENTATION		
12	In general, what are the challenges associated with the implementation of any SOP?	VPC
13	What factors will enable the successful adoption of an SOP for RCS sampling strategies?	VPC
14	What criteria are used to measure the successful implementation of an SOP?	VPC
15	Which stakeholders need to be consulted for input into the SOP adoption plan?	VPC
16	How will current SAMI service providers transition to an SOP for RCS?	VPC
RISK ASSESSMENT		
17	Has the employer conducted a baseline risk assessment to assess exposure to RCS?	DMRE
18	If yes to Q17, which aspects were considered in the risk assessment that relates to RCS personal exposure monitoring?	DMRE
19	Does the risk assessment identify RCS in terms of likelihood, impact, and risk matrix?	APG

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20	If potential risks to the impartiality of personal exposure monitoring identified during the baseline risk assessment were identified, are these risks reviewed and monitored continuously? Does it include those risks that arise from the mine's activities, its relationships, and/or the relationships of its personnel? NOTE: A relationship that compromises the impartiality of the exposure monitoring team can be based on ownership, governance, management, personnel, shared resources, finances, contracts, marketing (including branding), and payment of a sales commission or other inducement, etc.	17020 & 17025
21	Have the risks associated with the competency of personnel been identified, if any?	17020 & 17025
22	Have the risks associated with the capacity and capability in relation to personal exposure monitoring been identified?	17020 & 17025
23	Does the MCOP set out measures to ensure that both qualitative and quantitative risk assessment processes are followed, considering all the factors influencing the health of employees?	DMRE
24	Does the risk assessment sufficiently describe the aspects below:	DMRE
25	- The route of entry of RCS (e.g. inhalation)?	DMRE
26	- The health effects that RCS can have on employees?	DMRE
27	- Where in the mining environment RCS may be present?	DMRE
28	- The nature of the key workplace operations and activities that pose the greatest potential risk of exposure to RCS?	DMRE
29	- The occupations and number of employees who are exposed to RCS?	DMRE
30	- The pattern (e.g. intermittent or continuous), duration and frequency of employee exposure to RCS?	DMRE
31	- The exposure concentrations measured vs. the RCS OEL and Industry Milestones?	DMRE
32	- Control measures in place?	DMRE
33	- The additional control measures required to reduce or maintain exposures to below the OEL?	DMRE
34	- Where applicable, the planned programme of implementation of control measures?	DMRE
35	Is there an ongoing monitoring programme to assess the effectiveness of controls?	IBP
36	If yes, what is the frequency of monitoring to assess the effectiveness of the controls mentioned above?	DMRE
37	Does the MCOP address the annual review of the risk assessment (continuous risk assessment and management) based on the personal exposure monitoring data from the previous monitoring cycle?	DMRE
38	What was the reason for the last review of the risk assessment review?	DMRE
39	Are historical RCS exposure data stored as indicated in Section 12(3) of the MHSA?	DMRE
QUALITY ASSURANCE		
40	Is there an MCOP in place for quality assurance?	QAG
41	When was the MCOP last revised (date)?	QAG
42	Does the MCOP require measures to be put in place to ensure that a quality control programme for the selected sampling methodology is developed and implemented?	QAG

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43	Is there a Chain of Custody whereby the name of each person who takes ownership of the sample throughout the sample value chain is recorded (i.e. a series of consecutive steps to produce an RCS sample)?	17020 & 17025
44	If yes, does the Chain of Custody cover the entire sample value chain?	17020 & 17025
DETERMINATION OF HEGs		
45	Are HEGs identified according to the Airborne Pollutant Guideline process (8.3.2.1), e.g. sampling areas > ventilation districts > activity areas > area code list?	DMRE
46	If not, describe the process used to identify HEGs	IBP
47	Are methodologies used for personal monitoring as stipulated by NIOSH?	DMRE
48	If not, which methodologies are used?	IBP
49	Are the current or historic results of the RCS sampling compared to the OEL in Schedule 22.9(2)(a), Chapter 22 of the MHSA and regulations?	DMRE
50	Are previously collected/recorded data analysed to assess exposure trends over time? (Only the most recent exposure data should be used in the initial assessment where exposure trends exist)	DMRE
51	Does the statistical analysis conclude that the HEGs are correctly allocated?	DMRE
52	Are the RCS personal exposures within each activity area compared to the OEL?	DMRE
53	Is the activity area allocated into classification bands determined by the various HEGs within that activity area?	DMRE
54	Are RCS concentration data for each HEG statistically analysed and is each HEG re-classified (if required) at the end of each sampling cycle?	DMRE
55	Is the total number of exposed employees known and recorded at the beginning of the annual reporting cycle?	DMRE
56	Where there is an increase in the total number of employees during the quarterly reporting cycle, is this been accounted for in determining the HEGs?	DMRE
57	If there was a reduction in the total number of employees, has the mine maintained the total number of planned samples as determined at the beginning of the annual reporting cycle?	DMRE
58	What was the reason for the last HEG re-assessment?	DMRE
SAMPLING SCHEDULE		
59	Does the MCOP include a strategy to ensure that continuous sampling is conducted to assess whether significant changes in RCS concentrations have occurred?	DMRE
60	If yes, are the results from the continuous sampling added to accumulated data for statistical analysis and re-classification of HEGs (for the current sampling cycle)?	DMRE
61	Are the samples that are taken evenly spread over the full sampling cycle period for all HEG categories?	DMRE
62	Is a minimum of 5% of employees within a HEG, with a minimum of 5 samples (whichever is greater) taken per category for RCS sampling?	DMRE
63	What is the frequency of RCS sampling?	APG
64	Does the MCOP address an appropriate sampling methodology for RCS?	DMRE
65	Does the MCOP set out measures to ensure that personal exposure monitoring is conducted to obtain reliable estimates of employee shift exposures in a workplace?	DMRE

No.	ITEM ASSESSED	SOURCE
66	Is the personal exposure monitoring sample representative of employee exposure?	DMRE
67	Is sampling done over a full working shift?	DMRE
68	Are all shifts covered by the sampling schedule?	DMRE
69	Are all occupations covered by the sampling schedule?	DMRE
PERSONNEL & TRAINING		
70	What are the criteria used to determine that there is an adequate number of competent personnel to conduct personal exposure monitoring for the mine?	QAG & 17020
71	Is the department responsible for personal exposure monitoring capable and competent to perform its duties?	QAG & 17020
72	Does the mine have a sufficient number of competent employees to conduct objective and impartial exposure monitoring?	QAG & 17020
73	Does the employer provide training and have an awareness programme on RCS for employees?	DMRE
74	Which personal exposure monitoring activities require supervision?	QAG & 17020
75	What are the competency criteria for each occupation involved in personal exposure monitoring? Criteria should include education, training, technical knowledge, skills, experience, knowledge of and the ability to implement the relevant policies and procedures.	QAG & 17020
76	What are the competency criteria for the weighing analyst	17020 & 17025
77	What are the competency criteria for the Section 12.1 appointee	17020 & 17025
78	What are the competency criteria for the sampling pump issuer	17020 & 17025
79	What are the competency criteria for the occupational hygiene assistant	17020 & 17025
80	What are the competency criteria for the personnel that will provide training to the abovementioned occupations?	17020 & 17025
81	Does the employer have a sufficient number of competent personnel to deliver the required training?	DMRE
82	Is there a training programme for each occupation involved in the personal exposure monitoring programme?	17020 & 17025
83	What are the criteria for re-assessment of employees involved in personal exposure monitoring?	17020 & 17025
84	What does the training involve? Minimum requirements: sampling techniques, field or transport quality assurance of sampling, analytical methods, specificity, accuracy, precision monitoring, detection limits, potential interferences, uncertainty of measurement and regulatory limits.	QAG & 17020
85	Is there a training programme for employees handling sampling equipment?	DMRE
86	If yes, does the training cover storage and maintenance?	DMRE
87	- Issuing of the sampling equipment?	DMRE
88	- Wearer of the sampling equipment?	DMRE
89	- Handling of the sampling equipment?	DMRE
90	- Transportation of the equipment?	DMRE
91	- Pre and post calibration of the sampling train?	DMRE

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92	Are employees provided with awareness training and are they periodically retrained to ensure that they are capable of competently performing their duties safely? If yes, how often?	DMRE
93	What are the criteria for refresher training?	QAG & 17020
94	Is there a system to assess the effectiveness of the awareness programme?	DMRE
95	Do employees receive training for each task assigned to them?	DMRE
96	What does the training for employees exposed to RCS include? The nature, causes and recognition of possible dust sources, consequences of airborne dust exposure, and the correct use of respirators?	DMRE
97	Is training conducted in languages that employees understand?	DMRE
98	Does the training material make use of illustrations and/or pictures to make training themes more understandable?	DMRE
99	Does training include the importance of assessing worker exposure to RCS to protect the health of the worker?	DMRE
100	Are workers trained on the necessary procedures when required to wear dust sampling equipment?	DMRE
GRAVIMETRIC WEIGHING		
101	Is gravimetric weighing and cassette preparation done in-house?	DMRE
102	If these are done by an external provider, is the provider SANAS-accredited for this service?	17020 & 17025
103	What are the criteria used by the mine to select the external service provider?	17020 & 17025
104	Does the gravimetric weighing facility have the capacity and capability to provide the service?	17020 & 17025
105	Is the in-house weighing room (if this is what is used) compliant with the Quality Assurance Guideline requirements?	QAG
106	Is the weighing procedure documented in detail?	IBP
107	Is there evidence of compliance with the procedure?	IBP
108	Is there a record of the names of the analyst(s) that carried out the procedure(s)?	IBP
109	Was the analyst deemed competent based on the documented competency criteria?	IBP
110	Are the measurements captured accurately?	IBP
111	What measures are in place to prevent alteration of data?	IBP
112	Are electronic calculations verified?	IBP
113	Is there signage to prevent unauthorised access to the weighing room when weighing is in progress?	QAG
114	Is the weighing room in a location where it is free from contamination from other samples, and dust sources?	QAG
115	Does the room have a stable atmosphere, i.e. sealed, no open windows and no air movement?	QAG
116	Please specify the temperature and humidity range over the weighing period. Are measures in place to maintain conditions within this range?	QAG

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117	Are there measures in place to minimize the generation and discharge of static electricity?	QAG
118	Does the micro-balance stand on a stable surface to enable levelling?	QAG
119	Is the micro-balance calibrated? If so, provide reference to calibration facility and certificate.	IBP
120	Are sampling filters acclimatised in this room prior to weighing?	QAG
121	Does the weighing procedure include correction for moisture absorption or loss?	QAG
122	Is the weighing room dedicated to weighing?	QAG
123	Are the mass pieces calibrated? If yes, provide details of the calibration service provider and provide the calibration certificate.	IBP
124	Has the temperature and humidity measurement instrument(s) been calibrated? If so, provide reference of the calibration service and provide the calibration certificate.	IBP
SAMPLING PUMPS		
125	Does the sampling pump comply with the requirements of ISO 13137?	13137
126	Does the sampling pump run for ± 15 minutes for stabilisation before calibration?	13137
127	Is a minimum of three readings taken and recorded to accurately set the flow rate?	IBP
128	Is the flowmeter calibrated annually, and does it have an uncertainty of not more than $\pm 2\%$?	13137
129	Are sampling pumps calibrated before and after sampling, with a maximum variance of only 5%?	13137
130	Is each cassette matched with a dedicated pump during pre-calibration and post-verification?	IBP
131	Are pumps intrinsically safe for explosive atmospheres?	13137
132	Is the sampling train free from leakages?	IBP
CYCLONES		
133	Does the cyclone comply with ISO 7708, and will it collect the respirable fraction of the dust?	7708 & 24095
134	Are cyclones inspected prior to use to assess if they are in a good condition?	IBP
135	Are cyclones cleaned in an ultrasonic bath after use?	IBP
136	Are grit pots tight-fitting, with no cracks or cuts?	IBP
137	Are rubber "o" rings without cracks?	IBP
138	Do cyclones provide a secure fit to the cassette?	IBP
SAMPLING TRAIN ISSUING		
139	Does the sampling train consist of a pump, flexible tubing, cyclone, filter support pad, and filter holder, with suitable caps?	IBP
140	Is the sampling train issuer deemed competent to attach the sampling train to the employee?	IBP
141	Are cassettes inspected for cracks or damage?	IBP
142	Are all components of the sampling train in a good condition?	IBP
143	Are internal and external leakages prevented when cyclones are fitted cassettes?	IBP
144	Are the cassettes sealed prior to sampling?	IBP
145	Does the pre-sampling inspection include confirmation that the grit-pot is attached?	IBP

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SAMPLING PROCEDURE		
146	Are quality control inspections done during in-shift sampling?	IBP
147	If yes, who does this?	IBP
148	Which aspects of the sampling procedure are inspected during the in-shift sampling?	IBP
149	During sampling, is it ensured that the cyclone is kept in a position where the grit pot-end is facing the floor?	IBP
150	During the post sampling inspection, is it confirmed that the pump ran at the calibrated flowrate for the entire shift?	13137
151	Is the sampling train inspected to ensure that it is intact during the in-shift sampling?	IBP
152	Is the flowrate verified immediately at the end of the sampling period?	13137
153	Is the difference between the pre- and post-flow rates within the allowable range of 5%?	13137
154	Is the flowrate verified with the sampled filter attached?	IBP
155	Are cassettes transported to the gravimetric weighing lab with the cyclone attached and upright?	IBP
156	Is the sampling train inspected to ensure that it is intact at the end of the shift sampling?	IBP
TRANSPORTATION OF SAMPLES		
157	During transportation, is the cyclone kept in a position where the grit pot-end is closest to the ground to prevent big particles from falling onto the filter?	IBP
158	Are samples transported in containers to minimise possible particulate loss?	IBP
159	Is the transport case constructed to prevent inadvertent opening and ensure stability during handling or transport?	IBP
160	Are samples transported in a manner to preserve the integrity of the samples?	IBP
161	Have the relevant personnel been trained on the transportation method?	IBP
RCS ANALYSIS LABORATORY		
162	What criteria are used to select a service provider for RCS analysis?	17020 & 17025
163	Is the analytical laboratory SANAS accredited for RCS analysis?	APG
164	Were acceptable scores obtained in the Proficiency Testing Scheme?	APG
165	Is an appropriate chemical analysis methodology, which complies with internationally accepted good practice, selected and implemented for RCS?	DMRE
166	Are the RCS samples individually analysed by the laboratory?	DMRE
167	Verify the last Vertical Audit (SANAS F44 form) done according to SANS 17025 requirements.	17020 & 17025
REPORTING AND RECORDING		
168	Is there a system that records the mine's exposure history of each HEG and are the records readily available?	DMRE
169	Are the RCS exposure records secure, and access controlled?	17020 & 17025
170	If yes, are measures in place to prevent alteration of data?	17020 & 17025
171	Do the records include reasons for deviations on sample results?	DMRE
172	Are there records for when the controls are not operating effectively?	DMRE

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173	Are events or factors that might have influenced the measurements during sampling recorded? (e.g. high rainfall or excessive winds)	DMRE
174	What are the exclusion criteria for RCS personal exposure samples, e.g. why the sample is discarded, or a result is not reported?	17020 & 17025
175	Are mandatory personal exposure reports on results of samples analysed submitted to the Regional Principal Inspector of Mines on a quarterly basis for all HEG categories (A, B & C)?	DMRE
176	Is there a portfolio of evidence for HEG D category where these pollutants are monitored periodically to confirm that exposures remain in the D Category?	DMRE
177	Is the annual HEG reclassification band based on the 90th percentile of the previous annual results?	DMRE
178	Is the quarterly HEG classification based on 90th percentile measurement results?	DMRE
179	Is the HEG classification for additive compounds based on the 90th percentile of each pollutant and the AQI, whichever is the greatest of the two?	DMRE
180	Is RCS reported on a single pollutant reporting form when it does not have an additive effect with other pollutants?	DMRE
INSPECTORATE		
181	What are the roles, responsibilities and line authorities of the regional inspectorate?	17020 & 17025
182	What are the powers and mandates of the Principal Inspectorate?	17020 & 17025
183	Are the DMRE and MHSI committed to impartiality? Are there statements, policies, procedures and evidence available?	17020 & 17025
184	Are statements documented on how to manage conflicts of interest and ensure the objectivity of exposure monitoring activities. Actions emanating from the DMRE and MHSI shall not contradict this statement.	17020 & 17025
185	If yes, are these documented statements available for the assessment? Actions emanating from the top management shall not contradict this statement.	17020 & 17025
186	If a risk to impartiality is identified, how is it mitigated or eliminated?	17020 & 17025
187	What are competency criteria for inspectors?	17020 & 17025
188	What is included in the training programme for inspectors?	17020 & 17025
189	What are the criteria for refresher training?	17020 & 17025
190	Describe the recent assessments that were done in relation to RCS (excluding the DMRE audit tool)	17020 & 17025
191	Is there evidence that the RCS assessments were reviewed and sign-off by the Principal Inspector?	17020 & 17025
192	What is the frequency of assessments?	17020 & 17025
193	What is the nature of the audit findings/non-conformances?	17020 & 17025