CLIENT **: GUYANA ENVIRONMENTAL CAPACITY DEVELOPMENT PROJECT (GENCAPD)**

PROJECT**: REFERENCE GUIDE FOR IMPLEMENTATION OF THE ENVIRONMENTAL CODES OF PRACTICE BY GGMC MINES INSPECTORS**

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DISCLAIMER

The primary purpose of this publication is to provide references for implementing the environmental codes of practice in Guyana's artisanal, small and medium-scale mining industry. It expresses the professional opinion of SNC-LAVALIN INC. (SLI) regarding the matters set out herein, based on SLI's professional judgment and reasonable due diligence. It is to be read in the context of the agreement of August 4, 2003 (the Agreement) between SLI and Natural Resources Canada (the Client), and in accordance with the methodology, procedures and techniques that SLI used, the assumptions SLI made, and the circumstances and constraints under which SLI carried out its mandate. This document is meant to be read as a whole, and sections or parts thereof should therefore not be read or relied upon out of context.

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1. INTRODUCTION

In compliance with Article 224 and 250 of the proposed amendments to the Guyana Mining Regulations, which focus strongly on the environment, the Guyana Geology and Mines Commission (GGMC) recently prepared six (6) Codes of Best Practice for Environmental Mining. These Codes address the following issues:

- Use of mercury;
- Tailings management;
- Contingency and response plans;
- Mine effluents;
- Mine reclamation and closure plans;
- Mine waste management and disposal;

Moreover, the Codes on mercury and effluents shall form part of the Regulations.

In order for these Codes to be fully implemented by artisanal, small and medium-scale mine operators, GGMC's mine inspectors require a quick and simple reference guide that help them in enforcing the Codes' requirements. This reference guide has been designed by SNC-LAVALIN INC. with the financial support of the GENCAPD mining project

The guide is meant for the following users: 1- GGMC's mine inspectors and 2-Artisanal, small and medium-scale mine operators. It has been kept as simple, straightforward and user-friendly as possible so as to be comprehensible by all potential users.

2. HOW DOES THIS GUIDE WORK?

This reference guide is built of a number of control charts. There is one such chart for each one of the six (6) issues addressed by the Codes of Practice. The chart is intended to be used for two different purposes:

1) A compliance and control form.
2) A site assessment report.

As a compliance and control form, the chart will be filled out by GGMC's mine inspectors during a mine site tour aimed at auditing compliance with the Codes' requirements. For each mine site visited, the same form, completed and signed by the inspector, will be handed in to the mine operators as an assessment report. As the form contains observations and recommendations, mine operators will have an immediate feedback on their degree of compliance and will be provided with recommendations on improvements. This form may also be kept in files at GGMC as a mine site report and for further monitoring or follow up.

A suggested codification is provided to define the type of hazard involved (health and/or environmental hazard) and to set priorities of action.

3. USE OF MERCURY

The Mercury management control chart is provided in Table 3-1 along with an example of how the Code of Practice on the use of mercury can be enforced through the GGMC mining inspectorate. The chart is a compliance and control form as well as a site assessment report. Only those topics that must be implemented by the mine operators (five (5) out of the 6 topics addressed in the Code of Practice) are dealt with in the chart:

- Storage, handling and transport of mercury;
- Amalgamation of gold particles;
- Disposal of amalgamation tailings;
- Disposal of amalgam to recover gold;
- Burning of residual mercury to purify gold.

Occupational Health and Safety management and Environmental monitoring, the last topic addressed in the Code, is GGMC's responsibility to implement and is therefore not included in the chart.

Table 3-1
Mercury management control chart (based on the Code of Practice)

Topic/Sub-topic	Yes	No	Nature of non-compliance	Severity of consequences		
				Hazard	Priority	Observations and/or recommendations
1- Storage, handling and transport of mercury						
• Use of safety gears (respirator, gloves, etc.)?		√	Gloves but no respirator	H	1	Warning given to worker and management
• Proper storage of mercury?		√	Insufficient ventilation	H, E	1	Open windows at both ends of storage area
• Existence of emergency measures?		√	No response plan for spills	E	2	Provide support and follow up
2- Amalgamation of gold particles						
• Amalgamation in closed system?		√	Amalgamation in sluice box	H, E	1	Warning given to mine management
• Information material on proper amalgamation available?	√					
• Use of safety gears (respirator, gloves, etc.)?	√					
3- Disposal of amalgamation tailings						
• Safe disposal and containment of amalgamation tailings?		√	Tailings dumped in pools	E	2	Build containment facility
4- Burning of amalgam to recover						
• Closed-circuit burning of amalgam?		√	Open-air burning of amalgam	H, E	1	
• Use of retort?		√		H, E	1	Obligation to purchase retort *asap*
• Use of GGMC-certified retort?		√			2	Have retort certified by GGMC
• Use of safety gears (respirator, gloves, etc.)?	√					
5- Burning of residual mercury to purify gold						
• Mercury vapor abatement measures in use?	√		Fume hood but no filter	H, E	2	Obligation to install filter
• Local population exposed to mercury fumes?		√	Population living too close	H	3	
6- OH&S management and Environmental monitoring and environmental monitoring						
This section does not apply to GGMC inspectors						

N.B.: Except for the topic/sub-topic column, all information in the table is provided **as an example only**.

Legend:

Hazard	**Priority**
H = Health hazard	**1-** Practice to cease immediately (human health hazard).
E = Environmental hazard	**2-** Practice to cease in the short-term (< 1year).
	3- Practice that poses no immediate threat to human health or the environment but that must be improved.

4. TAILINGS MANAGEMENT

The Tailings management control chart is provided in Table 4-1 along with an example of how the Code of Practice on tailings management can be enforced through the GGMC mining inspectorate. The chart is a compliance and control form as well as a site assessment report.

The five topics found in the Code of Practice are included in the chart, namely:

- Overburden stripping;
- Tailings dam site selection and design;
- Tailings dam construction;
- Tailings dam operation;
- Decommissioning and closure of a tailings facility.

Table 4-1
Tailings management control chart (based on the Code of Practice)

Topic/Sub-topic	Yes	No	Nature of non-compliance	Severity of consequences		
				Hazard	Priority	Observations and/or recommendations
1- Overburden stripping						
• Hydraulic removal of overburden?	√		No overburden stripping	E	2	Remove topsoil prior to hydraulicking
2- Tailings dam site selection and design						
• Site selection and design criteria for tailings facility?	√					
• Risk assessment of design option?		√	No risk analysis	E, H	2	
• Appropriate site for tailings facility?		√	Too close to river shore	E	2	Apply mitigation measures
• Approvals obtained for selected site?		√			2	Seek approvals
• Design done by qualified or experienced person?	√					
• Design done in accordance with sound engineering practices?	√					
3- Tailings dam construction						
• Are there criteria and procedures for tailings facility construction?		√				
• Are there construction plans? (M)	√					
• Construction approvals and permits obtained ? (M)		√			1	Obtain construction permits
• Construction as per design? (M)	√					
• Construction done by qualified or experienced person? (M)	√					
• Construction done in accordance with sound engineering practices? (M)	√					
• Routine inspections carried out during construction?	√					
• Periodic inspection carried out during construction?		√			2	Carry out inspections during operation
4- Tailings dam operation						
• Is there a qualified person assigned to operate tailings facility?		√	Nobody is in charge	E	2	Assign qualified person
• Is there an operating plan?		√		E	2	Work out an operation plan.
• Is there an APELL plan en force?		√		E, H	2	Develop APELL.
• Were commissioning and operation approvals obtained?		√		E	2	Seek approvals by GGMC officials
• Operation in accordance with design specifications?	√					
• Is there a preventive maintenance schedule for the facility? (M)		√		E	2	Set up a preventive maintenance program
• Are there operational procedures?	√					
• Is there a routine or periodic inspection program?	√		Not always done by the same person			
5- Decommissioning and closing of the tailings facility						
• Is there a qualified person assigned to decommission the tailings facility?		√	Same problem as in topic 4 above	E	1	Assign a qualified and responsible person
• Is there an implementation plan for closing the tailings facility?	√					
• Were decommissioning approvals obtained?		√		E	1	Seek approvals
• Decommissioning and closure as per design?		√	Total improvisation	E	2	Develop a closure plan
• Is there a physical and environmental stability monitoring program?		√		E	2	Should be in the closure plan
• Is there an inspection program to measure performance after closure?		√		E	2	Should be in the closure plan

N.B.: Except for the topic/sub-topic column, all information in the table is provided **as an example only**. (M) = Medium scale mining only.

Legend:

Hazard

H = Health hazard

E = Environmental hazard

Priority

1- Practice to cease immediately (human health hazard).

2- Practice to cease in the short-term (< 1year).

3- Practice that poses no immediate threat to human health or the environment but that must be improved.

5. CONTINGENCY AND RESPONSE PLANS

The Contingency and response plans control chart is provided in Table 5-1 along with an example of how the Code of Practice on Contingency and response plans can be enforced through the GGMC mining inspectorate. The chart is a compliance and control form as well as a site assessment report.

The five topics found in the Code of Practice are included in the chart, namely:

- Defining the local community;
- Raising awareness;
- Forming a coordinating group;
- Developing the APELL;
- Communication, training and testing.

Table 5-1
Contingency and response plans control chart (based on the Code of Practice)

Topic/Sub-topic	Yes	No	Nature of non-compliance	Severity of consequences		
				Hazard	Priority	Observations and/or recommendations
1- Defining the local community						
• Is the community properly identified?		√	Did not take into account down-wind populations	H, E	2	Include these communities
• Was a risk analysis carried out?	√		Not comprehensive enough	E, H	3	Should update the risk analysis
2- Raising awareness						
• Are the different stakeholders adequately informed on the APELL?	√					
• Are meetings organized with stakeholders?	√					
• Have information on local emergency plans been compiled?		√	Risk of duplication or missed items		2	Proceed with comprehensive compilation
3- Forming a coordinating group						
• Was a coordinating group formed?	√					
• Is the core of the coordinating group made up of key representatives?		√	There is no EPA officer		2	Have an EPA officer designated
• Are members of the coordinating group representative of relevant institutions?		√	See above (no EPA)		2	See above
• Is thee sufficient cultural diversity in the coordinating group?		√	No representative from Amerindians		2	Seek participation of Amerindian people
• Was a leader designated?	√					
4- Developing the APELL						
• Were emergency response participants identified?	√					
• Were they assigned tasks, resources and concerns?	√					
• Were individual emergency plans reviewed to check adequacy with coordinated response?		√	Risk of duplication or missed items		2	Review plans and check for adequacy
• Were response tasks not covered identified?		√	Individual plans were not reviewed		2	Review plans. Identify items not covered.
• Were tasks and available resources matched?	√		Tasks assigned but not resources		2	Assign resources and concerns as well
• Were individual plans merged into one single plan (APELL)?		√	Individual plans were not reviewed		2	Review and merge individual plans.
• Was a consolidated plan (APELL) drafted?	√					
• Was the APELL endorsed by the participants?	√					
5- Communication, training and testing						
• Was integrated response (APELL) communicated to participating groups?	√					
• Were procedure manuals prepared?		√	No written document on the APELL		1	Write procedure manual ASAP !!!!!!
• Were field exercises, drills and workshops conducted?		√	No rehearsal equals inefficiency		1	Conduct drills ASAP !!!
• Is there a schedule for periodic testing and updating?		√			2	Write a testing schedule
• Was the APELL communicated to the overall community?	√					

N.B.: Except for the topic/sub-topic column, all information in the table is provided **as an example only**.

Legend:

Hazard

H = Health hazard
E = Environmental hazard

Priority

1- Practice to cease immediately (human health or environmental hazard).
2- Practice to cease in the short-term (< 1year).
3- Practice that poses no immediate threat to human health or the environment but that must be improved.

6. MINE EFFLUENTS

The Mine effluents management control chart is provided in Table 6-1 along with an example of how the Code of Practice on Mine effluents management can be enforced through the GGMC mining inspectorate. The chart is a compliance and control form as well as a site assessment report. The two (2) topics found in the Code of Practice are included in the chart, namely:

- Site preparation and construction;
- Mining operations.

Table 6-1
Mine effluents management control chart (based on the Code of Practice)

Topic/Sub-topic	Yes	No	Nature of non-compliance	Severity of consequences		
				Hazard	Priority	Observations and/or recommendations
1- Site preparation and construction						
• Is there a buffer zone between the area to be worked and the nearest stream?	√					
• Is some vegetation not removed in order to decrease runoff ?		√	Excessive debushing.	E	1	Install runoff control structures
• Are runoff control and collection structures installed?	√				3	Should install metal culvert across roadways and slope the roads
• Are runoff diversion structures installed?		√	Excessive runoff entering workings	E, H	2	Install water deflectors or level spreaders√
• Was size and location of settling ponds determined?		√	Settling ponds might be ineffective	E	2	Add extra settling ponds
• Are topsoil and overburden segregated and stockpiled?		√	Loss of valuable soil, turbidity	E	1	Segregate topsoil (use additional labour)
• Is reclamation being planned along with site preparation and construction?		√	No progressive reclamation	E	1	Start revegetating the site using topsoil
2- Mining operations						
• Was vegetation not removed in order to reduce limit from unvegetated areas?		√	Excessive runoff and erosion	E	1	Install additional runoff control structures
• Are runoff control and collection structures installed?	√		Not enough though	E		Install additional runoff control structures
• Are topsoil and overburden segregated and stockpiled?		√	Loss of valuable soil, turbidity			Segregate topsoil (use additional labour)
• Are measures taken to prevent wind and water erosion of topsoil stockpiles?		√	Use level spreaders and benched slopes			
• Are sediment control structures inspected to maintain efficiency?		√	Silt fences fabrics are clogged	E	1	Replace fabric or geotextile
• Is water quality monitored prior to discharge into the environment?		√	Turbidity plumes in nearby stream	E	1	Implement use of turbidity meter
• Are dredging tailings dumped directly into the river?	√			E	1	Stockpile tailings on the shore

N.B.: Except for the topic/sub-topic column, all information in the table is provided **as an example only**.

Legend:

Hazard	**Priority**
H = Health hazard	**1-** Practice to cease immediately (human health or environmental hazard).
E = Environmental hazard	**2-** Practice to cease in the short-term (< 1year).
	3- Practice that poses no immediate threat to human health or the environment but that must be improved.

7. MINE RECLAMATION AND CLOSURE PLANS

The Mine reclamation and closure plans control chart is provided in Table 7-1 along with an example of how the Code of Practice on Mine reclamation and closure plans can be enforced through the GGMC mining inspectorate. The chart is a compliance and control form as well as a site assessment report.

The six (6) topics found in the Code of Practice are included in the chart, namely:

- Reclamation planning;
- Progressive reclamation;
- Physical and chemical stability of the site;
- Land use;
- Pre and Post-closure monitoring;
- Relinquishment.

Table 7-1
Mine reclamation and closure plans control chart (based on the Code of Practice)

Topic/Sub-topic	Yes	No	Nature of non-compliance	Severity of consequences		
				Hazard	Priority	Observations and/or recommendations
1- Reclamation planning						
• Was a conceptual Reclamation plan prepared?		√	No planning for reclamation	E	1	Prepare conceptual reclamation plan
2- Progressive reclamation						
• Is the conceptual Reclamation plan updated and better defined as mining progresses?		√	No planning was made at the outset	E	1	
• Was progressive reclamation integrated into the conceptual plan?		√	No planning was made at the outset	E	1	Implement progressive reclamation NOW
• Is the principle *"Close as you go"* applied?	√		Incomplete (insufficient revegetation)	E	2	Improve soil stabilization
• Are there adequate financial securities to protect from closure liabilities?		√	Funds may turn out short	E	2	???????
3- Physical and chemical stability of the site						
• Are there safety hazards related to slope stability (including impoundments)?	√		Steep and unstable cliffs around pit	H, E	1	Immediate slope smoothing and stabilization (gabion, retaining wall, etc.)
• Are there any hazards related to openings to surface (shafts, raises, adits)?		√				
• Are there surface disruptions (collapses, caved-ins, subsidence)?		√				
• Is there acid mine drainage generation?		√				
• Are there visual impacts?	√		Excessive de-bushing. No revegetation	E	2	Revegetate.
4- Land use						
• Does the rehabilitated land blend in with the surrounding landscape?		√	Major visual disturbance	E	2	Backfill, revegetate, reestablish natural surface drainage
• Can the site support a balanced biodiversity?	√					
• Is surface drainage interrupted?		√				Reestablish natural surface drainage
• Is there groundwater loss (dry water wells)?		√				
5- Pre and Post-closure monitoring						
• Is a pre and post-closure monitoring program implemented?		√	We don't know if goals are achieved	E	1	Define and implement monitoring program
• Is there monitoring during progressive reclamation?		√	Same comment as above	E	1	Same comment as above
• Are performance goals being met?	?	?	We don't know (no monitoring)			
6- Relinquishment						
• Have standards and completion criteria been defined (GGMC)?	√					
• Have all agreed standards and completion criteria been achieved?		√	Impossible to assess without monitoring			
• Site ready for relinquishment?		√				

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8. MINE WASTE MANAGEMENT AND DISPOSAL

The Mine waste management and disposal control chart is provided in Table 8-1 along with an example of how the Code of Practice on Mine waste management and disposal can be enforced through the GGMC mining inspectorate. The chart is a compliance and control form as well as a site assessment report.

The four (4) topics found in the Code of Practice are included in the chart, namely:

- Waste dumps;
- Topsoil and overburden piles;
- Hazardous waste;
- Household waste;
- Pre and Post-closure monitoring;
- Relinquishment.

Table 8-1
Mine waste management and disposal control chart (based on the Code of Practice)

Topic/Sub-topic	Yes	No	Nature of non-compliance	Severity of consequences		
				Hazard	Priority	Observations and/or recommendations
1- Waste dumps						
• Are there waste dumps on the site?	√					
• Are waste dumps located near surface waters or swamp?	√		Risk of discharging sediments into the river	E	1	Divert runoff behind siltation berms or into catch basins.
• Are preventive measures taken to prevent wind and water erosion?		√		E	1	Minimize slope lengths. Use benched slopes and runoff dispersion structures.
• Does the dump show signs of instability?		√				
• Is the dump generating (or potentially generating) acid rock drainage?		√				
• Are measures taken for rapid revegetation of the dump?		√				
2- Topsoil and overburden piles						
• Are topsoil and overburden segregated in different piles?		√	Loss of valuable topsoil	E	2	Segregate in future workings
• Are topsoil and overburden piles located near surface waters or swamp?		√	Risk of discharging sediments into the river	E	1	Divert runoff behind siltation berms or into catch basins.
• Are preventive measures taken to prevent wind and water erosion?		√		E	1	Minimize slope lengths. Use benched slopes and runoff dispersion structures.
• Do the piles show signs of instability?		√				
• Is the topsoil pile kept biologically active (ventilation, planting, etc.)		√	Loss of productivity of topsoil	E	3	Ventilate the pile by stirring it periodically
• Was there proper debushing done prior to removal of topsoil?		√	Loss of valuable soil	E	3	Debush prior to stripping of topsoil
3- Hazardous waste						
• Was an inventory of on-site hazardous waste prepared?	√					
• Are there procedures for handling, transport and storage of hazardous waste?		√	Spill hazard	H, E	1	Work out a number standard procedures
• Were options identified for disposal and long-term storage of hazardous waste?	√					
• Is there an APELL in place?		√	No preparation in case of emergency	E, H	2	Have an APELL prepared and implemented
• Were workers trained on hazardous waste handling and storage?		√	Insufficient training	E, H	1	Proceed with training NOW !
4- Household waste						
• Is there a focus on waste minimization at the mine?		√	Plastics are discarded and could be reused	E	3	Have workers's implications on suggesting alternatives uses
• Is composting of organic matter carried out at the mine?		√	Waste of potentially valuable fertilizer for revegetation	E	3	Raise awareness
• Is there a compliant landfill at the mine site?		√	Seepages of waste water into the ground	E	1	Build adequate and impervious landfill in keeping with regulations

N.B.: Except for the topic/sub-topic column, all information in the table is provided **as an example only**.

Legend:

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E = Environmental hazard	**2-** Practice to cease in the short-term (< 1year).
	3- Practice that poses no immediate threat to human health or the environment but that must be improved.