Chapter 17

Loss Control and Safety Management

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17.1 Introduction

Loss control is defined as the intentional management action directed at the prevention or reduction of loss resulting from exposure to the perils associated with the pure risks of business. To achieve a high level of loss control, management must identify all areas where such losses can occur and manage the control of these losses. This can best be achieved by the implementation of a formal loss control programme.

The introduction of loss control or safety programmes as an integral part of a complete management system was started in the South African mining industry in 1975. Today, the programmes are well entrenched and have been successfully implemented on most of the gold mines in the industry. For example, the programme introduced in the metallurgical division of one of the largest gold mining complexes in the world has achieved encouraging improvements not only in casualty rates but in physical condition standards and plant availability and utilization.

The programmes consist of a number of activities which direct management’s efforts at critical areas with past loss experience or which have the potential for loss. Emphasis is placed on the activities being predictive and preventive rather than reactive. Many of the activities are interrelated and supportive of each other. For example, meaningful accident analysis is dependent upon effective accident investigations, and subjects for communication to employees emanate from accident investigation and analysis. Personal protective equipment standards are established from historic accident data, from planned task observations or the critical task inventory.

Managing the programme is a function of operating management, and the greatest potential for control exists at the point where the action takes place. Only line management, from the supervisor to the most senior manager, can ensure a successful loss control programme. Loss control decisions cannot be separated from operational decisions and are thus the responsibility of line management.

17.2 Loss Control Department

In order to provide the required motivation, expertise and education of line management in the principles and accepted practices of loss control and to provide for the vital auditing function, the formation and staffing of a loss control department is necessary. For maximum effectiveness staff should be
Figure 17.1. Metallurgical Division: physical conditions and disabling injury trends.
drawn from experienced metallurgical personnel. Loss control officers are administratively and operationally responsible to senior metallurgical personnel and technically to the loss control co-ordinator.

17.3 Physical Condition Rating Programme
The physical conditions in working areas are of fundamental importance in loss control. The Physical Condition Rating Programme is an effective system to enable management to upgrade physical conditions in working areas and to provide an unbiased measure of compliance with predetermined standards regarding physical conditions. It is a relatively inexpensive programme and it soon develops employees' pride in their working environments. Loss control staff normally form the nucleus of condition rating teams, and other team members include senior and middle managers from the operating and engineering disciplines. Benefits accruing from such a programme include inter alia:

- Identification of substandard conditions.
- Elimination of accidents and fire causes.
- Reduction of wasted energy.
- Maximization of space usage.
- Minimization of stores and equipment inventories.
- Guaranteeing of good working place appearance.
- Encouragement of better work habits.

An illustration of the improvement in physical conditions in a metallurgical plant over a five-year period is reflected in Figure 17.1. Note the concomitant decrease in the lost time injury rate.

A detailed checklist which directs the attention of rating teams or individual auditors to specific areas of known loss or to those areas which possess the potential for loss should be used during the inspections. The significant aspects covered by the checklist are:

- Premises and surroundings.
- Electrical, mechanical and personal safeguarding.
- Fire protection.
- Loss control programme knowledge.
- First aid equipment.

The same comprehensive checklist is used for both physical condition ratings and general planned inspections; the items listed and requirements stated are extracts from metallurgical standards, managerial instructions or Mines and Works regulations (Appendix 17.1).

To upgrade the level of programme implementation and to encourage additional participation by all levels of supervision and management as well as operating staff, expansion into other activities should be considered such as formal planned inspections, group meetings, planned task observations and objective accident/incident investigations.
17.4 The Manager's Policy
A loss control or safety programme without top management support will fail. To affirm management's full commitment to and indeed involvement in a safety programme, the most senior manager should issue a statement clearly specifying his safety philosophy and policy. The statement would include the reduction or elimination of incidents involving personal injury, damage to property, environmental health, fires, and unplanned interruption of operations. It must be clear to employees that all levels of supervision have a high degree of commitment to and involvement in the loss control programme. A programme steering committee under the chairmanship of a senior manager should be formed to develop the policy and set objectives to guide the programme through the various phases of implementation.

17.5 Training
Formal training of all levels of supervisors in the principles of safety and loss control is necessary. Practical and theoretical training is required for line personnel to enable them fully to understand and appreciate their responsibilities in respect of the programme. These must not be seen as additional to their management or production responsibilities but rather to complement and assist in their occupational duties. This training can be done either by in-house courses or by using outside organizations. It is necessary for additional and special training to be provided for loss control staff.

17.6 Planned Inspections
The planned inspection is one of the most widely used of the loss control activities available to management. It is an excellent tool for detecting potential incidents before loss of any kind occurs. It highlights the emphasis of the programme on prediction rather than reaction. Inspections can be classified into two main categories, namely general and critical parts.

17.6.1 The general inspection
This inspection is similar in many ways to the physical condition rating and is normally conducted by line personnel in their own areas of responsibility. It provides a formal system of inspection and follow-up, or overinspection, by a more senior line official to ensure a consistent identification of substandard conditions. The use of a checklist to assist the person conducting the inspection in knowing both "what to look for" and "what to look at" is highly recommended (Appendix 17.1).

All areas and structures in the plant should be inspected at predetermined intervals depending upon the criticality of the area and the nature of the work being performed therein. Inspection of plant areas and workshops should be conducted monthly by the metallurgical foreman and engineering foreman. Substandard conditions should be noted during the inspection and recorded, prioritized and finally remedial action responsibilities should be specified. To ensure that inspections have been judiciously conducted, over-
LOSS CONTROL AND SAFETY MANAGEMENT

inspections should be done in the same areas by the plant superintendent
or engineer on a random selection basis as soon as possible after the initial
inspection. An example of an inspection record sheet is shown in Figure 17.2.

17.6.2 Critical parts inspections
These inspections provide a formal system of inspection, service and overhaul
of plant, machinery and equipment which will restrict downtime to an ac­
ceptable level. The inspections are normally conducted by engineering per­
sonnel and controlled by the Planned Maintenance Department.

17.6.2.1 Pre-use inspection of equipment
These inspections ensure detection of faults in power-driven equipment, which
if not detected could result in loss. They are in fact an extension of the Critical
Parts Inspection and are usually conducted by the equipment operators using
a check list containing the critical items. As with the general inspection it
is imperative that overinspections be conducted in both these areas on a
random basis by senior plant personnel.

Regular analysis of substandard conditions and other deficiencies will
provide clear indicators to plant managers of repetitive problems which could
require action by them to bring about change in design or operational
procedures.

17.7 Accident/Incident Investigation and Analysis
Investigation of accidents is the responsibility of line management, and an
effective safety management programme must include an efficient and for­
mal system of accident and incident investigation. The reason for investigating
accidents is basically to prevent a recurrence of the event. This can only be
achieved by the clear identification of the sequence of events that resulted
in the accident.

It is essential for the manager or supervisor to understand what he is
trying to control with accident/incident investigation, and to provide some
clarity the following definitions are provided. “An incident is an undesired
event that could or does result in loss” and “an accident is an undesired event
that results in physical harm to a person or damage to property. It is usually
the result of contact with a source of energy above the threshold limit of
the body or structure.” The source of energy could be kinetic, electrical,
chemical or thermal.

Investigations should not be restricted only to events which have resulted
in loss due to some source of contact but should include other events which
could have caused losses or interruptions to operations or processes. Examples
of these are: shortage of strategic materials; unusually high incidence of wear
and tear on equipment components; near-loss or no-loss incidents that under
slightly different circumstances could have resulted in loss.

It is essential that incidents are reported to supervisors and managers
with the minimum of delay so that prompt action can be taken and investiga­
tions initiated before conditions alter or important evidence is destroyed.
Figure 17.2. Sample record sheet for planned inspections.

METALLURGICAL DIVISION

PLANNED INSPECTIONS: INITIAL AND OVERINSPECTIONS

<table>
<thead>
<tr>
<th>Date</th>
<th>Area</th>
<th>Sub-standard condition</th>
<th>Hazard class</th>
<th>Job Req. no.</th>
<th>Immediate remedial action taken</th>
<th>Permanent remedial action to be taken</th>
<th>Estimated completion date</th>
<th>Actual completion date</th>
<th>Inspectors sign</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

Note: Hazard potentials:

- A = Extensive or permanent disability
- B = Disruptive, serious injury
- C = Minor or no-loss

- Immediate action required (hazard to be rectified or area to be made safe)
- Schedule to be rectified as soon as possible (within one week)
- Schedule for a later date
17.7.1 The investigation
Investigations must include a visit to the accident scene by the investigators and the interviewing of casualties and witnesses to obtain as much insight as possible into the conditions and attitudes which prevailed at the time of the accident.

Accident causation is somewhat complex and could require broad considerations of personnel, equipment, materials, the environment and in particular management’s decisions which impact on design, installation and maintenance, operational practices and training. Only with relatively simple incidents is it generally feasible to expect line supervisors to be proficient in the causal determination and the recommendation of appropriate remedial actions. For obvious reasons, however, their active participation in the investigation of incidents which occur in their areas of responsibility is imperative. The loss severity potential and frequency of the incident will determine the level of management involvement. Loss control officers in their capacity as safety professionals should participate in the investigation to provide guidance, advice and to encourage probing into the less obvious areas which could have had some influence on the incidents. To obtain meaningful and unbiased information investigations should be conducted on the basis of fact finding rather than fault finding and blame fixing.

The recording of facts by the investigators must be accurate and complete. Identification of the immediate and basic causes should be comprehensive and remedial actions and those responsible for the implementation of these actions must be clearly specified. The immediate causes (or symptoms) of the accident include both substandard acts and substandard conditions. These result from deviations from accepted standards or practices and originate from the basic or underlying causes and the lack of management control.

A sample investigation form is shown in Figure 17.3. The form is designed to lead the investigators to recommend permanent remedial actions. When completed, it should contain all the necessary information for meaningful accident analysis.

It is imperative to ensure that the specified remedial action is taken and it is incumbent upon the loss control staff to provide this follow-up service.

The accident/incident investigation is a highly significant component of an effective safety programme. Safety professionals agree that all programme activities are to some degree complemented or downgraded by the quality of these investigations and the action taken to prevent the recurrence of the accident/incident. To assist investigators in identifying the immediate causes of substandard acts and conditions, and more importantly the basic causes of personal and job factors, the classification reference guide shown at the bottom of Figure 17.3 is provided, usually on the reverse side of the investigation form.

17.7.2 Analysis
17.7.2.1 Statistical data
It is normal practice for managers to obtain performance statistics on
Figure 17.3. Sample record sheet for accident/incident investigation.

**METALLURGICAL DIVISION**

**ACCIDENT/INCIDENT INVESTIGATION**

<table>
<thead>
<tr>
<th>REPORT NO.</th>
<th>.................................................</th>
</tr>
</thead>
</table>

## 1. BASIC DATA (Describe where applicable)

- **Department:**
- **Date of Occurrence:**
- **Day of Week:** Sun 01 Sat 07
- **Plant:**
- **Time (01-24 hours):**
- **Section:**
- **Name and Coy/P.F. No. of injured:**
- **Occupation:**
- **Age (years):**
- **Ethnic Group:**
- **Occupation and Name of Person in Most Control:**

### Probable Recurrence Rate:

- **Freq.**
- **Occ.**
- **Rare**

<table>
<thead>
<tr>
<th>Major</th>
<th>Serious</th>
<th>Minor</th>
</tr>
</thead>
<tbody>
<tr>
<td>COSTS</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Loss Severity Potential:

- **Part of Body Injured:**
- **Property Damaged:**
- **Task Performed:**
- **Extent of Damage or Breakdown:**

## 3. IMMEDIATE CAUSES: (what acts, failure to act and/or conditions contributed most directly to the incident)

<table>
<thead>
<tr>
<th>.................................................</th>
</tr>
</thead>
</table>

## 4. BASIC CAUSES (reasons for the existence of these acts/conditions)

<table>
<thead>
<tr>
<th>.................................................</th>
</tr>
</thead>
</table>

## 5. TEMPORARY REMEDIAL ACTION

<table>
<thead>
<tr>
<th>Action</th>
<th>By</th>
<th>Comp. Date</th>
</tr>
</thead>
</table>

## 6. PERMANENT REMEDIAL ACTION

| ................................................. |
1. Basic causes
   a) Insufficient or inadequate inspections (planned inspections, critical parts inspections, pre-use inspections, four-or five-step plan).
   b) Inadequate follow-up on inspections.
   c) Inadequate maintenance.
   d) Substandard accident/incident investigation or remedial action.
   e) Inadequate incident reporting programme.
   f) Inadequate accident/incident analysis.
   g) Inadequate emergency preparedness (including first aid training and equipment).
   h) Inadequate procedures, standards and rules (including signs and colour-coding).
   i) Inadequate communication and/or enforcement of procedures, standards and rules.
   j) Insufficient or inadequate planned task observations.
   k) Inadequate skill training.

(Continued overleaf.)
l) Inadequate training in hazard recognition.
m) Inadequate job induction.
n) Inadequate standards for enforcement or provision of protective equipment.
o) Inadequate standards or performance in giving of instructions (PTI and safety tips and hints).
p) Inadequate follow-up on instructions.
q) Inadequate purchasing standards.
r) Inadequate procurement/delivery of material or equipment.
s) Inadequate mining or engineering design and/or methods.
t) Improper placement (physical capability, heat tolerance, acclimatization, eye-sight, hearing, aptitude).
u) Inadequate propaganda programme – group meetings and/or promotions.
v) Other.

Suggested list – personal factors:
a) Inadequate capability – physical, mental, aptitude.
b) Stress – physical, mental.
c) Lack of knowledge.
d) Lack of skill.
e) Language/communication problem.
f) Improper motivation – negative, etc.
g) Other.

2. Immediate causes

Acts
a) Operating/working without authorization.
b) Working in dangerous area/situation.
c) Working without stopping equipment.

d) Failure to warn.
e) Failure to secure.
f) Operating at improper speed.
g) Making safety devices inoperable.
h) Using equipment improperly (misuse/abuse).
i) Failure to use protective equipment.
j) Improper loading or placement.
k) Taking improper position.
l) Alcohol or drugs.
m) Unauthorized entry.
n) Failure to recognize hazard.
o) Other.

Conditions
a) Inadequate guards.
b) Defective tools, equipment or material.
c) Inadequate tools, equipment or material.
d) Inadequate warning system.
e) Hazardous atmospheric conditions (gases, dusts, fumes, vapours).
f) Other fire and explosive hazards.
g) Substandard housekeeping.
h) Inadequate ventilation.
i) Inadequate illumination.

3. If any cause is selected from the above list, the reason therefor must be given.

4. Remember: problems are seldom, if ever, the result of a single cause. Look for multiple causes.
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... occupational injuries to employees on a daily, weekly, monthly and annual basis to facilitate the monitoring of trends and to initiate corrective action in problem sections or areas. These statistics enable comparisons to be made between various sections and supervisors on an equitable basis in ratios or rates. The standard formulae for the determination of the more commonly used rates are:

*Frequency rate*
The disabling injury frequency rate relates the injuries to the hours worked during the period and expresses them in terms of a million-hour unit by use of the following formula:

\[
\frac{\text{Number of disabling injuries}}{\text{Employee-hours of exposure}} \times 10^6
\]

A disabling injury is defined as an injury arising out of and in the course of employment which prevents the person from performing his or her own job or a similar job for one or more shifts.

*Reportable disabling injury rate*
The reportable injury rate refers to the injuries and deaths which are reportable in any month to the Chief Inspector of Mines under Mines and Works Regulation 25.1. These are related to the number of persons at work during that month by use of the following formula. Rates are expressed per annum per 1000 persons.

\[
\frac{\text{Number of injuries and deaths} \times 12}{\text{Number of persons} + 1000}
\]

*Fatality rate*
The fatality rate relates the deaths which are reportable in any month to the Chief Inspector of Mines under Mines and Works Regulation 25.1 (a) to the number of persons at work during that month by use of the following formula. Rates are expressed per annum per 1000 persons.

\[
\frac{\text{Number of deaths} \times 12}{\text{Number of persons} + 1000}
\]

*Additional analytical data*
From the accident investigation records, identification of certain key facts about each injury and the accident which resulted in the injury can be obtained. Summarization and analysis of these facts will generally show a pattern of injuries and accident occurrences. These patterns serve as a guide to areas within plants, conditions, acts and circumstances at which accident prevention efforts should be directed.

The frequency of analysis will to some extent depend upon the number of accidents which occur. In metallurgical sections where the accident experience is low, analysis should possibly cover an annual or six-monthly period...
so that meaningful trends can be obtained.

Salient items which should be extracted for analysis include:

*Occupation of injured.*

*Work place:* the specific place or area where the persons were injured.

*Nature of injury:* the type of physical injury incurred.

*Part of body:* the part of the injured person's body directly affected by the injury.

*Agency:* the object, substance or exposure which directly produced or inflicted the injury.

*Task performed:* the task the injured was performing when the injury occurred.

*Immediate causes:* what acts, failure to act and conditions contributed most directly to the accident.

*Basic causes:* the real problems and the reasons for the existence of the immediate causes.

Other facts such as time, age, ethnic group, experience can be included in the analysis.

This section has mainly dealt with occupational injuries. Loss in the other areas such as damage to equipment, loss and wastage of materials and the environment should be subjected to the same management corrective and preventative action.

**17.7.3 Benefits derived from accident investigations and analysis**

Facts highlighted during investigations and the analysis of these and other relevant data pertaining to accident trends have a direct impact on other programme activities. Management deficiencies relating to supervision, discipline, training and communication are identified. Faults are found in task procedures, plant design and layout and material and equipment specifications. All of these cause management to react and apply the required remedial action to tighten the control function.

**17.8 Communications**

Effective lines of communication are essential to successfully manage a safety system. These can be established on a group basis whereby communications from top management descend via the various levels of supervision down to individual groups of workers and also provide an avenue for communications from the workers to top management. In addition personal communication systems on a one-to-one basis must be formulated.

**17.8.1 Group meetings**

All plant employees, except clerical staff, attend monthly group meetings where topics supporting critical subject promotions are discussed. The majority of these subjects are selected from the incident investigation and analysis activities and are based on actual case histories of accidents or high potential near-loss incidents. The plant production superintendent and general engineer-
ing supervisors in consultation with the loss control officers normally select the topics and jointly document the salient points for promotion. Obviously the topics must be applicable to the section in which they are promoted and supported by visual aids in the form of posters or objects such as tools or equipment. The duration of the meetings is generally no longer than 10 minutes and meetings are held by the various levels from middle managers down to the workers. The plant production superintendents and engineering supervisors hold meetings with the next line of supervision below them, namely the metallurgical foremen and engineering foreman. These foremen hold meetings with the plant foremen and artisans who in turn communicate down to the technical officials and the remaining work force. Random checks are necessary to ensure that all employees have an understanding of the topic and that an increased awareness of the potential loss and prescribed action has been achieved. Brief notes of the meetings are kept, and points raised for upward communication and action taken are documented for discussion in senior management safety meetings.

17.8.2 Personal communication

Personal communication is effectively used to control losses by assisting employees to learn certain aspects of their jobs, providing individual job orientation, promoting and using proper task instruction techniques and key point tipping (more commonly known as 'safety tips and hints').

Newly engaged employees or employees who are transferred to sections of the plant with which they are unfamiliar are given formal on-the-job induction by their immediate supervisors. The foremen are responsible for inducting technical officials and artisans as soon as possible after the person arrives in the section. To ensure that no important points are overlooked, guidelines are provided for use by the foremen. These are in most instances specific to sections. An example of an induction format for the milling section is given in Figure 17.4.

As is the case in most programme activities, a follow-up on the induction is done by a metallurgical training officer with the new employee within a month to evaluate the effectiveness of the induction. Supervisors are encouraged to use proper task instruction techniques whenever an unfamiliar task is assigned to an employee to ensure complete understanding of what is to be done.

17.9 Emergency Preparedness

Even in the most efficiently run operations the risk of emergencies exists, in the form of fires, incidents involving chemicals, and accidents resulting in multiple casualties. To ensure prompt and effective action to control the losses which are possible from these emergencies, comprehensive procedures for gold plants should be established. Persons who are responsible for taking action in the event of an emergency occurring must be fully instructed and trained in their duties. Wherever practical, unscheduled drills or mock emergencies should be staged at intervals.
THE EXTRACTIVE METALLURGY OF GOLD

Figure 17.4. Sample record sheet for on-the-job induction of new employee.

**ON-THE-JOB INDUCTION OF THE NEW EMPLOYEE**

The employee will complete this form with his immediate Supervisor and return it to the Training Officer.

**SECTION:** MILLING

**NAME:** .........................................   **DATE:** .......................................... 

**DO YOU KNOW?**

<table>
<thead>
<tr>
<th></th>
<th>Explanations understood</th>
<th>I would like more information</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Where the fire alarm is situated?</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Where the assembly point is?</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Where the medical station is?</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>What personal protective equipment should be worn in your section?</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>How to identify drinking water on the plant?</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>The regulations pertaining to machinery?</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>The regulations pertaining to conveyor belts?</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>The regulations pertaining to machine guarding?</td>
<td></td>
</tr>
</tbody>
</table>

List below any further information you require regarding your job.

__________________________________________

**EMPLOYEE SIGNATURE:** .............................................................. 

**REMARKS BY SHIFT FOREMAN**

__________________________________________

**SIGNATURE OF SHIFT FOREMAN:** .............................................. 

c.c. LCO
Emergencies with high loss potential are grouped into three categories: accidents resulting in injury to persons; fires; miscellaneous.

17.9.1 Care of the injured and ill
In addition to the qualified medical staff and the modern medical services provided on the gold mines, a high degree of first aid training of employees is maintained. This ensures prompt and competent treatment of the injured and ill to alleviate pain and suffering and to prevent or reduce loss. Specialized training is required in the treatment of cyanide poisoning and the use of breathing apparatus and resuscitation equipment.

Medical stations, with qualified medical nursing staff in attendance, are situated in close proximity to the plants. Within the confines of the gold plants first aid equipment, including breathing apparatus and resuscitation equipment, is provided at strategic positions. In areas where acid and cyanide are handled, safety showers and eyewash fountains should be provided. The locality of all these facilities must be clearly identified by international symbolic signs. During induction employees should be briefed on the availability, and shown the exact locations, of the facilities. To promote interest and maintain proficiency in first aid treatment of patients employees should be encouraged to participate in annual competitions.

17.9.2 Hazardous chemicals
The handling of hazardous chemicals is a constant source of potential loss in chemical process plants and management recognizes its obligation to inform employees of the dangers involved and the treatment in case of accidental exposure.

Data sheets containing the basic information on all toxic substances used in gold plants are used to communicate the information to employees. The data include inter alia the description, usage and first aid treatment of each substance, and should be displayed on notice boards in the areas where the substance is used. It is essential that the information is conveyed to illiterate employees by their supervisors. An example of a data sheet for cyanide appears in Figure 17.5.

Similar data sheets are available for: hydrochloric acid, caustic soda, sulphuric acid, degreasing fluid, lead nitrate, aluminium sulphate and zinc dust.

17.9.3 Fires
The incidence of fires in gold plants is low but the potential is relatively high owing to the large quantities of rubber conveyor belting used. Stringent fire prevention standards should be enforced when arc-welding or oxy-acetylene equipment is used. No-smoking zones should be defined and open fires within the confines of the plants prohibited. Fire protection measures should receive close attention during physical condition ratings and planned inspections (refer to section 3 of checklist in Appendix 17.1), and detailed surveys should be conducted by fire protection consultants to identify exposures which have possibly been overlooked by plant and loss control personnel.
THE EXTRACTIVE METALLURGY OF GOLD

Figure 17.5. Hazardous chemical or substance data sheet.

<table>
<thead>
<tr>
<th>Name</th>
<th>Cyanide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>NaCN: Normally clear, colourless to pale straw-coloured liquid but may sometimes be darker. Ca(CN)₂: Slightly straw-coloured liquid but changes to yellowish-brown colour during storage. Ca(CN)₂: Steel grey to black flakes.</td>
</tr>
<tr>
<td>Usage</td>
<td>Gold dissolution.</td>
</tr>
<tr>
<td>Health Hazard</td>
<td>Extremely poisonous and can be absorbed through the skin. Symptoms of poisoning: General weakness, heaviness of limbs, difficulty in breathing, headache, dizziness, nausea and vomiting followed by death.</td>
</tr>
<tr>
<td>Emergency &amp; First Aid Treatment</td>
<td>Send for medical assistance. Ingestion: Give cyanide antidote followed by amyl nitrite. Apply artificial respiration if breathing stops. Absorption through the skin: Remove contaminated clothing and drench the skin with water. Inhalation of fumes: If patient is still breathing break a vial of amyl nitrite and give to patient by inhalation for 20 seconds. Repeat every 2-3 minutes.</td>
</tr>
<tr>
<td>Personal Protective Equipment to be Worn During Handling</td>
<td>Full face shield Elbow length PVC gloves Acid resistant overalls or coats Boots (Airline respirator to be available)</td>
</tr>
<tr>
<td>Storage</td>
<td>Store in closed tanks equipped with breather pipes.</td>
</tr>
<tr>
<td>Spill or Leak Procedure</td>
<td>Prevent spillage from entering drains or water courses. Detoxify with ferrous sulphate or hypochlorite. Flush residue away with copious quantities of water.</td>
</tr>
</tbody>
</table>

17.9.4 Miscellaneous
The incidents in this category which have the greatest potential and probability for loss include:

- Major electric power failure.
- Significant acid spills from a storage tank or pipe column.
- Acid or cyanide spillage during bulk off-loading operations.

An example of the emergency procedure to be followed when a major electric power failure occurs is:

- Close master valves. (All master valves are clearly identifiable.) Drain pipe columns.
- Close air valves under pachucas.
- Ensure that emergency power plant is started to drive thickener rakes.
- Drop load in filter pans.
- Arrange for equipment to clear chokes in pachucas.
Check slime filter pumps before restarting to ensure that slime has not solidified.
Start diesel generator to ensure adequate water supply in case of a fire.

17.10 Physical Examinations of Employees
17.10.1 Medical examinations
In terms of section 13 of the Occupational Diseases in Mines and Works Act of 1973 and the amendment thereto dated 28 January 1983, certain areas in gold plants are classified as risk areas owing to the presence of potentially harmful silica dust. These areas are: crusher plants, grinding mill plants, rotary filter plants, smelt houses, surface rock tipping bins and change-houses for persons employed in dusty atmospheres.
Before commencing duties employees allocated to these areas must be medically examined by the Medical Bureau for Occupational Diseases or the mine medical staff and declared fit to work in dusty atmospheres. They must be re-examined annually.

17.10.2 Eyesight examinations
The eyesight of all employees is assessed on engagement and at yearly intervals thereafter. This will ensure that those employees for whom good eyesight is important have the visual ability to enable them to work safely and efficiently. Where possible, deficiencies are corrected by medical treatment or by the wearing of spectacles. To determine visual acuity, employees undergo the Snellen E chart test which assesses the person’s ability to see correctly the orientation of the letter E symbol. It can be effectively used for illiterates. Snellen E charts of different manufacture differ from one another in the size and width of the lettering; for this reason, it is important to conduct eyesight tests at distances which suit the chart used. The 6/6 – 6/60, Curry & Paxton Ltd (London) chart, has been found to be most suitable for routine eyesight testing.

The Snellen chart should be kept free from dust and grime as the accumulation of such substances changes the contrast ratio of the chart resulting in incorrect visual acuity measurements. The Snellen chart (reduced size) is shown in Figure 17.6.

Following the assessment of visual acuity, colour perception should be determined on men employed in work categories requiring unimpaired colour vision. The test is done on binocular vision. As it is not necessary for this defect to be quantified, and for reasons of simplicity, the Ishihara Colour Blindness Test is recommended. Apart from the pseudoisochromatic plates, no other special equipment is required (Van Rensburg, Strydom and Kielblock, 1981). Included in these categories are: electricians and electrical aides, vehicle drivers, operators, and technical officials.
In addition to the visual acuity and colour blindness tests, the depth perception, peripheral vision and the rapid adaptation to low light conditions and glare recovery of all vehicle drivers are assessed using an orthorater (or similar) vision tester.
Figure 17.6. Snellen chart (reduced size).
17.10.3 Audiometric testing
In recent years noise pollution leading to deafness has been recognized as a major industrial hazard. The nature of the product handled in the rock delivery section of gold plants, and the nature of the processing in the crushing, sorting and milling sections results in a large percentage of the work force being subjected to noise levels in excess of 85 dB A scale for periods of 8 hours or longer per day. Areas in the plants where noise levels in excess of 85 dB A scale occur should be identified, and employees working in these areas should be required to wear hearing protection devices for the duration of the shift. Casual visitors to these sections should be supplied with protective devices for use whilst in the areas.

Noise-induced deafness caused in the work situation is compensatable in terms of the Rand Mutual Assurance rules. Although ear plugs and ear muffs afford some protection against deafness, the solution lies in engineering the noise out at the source. This, of course, is a long-term solution and considerable work by design engineers is necessary to reduce noise emission from machinery.

The hearing ability of all gold plant employees is assessed on engagement. The information is used to provide a data base against which periodic assessments are compared and thus ensures timeous warning of hearing impairment. An audiometer is used to measure objectively the amount of hearing loss in decibels at various frequencies.

Audiometric instruments and soundproof cubicles are used for the tests and approximately 25 persons can be tested per day on each instrument. The information is stored in the employees' computerized personal records to facilitate access.

The person being tested is seated in a soundproof cubicle and reacts by pressing a button to tones relayed through earphones by a trained operator. The results are printed on an audiogram for record purposes. These are compared with medically established norms to determine into which of four categories they are placed. Results of the tests are filed in the employees' personal records.

Category 1 - Cases where hearing loss is below warning level.
Category 2 - Cases where hearing loss is above warning level but below referral level.
Category 3a - Cases where the sum of the hearing loss for either ear at high or low frequencies is greater than referral level.
Category 3b - Cases where the difference in the sums of the hearing loss between the two ears exceeds 45 dB in the low frequency range or 60 dB in the high frequency range.
Category 3c - Cases where the sum of the hearing levels for low or high frequencies shows an increase of 30 dB or more when compared with the last audiogram or an increase of 45 dB over the last 3 years.

After categorization, the following action is taken for the various categories:

Category 1 - Audiograms are stored for record purposes.
Figure 17.7. Audiometric testing in progress. The audiometer is on the left of the picture, and the door of the cubicle is in the open position.
LOSS CONTROL AND SAFETY MANAGEMENT

Category 2 – Persons in this category are warned to use hearing protection devices. Their audiograms are stored and they are retested after six months to establish whether any further hearing loss has occurred.

Categories 3a, 3b and 3c – People in these categories are referred for medical treatment or specialist examination (Nairn 1985).

Figure 17.7 shows audiometric test equipment in use. The eyesight and audiometric testing is done in accordance with the recommendations of the Industrial Hygiene Branch of the Chamber of Mines of South Africa.

Figure 17.8 shows an environmental survey record sheet.

17.11 Personal Protective Equipment
Protection of employees by mechanical means and engineering design is generally more reliable than protection which is dependent upon human

Figure 17.8. Sample record sheet for results of dust, noise and illumination survey conducted at a gold plant on 23 January 1986.

ENVIRONMENTAL CONTROL DEPARTMENT
WASHING, SCREENING, SORTING AND CRUSHER PLANT

<table>
<thead>
<tr>
<th>Sample point</th>
<th>Description</th>
<th>Ave. dust</th>
<th>Ave. noise</th>
<th>Ave. illum.</th>
<th>Remarks</th>
</tr>
</thead>
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</table>

Recommended levels:
Dust – Less than 200p/ml
Noise – Less than 85 dB (A)
Illumination – Walkways – above 5 Lux
Moving machinery – above 20 Lux

Observed by: .................................................  Environmental Superintendent: .................................................

Sect. Envrm. Officer: .................................................  Gold Plant Superintendent: .................................................
behaviour. A machine designed so that it effectively confines flying particles eliminates a cause of accidents and the need for an operator to wear eye protection. Similarly, mechanical removal of hazardous fumes should be provided, rather than respirators for operators in hazardous environments. Notwithstanding the progress made in providing for safety in engineering design of machinery and equipment the wearing of certain personal protective equipment is mandatory in gold plants.

Each task performed by employees should be critically examined to identify those having a potential for injury which can be eliminated, or reduced in severity, by the use of protective equipment. Information from accident analysis (Section 17.7.2) is used to identify these tasks or occupations. For example, if the analysis shows high accident trends in toe injuries amongst grinding mill relining workers, the issue of steel toe-cap safety shoes would be justified. Generally a number of basic protective equipment items are supplied to all employees. These are: safety helmets, safety boots or shoes, overalls, and wrist-length PVC gloves.

Other items specific to particular occupations would be supplied, such as respirators for sand blasting operators and spray painters, and welding helmets and spats for boilermakers.

It is essential that stringent standards in respect of items to be worn whilst specific tasks are performed are clearly defined, and supervisors must ensure complete compliance with these standards. Protective equipment should be maintained in good condition. Safety goggles with badly scratched lenses could impede an employee's sight and he may be reluctant to wear them and thus risk an injury.

Most items of protective equipment are of a personal nature and employees should not have to share such items. These include safety helmets, goggles, hearing protection devices and dust respirators. Items which could be shared by a number of employees include safety harnesses and lifelines. Employees must receive instruction and demonstrations in the use of the more sophisticated equipment such as respirators and safety harnesses.

A number of factors should be considered when specifications are defined or selection of equipment is made. These are: comfort, provision of the necessary protection, correct equipment for specific application, and ease of use.

Comfort — If the item is not comfortable to wear, it will generally not be used. Examples of this are gloves which are too rigid and footwear with incorrect pitch of the sole.

Provision of the necessary protection — Safety goggles having low impact resistance, but supplied for use at pedestal grinders, provide no protection.

Correct equipment for specific application — Particulate filter respirators supplied as protection against solvent vapours are of little value.

Ease of use — If a safety harness is difficult to put on or assistance is required to fit the harness, there is a chance that it will not be used. Figure 17.9 shows personal protective clothing in use.
17.12 Task Analysis and Procedures

Supervisors will agree that there is a correct way to carry out all critical tasks and that most accidents result from substandard acts because an established procedure was not followed. A critical task can be described as any sequence of steps or activities carried out in the performance of a specific work assignment and which has a history of, or the potential for, significant loss. This could be in the form of an accident which results in injury to persons, damage to equipment, wastage of material or pollution of the environment.

It is necessary at an early stage in the safety programme development that all critical tasks be identified and an inventory of these compiled for each individual occupation within the gold metallurgy discipline. Responsibilities and organizational relationships which are normally included in a position charter or job description are not classified as tasks and should not be included. Supervisory functions such as giving instructions should not be included, and no benefit is derived from including management functions like planning and forecasting. Both line management and loss control staff should be involved in compiling the inventory. Members of line management have an intimate knowledge of the tasks performed by each occupation but experience has shown that guidance is required to enable them to classify tasks as critical or non-critical.

17.12.1 Identification of critical tasks

To identify tasks which are critical and the ranking of these in order of criticality, the following should be examined:

Can the task, if not carried out correctly, result in significant loss whilst being performed?
Can the task, if not carried out correctly, result in significant loss after having been performed?

How serious is the loss likely to be? (What is the severity of injury, cost of damage or cost of production loss likely to be? Are other persons or departments likely to be affected?)

What is the expected frequency of occurrence?

Frequency of occurrence is governed by a number of factors, of which the most important are:

The number of times the task is performed in the organization in a specific time period (repetitiveness).
The chance that there will be a loss as a result of performing the task (probability of loss).

It must be recognized that there are many degrees of criticality and, in fact, every task worth doing is critical to some degree. It follows, therefore, that a system which develops a scale of criticality is likely to result in fewer differences of opinion than one which merely classifies the task as critical or not critical. It is suggested that the above parameters be converted into three scales relating to severity, repetitiveness and probability of loss. Although much subjective judgement is still required, the fact that each parameter is given due consideration results in a more consistent and logical ranking and subsequent classification of tasks according to criticality.

Severity is derived from the injuries and costs of the losses being incurred or the loss most likely to be incurred as a result of wrong performance of the task. In many cases a whole range of losses could occur but only the most likely result should be considered. For example, if the lock-out procedure for a tube mill which is being relined is not followed correctly and this results in an accident, it is likely to be serious, whereas an incorrect shovelling technique used to clean up a slimes spill is more likely to result in a small loss rather than a large one.

17.12.1.1 Severity
A scale of from zero to six is suggested as follows:

0  No injury or a loss of less than R100.
2  Minor injury without lost time or a loss of R100 to R500.
4  A lost time injury without permanent disability or a loss of more than R500 but not exceeding R2 000.
6  A fatality or permanent disability or a loss exceeding R2 000.

The degree of severity corresponding to the various values on the scale and the number of points on the scale can be varied to suit requirements.

17.12.1.2 Repetitiveness
Repetitiveness can be assessed from the following tabulation according to a scale of 1 to 3.
The scale used can be extended if desired and, in this example, a scale of 1 to 5 could have been adopted.

17.12.1.3 Probability
The probability of loss occurring each time a particular task is performed is influenced by the following factors:

- Hazardousness, i.e. how dangerous is the task?
- Complexity of the task.
- The chance that there will be loss if the task is performed incorrectly.

It is not suggested that these factors should be evaluated separately but they should be borne in mind. The key question is, “How likely is it that things will go wrong as a result of the performance of this task?” For example, there is a higher than average probability (chance) of injury when manhandling heavy material whereas there is a less than average probability of injury when stacking small items in an equipment store. Since, for the sake of simplicity, only the most likely loss is considered when evaluating severity, it follows that only the probability of that particular loss should be considered.

A scale of from $-1$ to $+1$ is used as follows:

- $-1$ Less than average probability of loss.
- $0$ Average probability of loss.
- $+1$ Greater than average probability of loss.

The scale can be extended if desired. The points allotted to each of the three parameters are then added to indicate a scale of criticality ranging from 0 to 10. It is, in effect, an order of priority. Management may decide that all tasks allotted less than, say 3 points, will be disregarded from a loss control point of view and not be listed as critical tasks, whereas tasks allotted 8 or more points will be regarded as the most critical tasks requiring immediate and constant attention.

17.12.1.4 Identification of tasks requiring procedures, standards or rules
Once all critical tasks have been identified the next step is to identify those for which procedures, standards or rules should be established to control potential loss. A standard is a description or specification of the completed task. A procedure is a step by step description of how the task is accomplished and it is written in sufficient detail to suit the purpose for which it is intend-
ed. It is a tool for teaching employees the most systematic way to do a critical task consistently with maximum efficiency. Some tasks, particularly those performed by a skilled artisan, may not require a standard or a procedure but only a few task rules. Other tasks may require both a standard and rules. If a procedure is required, all necessary rules and standards are included since the procedure describes every step (Chamber of Mines of South Africa, International Safety Rating Manual, February 1984).

17.12.1.5 Task analysis
Having identified the tasks which require procedures, all important aspects of a task must be considered and evaluated in order to determine one unified procedure for doing the task the correct way. This is achieved by task analysis. The four steps representing the basic framework for doing a task analysis are:

- Determine the critical task to be analysed.
- Break the task down into an orderly sequence of steps.
- Determine the potential for incidents (loss exposures).
- Make an efficiency check of each task step. (Is there not a better, safer or more effective method?)
- Develop recommended controls.

If required, a complete and detailed task procedure can now be drawn up and used to develop lesson plans for skill training purposes. Experience has shown, however, that the information contained in the task analysis worksheet will usually suffice for task observation, information and lesson plan development. A specimen of a task analysis worksheet for adding cyanide to a pachuca is shown in Figure 17.10.

In the initial stage of the programme introduction, large numbers of tasks will be identified which require procedures to be written or revised. This work should be scheduled and priorities set for procedures. Loss control staff must provide the necessary advice and guidance to line management when this is done. Whenever a serious incident occurs, the appropriate procedure, standard or rule should be reviewed and where necessary revised. It is important that procedures, standards and rules and the changes thereto be communicated to supervisors and workers. The training department plays a vital role in this regard and many lesson plans used for formal training courses originate from task procedures. Procedures, standards and rules are available to literate employees in all control rooms, and illiterate employees are briefed by their supervisors on what is relevant to their jobs.

17.12.1.6 Critical task inventory summary
Some of the tasks performed by a gold plant technical official appear on the inventory summary in Figure 17.11.

The criticality of each task has been determined. It is convenient to make use of the summary to include other factors which have an influence on safety and efficiency whilst the task is performed. These are training requirements, personal protective equipment, eyesight and hearing tests.
LOSS CONTROL AND SAFETY MANAGEMENT

Figure 17.10. Typical task analysis worksheet.

**METALLURGICAL DIVISION**

<table>
<thead>
<tr>
<th>STEP NO.</th>
<th>SEQUENCE OF TASK STEPS</th>
<th>LOSS EXPOSURES (Safety, Health, Equipment Damage, Production Loss, Grade)</th>
<th>RECOMMENDED CONTROLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Person performing the task to wear appropriate protective equipment.</td>
<td>Personal injury.</td>
<td>Ensure that person performing the task is clad with all the appropriate protective equipment before commencing with task.</td>
</tr>
<tr>
<td>2.</td>
<td>Start cyanide pump (see Standard Procedure).</td>
<td>Damage to pump if started incorrectly.</td>
<td>Adhere strictly to starting procedure.</td>
</tr>
<tr>
<td>3.</td>
<td>Fill metering tank with cyanide.</td>
<td>No loss exposure (tank totally enclosed).</td>
<td>No loss exposure.</td>
</tr>
<tr>
<td>4.</td>
<td>Check that cyanide pump stops when metering tank is full and reset automatic stop switch after pump stopped.</td>
<td>Waste of reagents as contents of metering tank will overflow into pachuca if pump is not stopped.</td>
<td>Ensure pump has stopped. Check visually.</td>
</tr>
<tr>
<td>5.</td>
<td>Ensure correct amount of slime in pachuca.</td>
<td>Waste of reagents, Insufficient dissolution of gold.</td>
<td>Ensure pachuca level is correct. Re-check measurement.</td>
</tr>
<tr>
<td>6.</td>
<td>Check slime pH (must be 10.5 or more).</td>
<td>Waste of reagent and personal injuries through cyanide gas if pH is below 10.5.</td>
<td>Ensure pH is correct. Check and re-check.</td>
</tr>
<tr>
<td>7.</td>
<td>Ensure agitation is adequate.</td>
<td>Inadequate agitation will result in inadequate dissolution of gold.</td>
<td>Check agitation visually.</td>
</tr>
<tr>
<td>8.</td>
<td>Open valve to empty cyanide contents from metering tank into pachuca.</td>
<td>Insufficient dissolution of gold if all cyanide in metering tank is not added.</td>
<td>Ensure that correct amount was added by conducting a titration test (see procedures for cyanide titration).</td>
</tr>
</tbody>
</table>

**PROTECTIVE EQUIPMENT TO BE WORN**

- Full face shield
- Elbow length PVC gloves
- Acid resistant overalls
- Boots

*Note: Air line respirator to be available.*
Figure 17.11. Typical summary record of a critical task inventory.

<table>
<thead>
<tr>
<th>METALLURGICAL DIVISION</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical</td>
<td>Decant a Merrill filter</td>
</tr>
<tr>
<td>Official</td>
<td>Recover amalgam</td>
</tr>
<tr>
<td></td>
<td>Prepare a cascade trolley for gold pour</td>
</tr>
<tr>
<td></td>
<td>Weigh gold bar</td>
</tr>
<tr>
<td></td>
<td>Acid treat gold slime</td>
</tr>
<tr>
<td></td>
<td>Acid treat Merrill filter</td>
</tr>
<tr>
<td></td>
<td>Add cyanide to pachucas</td>
</tr>
<tr>
<td></td>
<td>Coat Merrill filter</td>
</tr>
</tbody>
</table>

*Refer to table below for particulars of items and codes

<table>
<thead>
<tr>
<th>PERSONAL PROTECTION EQUIPMENT CODE</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Protective Equipment</th>
<th>Code</th>
<th>Protective Equipment</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard hat</td>
<td>A</td>
<td>Standard overall</td>
<td>J</td>
</tr>
<tr>
<td>Clear goggles/face shield</td>
<td>B</td>
<td>Rubber suit</td>
<td>K</td>
</tr>
<tr>
<td>Shaded goggles/face shield</td>
<td>C</td>
<td>Acid resistant overalls</td>
<td>L</td>
</tr>
<tr>
<td>Welding helmet</td>
<td>D</td>
<td>Red reflective jackets</td>
<td>M</td>
</tr>
<tr>
<td>Sand blast helmet</td>
<td>E</td>
<td>Numo jacket: Black PVC</td>
<td>N</td>
</tr>
<tr>
<td><em>Gloves:</em> Elbow length PVC</td>
<td>F1</td>
<td>Apron: Full length leather</td>
<td>O</td>
</tr>
<tr>
<td>Short length</td>
<td>F2</td>
<td>Safety belt and chain</td>
<td>P</td>
</tr>
<tr>
<td>Long leather</td>
<td>F3</td>
<td>Ankle spats</td>
<td>Q</td>
</tr>
<tr>
<td>Short leather</td>
<td>F4</td>
<td>Respirator</td>
<td>R</td>
</tr>
<tr>
<td>Long rubber</td>
<td>F5</td>
<td>Hearing protection device</td>
<td>S</td>
</tr>
<tr>
<td>Short rubber</td>
<td>F6</td>
<td>Dust coats</td>
<td>T</td>
</tr>
<tr>
<td>Approved boots/shoes</td>
<td>G</td>
<td>Butcher aprons</td>
<td>U</td>
</tr>
<tr>
<td>Rubber gumboots</td>
<td>H</td>
<td>Air line respirator</td>
<td>V</td>
</tr>
<tr>
<td>Rubber leg guards</td>
<td>I</td>
<td></td>
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</tr>
</tbody>
</table>
17.13 Planned Task Observations

Planned task observation is a proven technique which enables a supervisor to know whether or not a worker is performing all aspects of a specific task with maximum efficiency. Maximum task efficiency means greater and safer production at lower costs. Observations of substandard performance provides warning to take corrective action before downgrading incidents occur.

There are basically two types of task observations, namely the informal observation and the planned observation. The informal observation is done by a supervisor as he goes about his routine activities. He naturally looks at tasks being performed by the workers and will on occasions notice unsafe acts, but in fact these informal and casual observations are usually quite haphazard and are of little value. The planned observation, however, is a purposeful activity which requires time to observe a task in a systematic way. It is not done informally nor simultaneously with some other duty or activity.

An effective planned task observation programme will indicate to management the degree of worker compliance with the authorized task procedures with special emphasis on personal injuries. It will highlight if existing training procedures no longer meet the practical on-the-job requirements. The programme must ensure systematic coverage of the tasks which have been included in the critical task inventory summary, starting with the most critical and proceeding on a diminishing priority basis to the less critical. It must be flexible to enable observations on problem areas revealed by the incident analysis to be done whenever necessary. Priority must be given to observing the task performance of the new employee as well as the poor performer and the known risk-taker.

The observations should be done by the foremen and technical officials in charge of workers and should not as a matter of routine be delegated to a staff department such as industrial engineers. Details of how a planned task observation should be conducted are:

Select the worker and task. This could be influenced by accident trends, a new worker engaged in the section or a programmed routine observation.

Prepare for the observation. The supervisor should refer to the previous observation done on the worker and the task and must be completely familiar with the sequenced steps to be followed, special tools, safety or other equipment to be used. This information is available in the procedure and on task analysis worksheets. The worker should be advised that he will be observed whilst doing the particular task.

Making the observation. The supervisor must give the observation his undivided attention and should make notes of any deviations from the authorized procedure. Only if the worker is doing something that seriously endangers himself or others or if a process is likely to be affected must he be interrupted.

On completion of the observation the supervisor should discuss any deviation and other salient points with the worker and complete the planned task observation record shown in Figure 17.12.
Figure 17.12. Sample record sheet for observations on planned tasks.

**METALLURGICAL DIVISION**

<table>
<thead>
<tr>
<th>Date</th>
<th>Task observed</th>
<th>Working place observed</th>
<th>Person observed</th>
<th>Observer</th>
<th>Deviations</th>
<th>Reasons for deviation and action to ensure future compliance</th>
<th>Suggested improvements in procedures, training, tools, equipment and material</th>
<th>Superior sign</th>
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</table>
LOSS CONTROL AND SAFETY MANAGEMENT

To enable management to direct corrective action at the most important areas, a quarterly analysis of deviations from authorized procedures, the reasons therefor and the suggested improvements in procedures, training, tools and equipment is done for the discussion at the senior steering committee meetings.

17.14 Engineering and Purchasing Controls

The prime objective of this activity is to ensure that in the design stage of equipment, plant or processes, exposures to hazards and injuries are eliminated or controlled. In addition, good design will optimize maintenance of plant and equipment and facilitate production at the planned rate.

A checklist is used which itemizes the important points to be considered by competent persons and is designed to review the most common hazards. It does not preclude other hazards. The intent is to focus attention on the potential risks to employees who will operate the equipment or work in the plant area. Engineering provisions will be made in the design to eliminate or reduce to a minimum any dangers to the health and safety of the employees.

Before final approval by the Manager Engineering, designs of new or modifications to existing buildings, structures and equipment will be scrutinized by the following persons: design engineer, plant engineer, chief engineer plants, firemaster, security officer, environmental officer, and loss control officer.

Designs are checked to ensure compliance with mechanical, electrical, civil and structural engineering standards and Mines and Works regulations. Other areas considered are acoustics, radiation, ergonomics, fire protection and security.

Construction of new plants and major modifications is usually undertaken by outside contractors rather than mine labour. A procedure to be followed by contracting firms whilst working in the metallurgical plants is included in the tender documentation. Before construction work begins, the senior site engineers should be briefed by the loss control officer on their responsibilities in respect of the safety programme.

The purchasing function must be included in the programme to ensure that no items are issued which do not have established purchasing specifications. Rigid quality control examinations of items both at the manufacturing stage and on delivery to the users are necessary to ensure that losses which can arise from using inferior equipment, tools or chemicals are minimized.

17.15 References


APPENDIX 17.1
Checklist for General Planned Inspection and Physical Condition Ratings

Hazard Potentials

"A" — Extensive or permanent disability = Immediate action required

"B" — Disruptive, serious injury = Scheduled to be rectified as soon as possible

"C" — Minor or near losses = Scheduled for a later date

***

The following is a brief description of what the rating team will scrutinize during inspections:

1. **Premises and surroundings**
   1.1 *Building Clean and in Good State of Repair*
   1.1.1 Gutters, sheeting, doors, hinges and windows in good order.
   1.1.2 Broken windows removed completely to eliminate immediate danger.
   1.1.3 Broken window panes near electrical equipment must be replaced immediately.
   1.2 *Walking Surfaces, Elevated Walking Surfaces and Roads Clean and in Good State of Repair*
   1.2.1 Floor openings covered.
   1.2.2 No tripping and slipping hazards, e.g. loose boards, holes, grease or oil or any other substance that may cause slipping.
   1.2.3 Trenches of up to 150 mm in depth must be curved on both sides and trenches in excess of 150 mm must be covered or handrails erected.
   1.2.4 Elevated walking surfaces in excess of 0.5 metre above normal immediate surroundings must be guarded with handrails.
   1.3 *Good Lighting — Natural and Artificial*
   1.3.1 Windows clean.
   1.3.2 The standards of illumination in all sections of the plants will be determined by the Environmental Control Department in conjunction with the Plant Superintendent in day and night conditions. The Environmental Control Department will be required to do an illumination measurement during April and October, each year and produce a report of the results. Evaluation will be based on the results of the above reports against the set standards. In case of any deviation from the set standards, remedial action must be taken followed by a remeasurement of the specific area.
   1.3.3 Surveys conducted by competent persons appointed in writing by the Plant Superintendent will be acceptable.
   1.4 *Ventilation, Heating and Dust Control*
   1.4.1 Extraction fans available where required.
   1.4.2 The maximum permissible dust limit is 200 particles per ml. The Environ-
mental Control Department will be required to take dust measurements during January, April, July and October and produce a report of the results. Evaluation will be based on the results of the quarterly report against the set standards. In case of any deviation from the set standards, remedial action must be taken followed by a remeasurement of the specific area.

1.4.3 Steam Pipes — Leaking steam pipes, valves and flanges having the potential to cause injuries to persons must be barricaded off and made safe until repairs can be effected.

1.5 Noise Control
1.5.1 The maximum equivalent noise exposure is 85 dB.
1.5.2 The Environmental Control Department will be required to take noise level measurements on all sections of the plant during April and October and produce a report of the results.
1.5.3 Areas above 85 dB must have the appropriate symbolic signs displayed at all main entrances of the buildings.
1.5.4 Any person working in such areas permanently must wear ear protection at all times.
1.5.5 Surveys conducted by competent persons appointed in writing by the Plant Superintendent will be acceptable.

1.6 Aisles and Storage Demarcation
1.6.1 Aisles, pathways, roadways, storage areas and areas in front of switchgear and remote controls must be suitably demarcated.
1.6.2 These areas must be kept clear.
1.6.3 A “No Parking” area of 1m² in front of all open element type heaters to be demarcated with yellow lines.

1.6.4 Colour Codes
(a) White
   Indicates travelling areas; normally no work should be done nor should any stacking or storing be permitted in these areas.
(b) Green
   Indicates storing areas. Should only be used where material and equipment is stored on a permanent basis.
(c) Yellow
   Indicates “No Parking and No Storing Areas” and is normally used where access is required in an emergency, e.g. Fire Extinguishers, Emergency Exit Doors, Remote Switches, Electrical Switchgear and Distribution Switch Boxes and also in front of open element type heaters to prevent the storing of any combustible materials in front of the heaters.
(d) Grey
   Indicates working areas and is normally used in workshops.

Please Note: The above colours are specific for demarcations according to Managerial Instructions and should not be used for decorative painting on floor areas inside the plants.
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1.7  Good Stacking and Storage Practices
1.7.1 Corners of stacks to be bonded.
1.7.2 Stack stable and height of stack restricted to three (3) times the base.
1.7.3 Non-compatible materials stored separately.
1.7.4 Heavy articles to be stored on lower shelves.
1.7.5 Stacking of materials must be done in such a manner as to avoid the necessity for climbing over stacked articles. (Easily accessible from walkways.)

1.8  Plant and Yard Clear of Superfluous Materials
1.8.1 Scrap sent to salvage yard.
1.8.2 Rubbish sent to dumping site.
1.8.3 Re-usable items sent to storage area.

1.9  Scrap and Refuse Bins Removal and Disposal
1.9.1 Sufficient bins for scrap and waste.
1.9.2 Mantles changed regularly when full.
1.9.3 Mantles not overfilled.

1.10 Colour Coding
1.10.1 Colour coding board depicting all the various colours in words and in colour.
1.10.2 Boards prominently displayed.
1.10.3 Colour codes adhered to.

1.11 Guarding Around Tips, Tanks, Platforms and Pebble Bins
1.11.1 Effectiveness of guards.
1.11.2 Platforms or landings above 2 m high fitted with kickboards of 100 mm. Kickboards must be flush with the walking surface.
1.11.3 Handrails installed to a minimum height of 900 mm above the walkway surface and kneerails at 450 mm.

2.  Electrical, mechanical and personal safeguarding
2.1  Machine Guarding
2.1.1 Pinch points guarded.
2.1.2 Gears, couplings and “V” Belts totally enclosed.
2.1.3 Insides of guards and areas that are to be protected painted ORANGE (where applicable) so that when a guard is removed it will be obvious.
2.1.4 Guards securely bolted in position.
2.1.5 All drives securely guarded (handrails not acceptable).

2.2  Lock-out System and Usage
2.2.1 Switches fitted with effective locking-out devices and padlocked while employees work on equipment, regardless of being isolated in substations.
2.2.2 Tripwires fitted to both sides of conveyors for the full length and in good working order.
2.2.3 To prevent unauthorized use of machinery in workshops, all units must be locked out in the absence of the artisan.

2.3  Labelling of Switches and Isolators
2.3.1 Switches and isolators clearly labelled to eliminate any possibility of confusion.
2.3.2 Isolators labelled on both back and front of the panel.
2.4  
**Ladders and Stairs — Numbered and Recorded**
- Portable ladders numbered and records kept of monthly inspections.
- No portable wooden ladders are allowed in any section of the plant other than smelthouses and electrical substations.
- Vertical ladders above 2 m enclosed with a cage.
- Vertical ladders without landings barricaded at the top.

2.5  
**Lifting Gear, Crawls, Hoists, Slings and Records**
- Coffin hoists, chain blocks and rope tackles clearly numbered and records kept of monthly inspections.
- No manilla rope will be used.
- Slings marked with their safe working loads, either by means of paint or ferrules (if painted, a notice board should be erected at sling storage areas indicating colour for S W L).
- Crawl beams painted ORANGE and “Safe Working Load” painted on web of beam, e.g. S W L 2 Ton. Safety stops fitted. All crawls to be numbered and records of inspections kept.
- Hooks pop marked (both sides), checked, records kept of these checks and latches in order where applicable.
- The standard checklist for scaffold planks must be used. Checks carried out monthly and records kept.

2.6  
**Hand Tools — Condition of Hammers, Chisels, Etc.**
- No split hammer handles or burred heads.
- No mushroom head tools.
- Tools clean and in good condition.
- Standard of tool storage.

2.7  
**Welding Equipment, Cutting Torches, Hoses and Flash-Back Arrestors**
- Welding machines numbered, checked and records of inspections kept.
- Welding plug and feeder cable in a good state of repair (no joints).
- Welding cables free of bolted joints and in a good state of repair.
- No open wires protruding from the holder.
- Oxygen and acetylene trolleys equipped with fire extinguishers (9 kg). The portapack oxygen and acetylene sets require a 2,5 kg fire extinguisher.
- Oxygen and acetylene bottles including portapacks fitted with flash-back arrestors, as near to the bottles as possible.
- Oxygen and acetylene bottles on trolleys must be secured.
- Condition of hoses and gauges. (Only approved brass connectors permitted.)
- Approved oxygen and acetylene bottle trolleys to be used for transporting purposes.
- Only AFROX recommended pipe clips to be used for tying oxygen and acetylene pipes together.
- The key to close off gas bottles must be kept in position on acetylene bottle whenever this apparatus is in use.
- Controls of oxygen and acetylene bottles must be closed when not in use or when left unattended for any extended length of time.
- Welding protection screens available in workshops and in good condition.
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2.8  Operating Equipment — Valves, Handwheels and Master Valves
2.8.1 Operating equipment in good order, e.g. handwheels, chute handles, launder isolators, etc.
2.8.2 Master valves identified and records kept of monthly inspections as per standard checklist.
2.8.3 Master valve location plans displayed at strategic places.
2.8.4 Master valves easily accessible.
2.8.5 Bulk hazardous chemicals, steam and compressed air lines to be fitted with master valves.

2.9  Grinding Equipment
2.9.1 Notice at the grindstone indicating the RPM and the appropriate symbolic sign pertaining to the wearing of safety goggles.
2.9.2 Goggles available at grindstone at all times.
2.9.3 Tool rest parallel with the centre of the stone and a maximum of 3 mm away from the stone.
2.9.4 Stone free of glazing and loading. No evidence of side grinding. Stones not in standard condition to be removed from grinder.

2.10  Hazardous Chemicals and Old Explosives Storage
2.10.1 "A Class" — Hazardous Chemicals

<table>
<thead>
<tr>
<th>Requirements</th>
<th>NaCN</th>
<th>NaOH</th>
<th>HCl</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Bund Walls</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>(b) Security Fence</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>(c) No Smoking Signs</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>(d) No Naked Flame Signs</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>(e) Two × 9 kg Fire Extinguishers</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>(f) Appropriate Symbolic Signs WW4, WW5</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>(g) Notices re Protective Clothing to be Worn</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>(h) Demarcation where applicable</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>(i) Persons to be Conversant with First Aid Treatment for these Chemicals</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>(j) All Areas that require a security fence must be locked when not in immediate use</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

(k) The following symbolic signs to be displayed whilst offloading hazard chemicals:
- No Entry Sign PV6
- Warning of Corrosion WW4
- Warning of Poisonous Substances WW5
2.10.2.1 The appropriate symbolic signs must be displayed at all possible entrance routes to hazardous chemical installations.

2.10.2.2 Flanges on delivery lines of all bulk hazardous chemical pumps to be covered to prevent spraying out of contents in the event of a leak occurring.

**Notes**

- The bund wall requirements for cyanide, caustic soda and hydrochloric acid area:
  - **Cyanide**
    - Must be able to hold the total contents of the bulk installation.
  - **Caustic Soda**
    - Must be able to hold the total contents of bulk installation.
  - **Hydrochloric Acid**
    - Must be able to hold the total contents of bulk installation.

**Old Explosives Storage**

A plan to be posted up indicating the following:

- Position of boxes.
- The number of fire extinguishers required and distances away from boxes.
- Type of extinguishers to be used.
- The number of “No Smoking” and “No Naked Flame” symbolic signs required and location thereof.

2.10.2.2 Detonator and cartridge explosives boxes must be of robust construction and manufactured from non-metallic material.

2.10.2.3 Kept locked at all times.

2.10.2.4 Boxes must be numbered and records kept.

2.10.2.5 Boxes must be painted RED.

2.10.2.6 Boxes must be clearly marked “Old Explosives” or “Detonators”.

### Flammable Substance Stores

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Flammable liquid stores</th>
<th>Gas stores</th>
<th>Diesel</th>
<th>Paraffin</th>
<th>HTH</th>
<th>Methanol</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Bund Wall</td>
<td>N/A</td>
<td>N/A</td>
<td>Yes</td>
<td>Yes</td>
<td>N/A</td>
<td>Yes</td>
</tr>
<tr>
<td>(b) Security Fence</td>
<td>N/A</td>
<td>N/A</td>
<td>No</td>
<td>Yes</td>
<td>N/A</td>
<td>Yes</td>
</tr>
<tr>
<td>(c) No Smoking Signs</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>(d) No Naked Flame Signs</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>(e) No Unauthorized Entry Signs</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>(f) 2 x 9 kg Fire Extinguishers</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
## THE EXTRACTIVE METALLURGY OF GOLD

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Flammable liquid stores</th>
<th>Gas stores</th>
<th>Dieselene</th>
<th>Paraffin</th>
<th>HTH stores</th>
<th>Methanol</th>
</tr>
</thead>
<tbody>
<tr>
<td>(g) Drip Trays (where applicable)</td>
<td>Yes</td>
<td>Yes</td>
<td>N/A</td>
<td>Yes</td>
<td>Yes</td>
<td>N/A</td>
</tr>
<tr>
<td>(h) Trestles for Drums (where applicable)</td>
<td>Yes</td>
<td>Yes</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>(i) Aisles and Storage Areas to be Demarcated</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>N/A</td>
<td>N/A</td>
<td>Yes</td>
</tr>
<tr>
<td>(j) Stacking and Storing Neat and Safe</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>N/A</td>
<td>N/A</td>
<td>Yes</td>
</tr>
<tr>
<td>(k) New Gas and Flammable Liquid Stores to be Constructed in Compliance with Managerial Instructions</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>N/A</td>
<td>N/A</td>
<td>Yes</td>
</tr>
<tr>
<td>(l) Oxygen and Acetylene Bottles must be stored separately</td>
<td>N/A</td>
<td>N/A</td>
<td>Yes</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>(m) All Cylinders to be secured in upright position (both empty and full bottles) and clearly marked “full” or “empty”</td>
<td>N/A</td>
<td>N/A</td>
<td>Yes</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>(n) All Stores and Areas which require a fence must be locked when not in use</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>N/A</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### Notes

1. Bund wall requirements are as follows:
   - **Dieselene**
     - Holding the total contents of the bulk installation.
   - **Paraffin**
     - Holding the total contents of the bulk installation.
   - **Methanol**
     - Holding the total contents of the bulk installation.
LOSS CONTROL AND SAFETY MANAGEMENT

2. Oil pump stations at Crusher Plants to be equipped with symbolic signs and fire extinguishers as for oil stores.
3. All permanently fitted diesel and paraffin storage tanks will be classed as bulk storage areas.
4. Acetylene cylinders used at On Line Gold Analyser (OLGA) machines to be stored as per gas store standards, i.e. enclosed with fire extinguishers available and the appropriate symbolic signs displayed.
5. Appropriate symbolic signs to be displayed at all OLGA machine rooms, for warning against flammable gases, as well as the required number of fire extinguishers.
6. Oxygen and acetylene sets normally used in instrumentation workshops must be stored outside the building as per gas store specifications.
7. Handy gas bottles at acid plants and laboratories must be stored as per standard.
8. Rubber Lining Stores and Workshops
   8.1 Only Class 1, Division 2 electrics will be allowed in rubber lining stores and workshops.
   8.2 No heaters will be allowed in the rubber lining stores and workshops.
   8.3 Offices inside a rubber lining workshop can be equipped with a heater providing it is not an open bar type.

2.12 Portable Electrical Equipment
2.12.1 All electrical equipment to be fitted with pinplugs, numbered and records of monthly inspections kept in a record book (i.e. drilling machines, disc grinders, extension leads, etc.). Inspections to be done according to a checklist which must be available in the book.
2.12.2 Urns, heaters, etc. in good order (no joins in flexible cords) and records kept of monthly inspections. Heaters to be permanent fixtures.

2.13 Earth Leakage Relays – Permanent and Portable
2.13.1 Records of monthly inspections to be kept.
2.13.2 Where permanent, the office location must be recorded in the monthly inspections book.
2.13.3 Where portable, the unit must be numbered and recorded in the monthly inspections book.

2.14 Vehicles, Dump Trucks, Forklifts and Rail Transport

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Front end loaders</th>
<th>Forklifts</th>
<th>Dumper cars</th>
<th>Tractors</th>
<th>LDVS</th>
<th>Shunters</th>
<th>Locos</th>
<th>Jumbos</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roll Over Bar</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Seat Belts</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>2.5 kg Fire Extinguisher</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Pre-use Checklist</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
(a) Safety belts must be worn on all vehicles which are equipped with them.
(b) Notices to be fitted to vehicles if passengers are permitted. Number of passengers to be specified.
(c) If passengers are permitted, seats and seat belts to be fitted and used.
(d) Pre-use checklists available on vehicles and correctly completed by drivers.

2.15 General Electrical Installations
2.15.1 Cables properly suspended. Disconnected cables must be starred and taped.
2.15.2 Cable glands secure and armouring well earthed in gland.
2.15.3 Sprag tubing intact and not unravelled.
2.15.4 Double adaptors being used correctly, i.e. not exceeding 15 amps.
2.15.5 Instrument panels locked (regardless of voltage).
2.15.6 Holes where circuit breakers and cables have been removed closed with grommets.

2.16 Substations
2.16.1 Notices to be displayed:
   (a) No unauthorized entrance (on all doors).
   (b) Procedures in case of fire.
   (c) Treatment for electrical shock.
   (d) Unauthorized persons prohibited from working on electrical apparatus.
   (e) “Danger” symbolic sign (Flash signs) on all doors.
2.16.2 Tap switches on transformers locked.
2.16.3 Transformers fenced or enclosed as per regulation, with no unauthorized entrance and “danger” symbolic signs posted.
2.16.4 A plan to be posted up outside the substation indicating the types of fire extinguishers, the number required and their position.
2.16.5 Substations with two doors or more must have an emergency door which can be easily opened from the inside.
   Outside locking devices on emergency doors must be removed.
2.16.6 Substation emergency exit doors to be demarcated a “No Parking” zone to cover at least the width and radius of travel of the door.
2.16.7 Inspection records of substations available.

2.17 Personal Protective Equipment
2.17.1 Wearing of personal protective equipment enforced.
2.17.2 Respirators used where necessary.
2.17.3 Hard hats to be worn in the plant area at all times except in offices.
2.17.4 Records of equipment issues available.
2.17.5 Symbolic signs used to indicate particular equipment or clothing to be worn in specific areas or workshops.

3. Fire Protection
3.1 Plans
3.1.1 Fire hydrant plans posted up in conspicuous places and including position of fire station and first-aid stations.
3.2 Fire Hazard Control
3.2.1 Flameproof equipment to be used in flammable areas.
3.2.2 Emergency telephone numbers displayed at P T telephones.
3.2.3 Outside contractors supplied with fire extinguishers by the General Engineering Supervisors.
3.2.4 No unauthorized fires allowed in the plant area.
3.2.5 No tapping-off of any fire service to be allowed.
3.3 Overinspections by Senior Personnel
Overinspections are to be conducted by:
3.3.1 Metallurgical Superintendents and Plant Engineers — quarterly.
3.3.2 Plant Superintendents, Plant Production Superintendents and Engineering Supervisors — monthly.
3.4 Area: Demarcated and Clear, Extinguishers and Hydrants Accessible
3.4.1 Extinguisher positions indicated.
3.4.2 Extinguishers properly maintained, i.e. 1.5 m from floor to base of extinguisher.
3.4.3 Fire hydrants demarcated.
3.5 Maintenance of Extinguishers, Hydrants and Fire Carts
3.5.1 Extinguishers and hydrants checked monthly and records kept. (Hydrant pressures 4 to 5 bar.)
3.5.2 Extinguishers screened three-monthly and inspection records updated, both on extinguishers and in a record book.
3.5.3 Foam and equipment available on fire cart.
3.5.4 CO₂ cartridges weighed every 3 months and records kept.
3.5.5 Checklists available on fire carts and in fire boxes and contents checked daily.
3.5.6 Only B.C.F. type Fire Extinguishers to be used in OLGA machine rooms.
3.6 Fire Alarm System
3.6.1 Fire alarm clearly understood by all employees.
3.7 Fire Drill and Instructions on the Use of Extinguishers
3.7.1 Employees must know how to operate a fire extinguisher.
3.7.2 Fire drills to be held monthly and records kept of the results.
4. Loss Control
4.1 Knowledge of:
Loss Control Policy Statement
Safety Promotion Topic
Colour Coding
Symbolic Signs
Quebec Safety System — 5 Point
2 Notice Board Indicating Injury Experiences
2.1 Strategically positioned notice board indicating the previous best performance and the current position of injury experience.
Poster Programme — Safety, Statutory and Symbolic Signs
1 Posters must support current safety topic.
2 One topic promoted at a time.
3 Loss Control Policy — prominently displayed.
4 Only the appropriate (international) Safety and Symbolic Signs used unless
THE EXTRACTIVE METALLURGY OF GOLD

otherwise specified by Management.

.4.4 Bulletin Boards
4.4.1 Boards illuminated and uncluttered and the following displayed:
   Manager's Policy
   Plant-wide Rules
   Major Loss Announcement
   Safety Promotion Topic
   Poster Promoting the Topic

5. First-aid Treatment
5.1 Availability and Stocks
5.1.1 First-aid stocks checked daily according to a checklist and replenished as required.
5.1.2 Stretchers checked daily according to a checklist.
5.1.3 First-aid boxes positions clearly demarcated.
5.1.4 Cyanide antidotes available where applicable.
5.1.5 Emergency rescue and first-aid equipment available at ammonia storage areas.
5.1.6 Acid, cyanide, ammonia areas equipped with at least one safety shower, with an eyewash fountain and checked weekly.
   Safety shower standards are as follows:
   (a) The shower must be automatically activated when a person steps under it.
   (b) The eyewash fountain should be so situated that the lever is easily accessible.
5.1.7 All safety showers and eyewash fountains must be readily accessible and equipped with appropriate safety symbolic signs, viz:
   Safety Symbolic Sign
   Eyewash Fountain Symbolic Sign.
5.1.8 Notices pertaining to the treatment of the following must be displayed in both official languages in all change-houses and first-aid stations.
   Gassing
   Drowning
   Heat Illness
   Electric Shock