HEALTH SAFETY AND ENVIRONMENT MANUAL

(A GUIDE FOR MEMBERS OF THE SOUTHERN AFRICAN BITUMEN ASSOCIATION)

Introduction

The case for change

Over the past number of years SABITA has developed several HSE documents, codes of practice, processes, etc. to provide information and guidance to support Member Organisations in their efforts to continuously improve HSE performance. These documents have been made available to members as individual publications under various titles and printed formats.

A recent review of the HSE material developed and published by SABITA has revealed that:

- A significant degree of duplication/repetition of information is prevalent across the various documents;
- In some cases the information (especially legal requirements) is outdated;
- Different versions of documents are in circulation and outdated versions could be in use;
- Costs of revision and updating of documents (re-prints by professional printers) will be very high if done regularly as required;

Purpose of this manual

The primary objective of this document is to provide a streamlined and consolidated reference manual that includes all the SABITA HSE publications that have been, and will in future be, developed to support the SABITA HSE Charter and HSE Management System. Further important aims of this manual are:

i) To eliminate duplication and minimize repetition of information;
ii) To publish in a format that will facilitate ease of revision and updating;
iii) To promote easier access to information by providing an internet download facility via the SABITA website;
iv) To ensure only the current up-to-date documents are available for distribution to Members;
v) To minimize the costs of publication and distribution of documents.

Using this manual

For quick navigating through the document:

- Click on **Bookmarks** tab to left of screen
- Scroll over subject headings and click on the heading that you want to view
- Click on + symbol to expand view of subject headings and click on sub-heading to view

Disclaimer

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SECTION 1

SABITA Health, Safety and Environment Charter

This charter depicts a set of objectives that will be used as a framework for developing a schedule of requirements to endorse membership of Sabita and to formulate a certification scheme to incentivise members continually to strive for improved performance on the health, safety and environmental front.

In terms of this charter, all members of Sabita undertake to implement the ***best available techniques*** to protect the health, safety and well being of all employees and conserve the environment during the handling and application of bituminous materials. In order to achieve this objective in the pursuit of corporate proficiency and cost-effectiveness ***all members will undertake to***:

1. ***Be compliant with*** the relevant requirements of South African ***legislation*** and associated regulations on the protection of health and safety of employees and affected parties and the environment.
2. ***Compile a*** written ***company policy*** which creates a health, safety and environmental ethos amongst all employees and embraces the principles contained within this charter.
3. ***Induct*** all new recruits in health, safety and environmental policies and procedures ***and implement schemes to train*** all employees in the risks and hazards associated with the handling and application of bituminous materials and procedures to mitigate exposure to these.
4. Take the necessary steps to protect workers against hazards by ***issuing*** them with the required ***personal protective equipment*** to handle and apply bituminous materials.
5. Identify all health and safety hazards by ***conducting risk assessments*** and developing and implementing safe work practices for all activities involving the handling and application of bituminous materials.
6. ***Report all incidents*** arising from the handling and application of bituminous materials which caused death or injury to workers or people or damage to property or the environment and report measures taken to prevent the incident from recurring.
7. ***Use, manufacture and apply materials and products in a manner which is not harmful*** to the environment or pose a health hazard to workers and communities in the proximity of the site or operation.
8. Reduce the impact of bituminous materials on the environment by ***reducing waste*** through recycling and disposing of waste at approved land fill sites.
9. ***Transport*** bituminous materials ***on vehicles which are legally compliant*** with respect to their condition, payload and driver wellness and loaded in accordance with approved codes of practice and only accept delivery of bituminous materials from vehicles which comply with these requirements.
10. ***Store bituminous binders*** in suitably designed and constructed facilities which will prevent contamination of the ground water sources and do not pose a danger to life or the environment.
11. ***Operate and maintain application plant*** in such a manner that they do not pose a danger to life and that their operation does not impact negatively on the environment.
12. ***Limit*** the generation of ***green house gasses and conserve energy*** during the manufacture and application of bituminous materials in order to preserve the environment for future generations.

Please take note that the conformance to these requirements means operating in accordance with the laws and constitution of South Africa. Sabita undertakes to develop the necessary tools to assist its members in the attainment of these objectives. Non compliance to the above principles could result in the cessation of a company's membership of Sabita.

SECTION 2

Health, Safety and Environment Management System

1. Purpose, Scope, Reference Standards, Custodian & Owner

1.1 Purpose

The objectives of this document are to:

- Provide a management control framework aimed at meeting all Health and Safety standards as agreed in the SABITA HSE Charter and the HSE Certification Scheme
- Outline the processes for the implementation of the SABITA Health, Safety, and Environment Management System (HSE-MS) Core Expectations
- Protect people and assets of SABITA and Member Organisations (MO) against physical risks
- Meet agreed customer service delivery levels, product quality specifications and standards
- Ensure that assets function as designed and that the environmental impact of operations and products meet industry best practice
- Facilitate operation within the framework of statutory requirements
- Facilitate evaluation of operations to an international standard(s) as appropriate

1.2 Scope

This document covers the activities of a "typical" Member Organisation of SABITA during the handling and application of bituminous materials. The SABITA HSE-MS serves as a Generic Template and the expectation is that all SABITA Members shall adopt this system as the minimum standard for managing matters HSE within their own Organisations.

1.3 Reference Standards

During development of this HSE-MS various International, National and Local HSE standards and codes of practice were consulted to ensure that the MS conforms to at least the minimum acceptable principles for Legal Compliance and (in addition) appropriate selected Enhanced Safety Management elements. The following standards and documents were referenced during the development of this HSE-MS:

- BSI – Occupational Health and Safety Assessment Series (OHSAS)
- The Shell Group HSE Control Framework and Downstream procedures for developing an HSE-MS
- The South African Occupational Health and Safety Act, 1993 as amended, and Regulations
- SABITA HSE Charter, version 2
- Guidelines for the Development and Application of Health, Safety and Environmental Management Systems, E & P Forum, Report No. 6.36/210, July 1994

1.4 Chief Custodian – SABITA HSE-MS Generic Template

The chief custodian of this Generic HSE-MS Template is the CEO of SABITA. The responsibilities of the chief custodian are;

- Participating in the development and periodic reviews of this Generic HSE-MS
- Approval of the Generic HSE-MS and any subsequent amendments
- Assuring distribution of the Generic HSE-MS and subsequent revisions and updates to SABITA Members
- Assuring that periodic review (at least annually) takes place and that proposed revisions to this Generic HSE-MS are communicated to Members

1.5 Owner (MO HSE-MS)

When a SABITA Member elects to adopt this HSE-MS the CEO of the relevant Organisation shall accept ownership of the HSE-MS. This role is not to be delegated. The responsibilities of the owner are;

- Where necessary to customise/personalise this HSE-MS Template to ensure it is compatible with the MO Culture and Structure

- Issuing the MO HSE-MS and any revisions under his/her signature
- Demonstrating commitment to HSE management by personal involvement in its implementation

- Giving clear directives on how the HSE-MS is to be implemented and maintained within his/her Organisation
- Communicating proposals for changes to the Generic HSE-MS to the Chief Custodian
- Assigning the custodian for the MO HSE-MS

1.6 Custodian (MO HSE-MS)

The custodian of the MO HSE-MS shall be the most senior person in the MO charged with responsibility for implementation of the MS. The responsibilities of the custodian are;

- Notification to the owner when deficiencies or potential improvements are identified
- Communicating with MO personnel on implementation
- Distribution of the MO HSE-MS and subsequent revisions/updates as appropriate within the MO
- Participating in the development and reviews of the MO HSE-MS

1.7 Updates

Updates of this document shall be approved by the Chief Custodian and the controlled version of the SABITA HSE-MS is held in the Members section of the SABITA website. Printed copies are not controlled and their users should refer to the website version to ensure that they are using the latest revision.

2. Terms, Abbreviations and Definitions

For the purposes of this HSE-MS, the following terms, abbreviations and definitions apply:

Term/Abbreviation	Definition
ALARP	***As Low as Reasonably Practicable***. To reduce a risk to a level which is 'as low as reasonably practicable' involves balancing reduction in risk against the time, trouble, difficulty and cost of achieving it. This level represents the point, objectively assessed, at which the time, trouble, difficulty and cost of further reduction measures become unreasonably disproportionate to the additional risk reduction obtained.
BowTie Methodology	BowTie methodology is a way to analyse, communicate and manage the major risks within an organization. BowTie diagrams are used to demonstrate that hazards are being controlled, and that there is a direct link between the controls and elements of the management system.
Environment	The surroundings and conditions in which a MO operates or which it may affect, including living systems (human and other) therein.
Hazard/s	The potential to cause harm, including ill health or injury; damage to property, plant, products or the environment; production losses or increased liabilities.
HEMP	***Hazards and Effects Management Process***. A systematic process that provides a structured approach for the management of workplace HSE Risks. The HEMP consists of 4 steps: 1. Identify (Hazards/threats/consequences) 2. Assess Risks (To People, Assets, Environment, Reputation) 3. Control (Implement controls to prevent Hazard release) 4. Recover (Implement controls to mitigate consequences)
HSE	***Health, Safety and Environment*** as used in the context of managing the aspects of: ❖ Occupational Hygiene and Safety of persons at work; ❖ The health and safety of persons in connection with the use of plant and machinery; ❖ The protection of persons other than persons at work against hazards to health and safety arising out of or in connection

	with the activities of persons at work; ❖ The protection of the environment against adverse effects arising out of or in connection with the activities of persons at work;
Term/Abbreviation	**Definition**
HSE Critical	Designates activities, tasks, positions (personnel) or measures that have been identified as vital to ensure asset integrity, prevent incidents, and/or to mitigate adverse HSE effects.
HSE Management	Those aspects of the overall management function (including planning) that develop implement and maintain the HSE policy.
HSE-MS	HSE Management System. The collective term for the Member Organisations structure, responsibilities, practices, procedures, processes and resources for implementing HSE management.
HSE-MS Audit	An independent, systematic and documented process of objectively obtaining and evaluating verifiable evidence to determine: ❖ Whether the HSE-MS and its results conform to the audit criteria; ❖ Whether the system is implemented effectively; and ❖ Whether the system is suitable to achieve the health, safety and environmental policy and objectives.
HSE Management Review	The formal review by MO senior management of the status and adequacy of the health, safety and environmental management system and its implementation, in relation to health, safety and environmental issues, policy, regulations and new objectives resulting from changing circumstances.
HSE Strategic Objectives	The broad goals, arising from the HSE policy, that a company sets itself to achieve, and which should be quantified wherever practicable.
HSE Policy	A public statement of the intentions and principles of action of the MO regarding its health, safety and environmental effects, giving rise to its strategic and detailed objectives.
Incident	An event or chain of events which has caused or could have caused injury, illness and/or damage (loss) to assets, the environment or third parties.
Maintain (procedures)	The term ***'maintain' or 'maintenance'*** as used in this HSE-MS should be understood to mean 'establish and maintain' if the procedure which is to be maintained does not yet exist. Establish also means that the procedure shall be documented.
MO	***Member Organisation***. An organisation (Company) engaged, as principal or contractor, directly or indirectly, in the production, storage, transportation and application of bituminous products and is a Member of SABITA.
Monitoring (activities)	All inspection, test and monitoring work related to health, safety and environmental management.
Performance criteria	***Performance criteria*** describe the measurable standards set by MO management to which an activity or system element is to perform. (Some MO may refer to performance criteria as 'goals' or 'targets'.)
Practice	Accepted methods or means of accomplishing stated tasks.
Procedure	A documented series of steps to be carried out in a logical order for a defined operation or in a given situation.
Risk	The product of the likelihood that a specified undesired event (consequence) will occur and the severity of the consequences of the event.
Risk Assessment Matrix	The Risk Assessment Matrix (RAM) is a tool designed to enable a consistent approach to qualitative risk assessment. See Appendix 1 (Hazard Register) for the RAM used for purposes of this HSE-MS.
Significant Incident/s	Designates incidents with (actual or potential) significant adverse

	impact on the achievement of HSE objectives. Such incidents will be rated in the HIGH risk zone of the Risk Assessment Matrix.
Term/Abbreviation	**Definition**
SMART	With reference to HSE targets SMART means: **S**pecific (relating to a clearly defined outcome) **M**easurable (so that progress can be assessed) **A**ppropriate (relevant to the organisation's key issues) **R**ealistic (with the resources and time frame available) **T**ime-bound (by a clearly set out date)
Sustainable business (performance)	***Sustainable business*** means adopting business strategies and activities that meet the needs of the company and its stakeholders today while protecting, sustaining and enhancing the human and natural resources that will be needed in the future.

3. Introduction

The SABITA HSE Charter requires all members of SABITA to implement the best available techniques and to continually strive for improved performance in health, safety and environmental management. This requires that HSE is managed in a systematic manner.

The SABITA HSE Management System is a framework of controls and is the key enabler for achieving ***sustainable business performance and risk management***. This HSE-MS consists of an HSE MS Framework with eight Elements (Figure 1), each of which includes an underlying Core Expectation to be met in the design, and operation of our business activities.

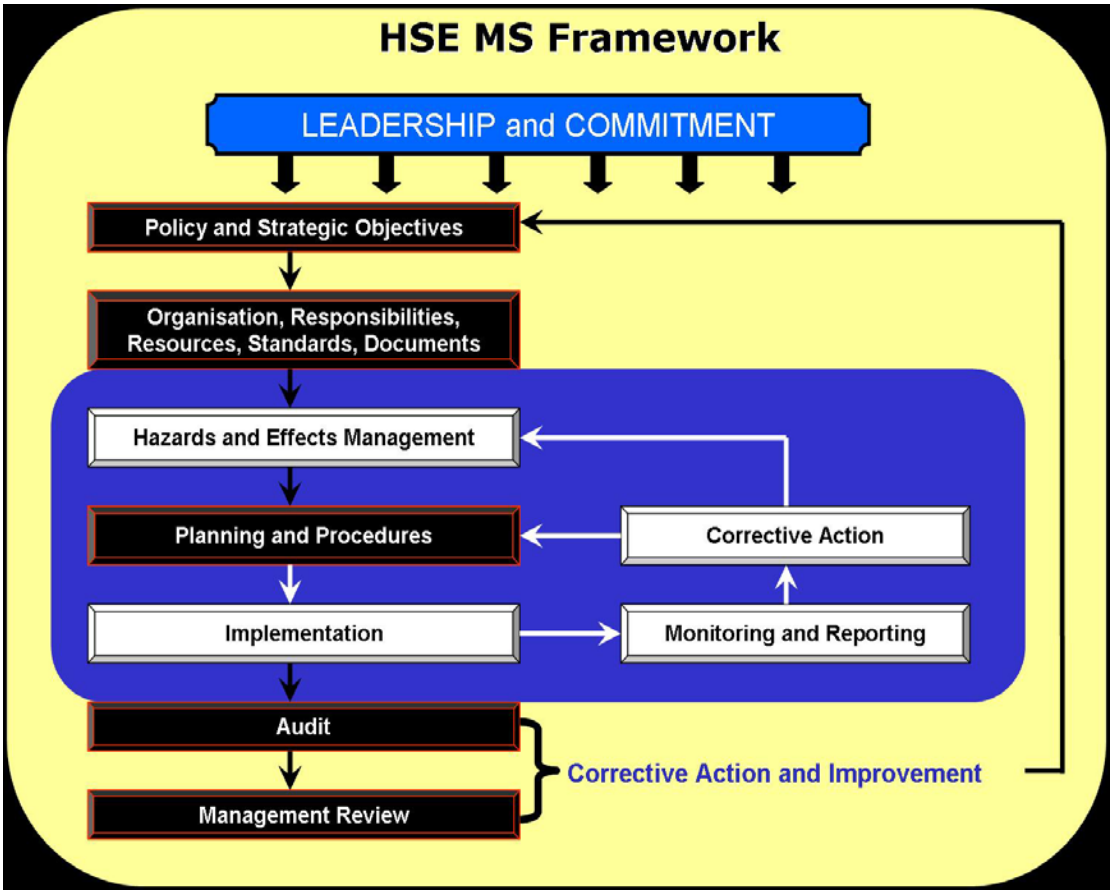


Figure 1 - SABITA HSE MS Framework

In support of each Core Expectation is a list of the processes needed to meet the expectations, and defined performance criteria used to ensure the expectations are met. The elements are aligned to

ensure a logical flow and to maintain the vital feedback cycle all management systems should have to drive continuous improvement.
In pursuit of improved HSE performance SABITA Members will strive, through Sabita's HSE Certification Scheme, to demonstrate adherence to all of the SABITA HSE-MS Core Expectations outlined in this document.

4. SABITA HSE-MS Core Expectations

The following Core Expectations have been adopted by SABITA as the **Critical Success Factors** to achieve ***sustainable business performance***. For each core expectation, SABITA has identified the processes and actions to meet the core expectation, and has defined the criteria to monitor performance. These are described in Section 5.0 of this document.

The underlying principles for design of Core Expectations processes and actions are:
- first and foremost, that the minimum legal requirements are met; and
- secondly, that elements of enhanced HSE management standards and practice are incorporated where necessary to establish and maintain a management system that effectively supports the implementation of best available techniques

4.1 Leadership and Commitment

Create and sustain an organisational culture that supports effective HSE management through appropriate personal behaviour of leaders at all levels

4.1.1 Management demonstrates strong commitment, accountability and visible leadership to HSE through measurable actions

4.1.2 Management ensures HSE-MS expectations are communicated, understood, and implemented at the appropriate levels

4.1.3 Management insists on compliance with applicable laws and regulations, and the requirements of this HSE-MS, and takes appropriate action to correct deficiencies

4.2 Policy and Strategic Objectives

Establish, communicate, and maintain a sound HSE policy and coherent objectives

4.2.1 Establish, communicate, and make available an HSE policy and HSE objectives to all employees and contractors

4.2.2 The Policy shall commit the company to meet or exceed all relevant regulatory and legislative requirements by establishing and implementing specific standards as needed, and applying responsible standards of its own where laws and regulations do not exist

4.3 Organization, Responsibilities, Resources, Standards, & Documents

Establish and maintain an organisation which supports effective HSE management

4.3.1 Design and staff the organisation with competent individuals and sufficient resources committed to the HSE-MS.

4.3.2 Responsibilities and accountabilities defined in the HSE-MS are clearly documented, communicated, and understood at all levels including contractors

4.3.3 HSE standards, manuals and procedures remain current, readily available, and personnel understand the requirements

4.4 Hazards and Effects Management

Provide structured support for a systematic approach to manage HSE Risks

4.4.1 Maintain an inventory of the major hazards; assess the associated risk and develop controls to manage the risk to As Low as Reasonably Practicable (ALARP)

4.4.2 Apply recognised Legal and Industry principles to determine and demonstrate ALARP for all identified HIGH risk hazards

4.4.3 Perform Health Risk Assessments to address HIGH risk physical, chemical, biological, ergonomic and psychological health hazards

4.4.4 Perform Environmental Impact Assessments as necessary

4.4.5 Ensure employees and contractors are aware of the hazards and risks associated with their jobs

4.4.6 Implement a management of change procedure that includes changes to facilities, processes, operations and personnel

4.5 Planning and Procedures

Incorporate HSE management into business plans, work plans and procedures

4.5.1 Set SMART HSE targets for each relevant function and at each level of the organisation in order to demonstrate continuous improvement

4.5.2 Define HSE key performance indicators and establish procedures for reporting and capturing information relevant to the indicators

4.5.3 Incorporate HSE targets into departmental action plans and individual performance contracts for management, employees and contractors

4.5.4 Establish emergency response plans including procedures for review and testing

4.6 Implementation

Implement the HSE-MS processes and, monitor and report on performance

4.6.1 Ultimate accountability for HSE Management rests with the CEO of the MO who shall designate a Senior Manager to assist with implementation of the HSE-MS.

4.6.2 Maintain procedures for reporting and recording information relevant to HSE key performance indicators

4.6.3 Monitor and measure HSE performance and, take corrective action

4.7 Audit

Conduct audits of HSE management and communicate the results effectively

4.7.1 Conduct self-assessments and internal audits to assure compliance internally

4.7.2 Conduct periodic independent audits of the HSE-MS

4.7.3 Executive Management review and endorse audit reports and assign responsibility for close-out of corrective actions

4.7.4 Corrective actions for audit findings of ALL audits are recorded in the MO HSE Remedial Action Plan and tracked to measure progress with implementation and close-out within the assigned time-frames

4.8 Management Review

Management regularly and effectively reviews HSE

4.8.1 Conduct an annual management review of the HSE-MS

5. Processes and actions to meet Core Expectations

HSE-MS Element – Leadership and Commitment

Core Expectation - Create and sustain an organizational culture that supports effective HSE management through appropriate personal behaviour of leaders at all levels

Process and/or actions to meet expectations:

Expectation 4.1.1 - Management demonstrates strong commitment, accountability and visible leadership to HSE through measurable actions:

4.1.1.1 Personal involvement in the review of significant incidents and the audit process

4.1.1.2 Preparation of an annual plan/schedule for Senior Management site HSE visits and inspections

4.1.1.3 Rewarding or recognising good HSE performance and taking appropriate corrective action for poor performance

4.1.1.4 Reviewing HSE performance data at each Executive Management meeting

4.1.1.5 HSE is the first item on the agenda of all Executive Management meetings to ensure that managers are engaged and provide guidance on HSE issues

Expectation 4.1.2 - Management ensures HSE-MS expectations are communicated and understood at all levels of the Organisation:

4.1.2.1 Ensure that individual responsibilities in connection with HSE Policy and HSE-MS expectations are included in the Job Descriptions of each employee

4.1.2.2 Ensure that written and verbal HSE communication takes place in the most appropriate language to assure clear understanding of requirements and individual responsibilities

Expectation 4.1.3 - Management insists on compliance with applicable laws and regulations, and the requirements of this HSE-MS, and takes appropriate action to correct deficiencies:

4.1.3.1 Establish and maintaining a culture of “zero tolerance” towards HSE non-compliance; and

4.1.3.2 Consistently apply a clearly understood process of “consequence management” for HSE non-compliance

HSE-MS Element – Policy and Strategic Objectives

Core Expectation - Establish, communicate, and maintain a sound HSE policy and coherent objectives

Process and/or actions to meet expectations:

Expectation 4.2.1 - Establish, communicate, and make available an HSE policy and HSE objectives to all employees and contractors:

4.2.1.1 Prepare an HSE Policy document (preferably a “one-pager”) signed by the CEO of the MO and effectively communicate the Policy to employees and other interested parties

4.2.1.2 Develop overall Strategic Objectives to support compliance with the Policy, and ensure that specific HSE targets, at appropriate levels in the Organisation, are set and are fully aligned to achieve coherent implementation of the HSE-MS expectations

Expectation 4.2.2 - The HSE Policy commits the Organisation to meet or exceed all relevant regulatory and legislative requirements by establishing and implementing specific standards as needed, and applying responsible standards of its own where laws and regulations do not exist. Demonstration of this commitment will be achieved by:

4.2.2.1 Maintaining a register (list) of Legal Requirements and Mandatory Standards that shall be implemented to comply with the expectations of this HSE-MS

4.2.2.2 Periodic review, by Executive Management, of the HSE Policy and Strategic Objectives to confirm that these remain appropriate to the activities, products and services of the Organisation

HSE-MS Element - Organization, Responsibilities, Resources, Standards, & Documents

Core Expectation - Establish and maintain an organisation which supports effective HSE management

Process and/or actions to meet expectations:

Expectation 4.3.1 - Design and staff the organisation with competent individuals and sufficient resources committed to the HSE-MS:

4.3.1.1 Identify and document HSE critical tasks and positions, and ensure that staff and contractor personnel are competent to perform these tasks

Expectation 4.3.2 - Ensure that responsibilities and accountabilities for HSE Critical tasks are clearly described, communicated, and understood at all levels, including contractors:

4.3.2.1 Document HSE critical positions and the links to HSE critical tasks in the MO Hazard Register

4.3.2.2 Provide, as appropriate, copies as well as training and instructions for compliance with requirements, of the relevant sections of the MO Hazard Register to affected own staff and contractor personnel

Expectation 4.3.3 - HSE standards, manuals and procedures remain current, readily available, and personnel understand the requirements:

4.3.3.1 Maintain an indexed list of relevant Legal Requirements, Standards and Procedures in connection with identified HSE critical tasks and associated hazards

4.3.3.2 Include periodic review of Legal Requirements, Standards and Procedures in the Management of Change Procedure to ensure relevant Standards and Procedures remain current

HSE-MS Element – Hazards and Effects Management

Core Expectation - Provide structured support for a systematic approach to manage HSE Risks

Process and/or actions to meet expectations:

Expectation 4.4.1 - Maintain an inventory of the major hazards; assess the associated risk and develop controls to manage the risk to As Low as Reasonably Practicable (ALARP):

4.4.1.1 Apply the Hazards and Effects Management Process to prepare a MO (company specific) Hazard Register consistent with the SABITA generic template

Expectation 4.4.2 - Apply recognised Legal and Industry principles to determine and demonstrate ALARP for all identified HIGH risk hazards:

4.4.2.1 For all Major Hazards (classified as HIGH risk in the RED zone of the RAM) a documented demonstration of ALARP shall be provided by applying BowTie or equivalent methodology

Expectation 4.4.3 - Perform Health Risk Assessments to address HIGH risk physical, chemical, biological, ergonomic and psychological health hazards:

4.4.3.1 HIGH risk Health hazards included in the Hazard Register, and considered to be **NOT ALARP**, require further in depth analysis (to be performed by an Occupational Hygiene Practitioner) to ensure that the minimum requirements of the Occupational Health and Safety Act are complied with

Expectation 4.4.4 - Perform Environmental Impact Assessments as necessary:

4.4.4.1 The minimum Legal Requirements with regard to the performance of Environmental Impact Assessments shall always be complied with regardless of the results of risk assessments documented in the Hazard Register. For control purposes the results of an EIA shall be referenced, and where necessary, relevant specific control measures for HIGH risk environmental aspects shall be included in the Hazard Register

HSE-MS Element – Hazards and Effects Management (Continued)

Core Expectation - Provide structured support for a systematic approach to manage HSE Risks

Process and/or actions to meet expectations:

Expectation 4.4.5 - Ensure employees and contractors are aware of the hazards and risks associated with their jobs:

4.4.5.1 The Occupational Health and Safety Act, 1993 Section 8 and Section 13 clearly place a firm obligation and duty on an MO CEO to comply with this HSE-MS expectation. These obligations are incorporated as the minimum requirements for this expectation:

Section 8.2. (d) General duties of *employers* to their *employees*
"establish, ***as far as is reasonably practicable***, what hazards to the health or safety of persons are attached to any work which is performed, any article or substance which is produced, processed, used, handled, stored or transported and any plant or machinery which is used in the business and; as far as is reasonably practicable, further establish what precautionary measures should be taken with respect to such work, article, substance, plant or machinery in order to protect the health and safety of persons and provide the necessary means to apply such precautionary measures"

Section 13 (a) Duty to inform
Without derogating from any specific duty imposed on an employer by this Act, ***every employer shall -***
"***as far as is reasonably practicable***, cause every employee ***to be made conversant*** with the hazards to his health and safety attached to any work which he has to perform, any article or substance which he has to produce, process, use, handle, store or transport and any plant or machinery which he is required or permitted to use, as well as with the precautionary measures which should be taken and observed with respect to those hazards"

The expectation is therefore that the Hazard Register, or relevant sections thereof, shall be made available to employees and furthermore used as the main point of reference to determine HSE competencies and facilitate workplace HSE Training (in general) but specifically for employees (including contractors) performing HSE critical tasks.

Expectation 4.4.6 - Implement a management of change procedure that includes changes to facilities, processes, operations and personnel:

4.4.6.1 Establish and maintain a Management of Change Procedure to ensure that permanent or temporary changes to organisation, equipment, plant, materials, standards or procedures and changes associated with laws and regulations are subjected to Risk Assessment to evaluate the potential HSE impacts of the change.

HSE-MS Element – Planning and Procedures

Core Expectation - Incorporate HSE management into business plans, work plans and procedures

Process and/or actions to meet expectations:

Expectation 4.5.1 - Set SMART HSE targets for each relevant function and at each level of the organisation in order to demonstrate continuous improvement:

4.5.1.1 Set HSE targets that include at least some of the following reactive and proactive measures:

% Reduction in Total Recordable Case incidents. KPI = TRCF

# of consecutive days worked without a Recordable Case incident. KPI = DWRC

# of HSE-MS self assessments (whole or part of MS). KPI = % Achieved vs set target

# of workplace inspections per year. KPI = % Achieved vs set target

Achieving SABITA HSE Certification within ..... (specified time frame, months/years)

HSE-MS Element – Planning and Procedures (Continued)

Core Expectation - Incorporate HSE management into business plans, work plans and procedures

Process and/or actions to meet expectations:

Expectation 4.5.2 - Define HSE Key Performance Indicators (KPI) and establish procedures for reporting and capturing information relevant to the indicators:

4.5.2.1 Maintain a register for recording information required for the tracking of performance indicators

4.5.2.2 Determine and assign responsibilities for maintenance of the register

Expectation 4.5.3 - Incorporate HSE targets into departmental action plans and individual performance contracts for management, employees and contractors:

4.5.3.1 Accountability and responsibility for workplace HSE targets and action plans is clearly documented in the following:

- Annual MO declaration of HSE Objectives and Targets (For guidance see Supplementary section to this document)
- Contractor agreements and Health and Safety Plans where applicable
- Annual Performance Appraisal targets of individual employees

Expectation 4.5.4 - Establish emergency response plans including procedures for review and testing:

4.5.4.1 General Emergency Response Planning is dictated by recovery measures identified in the Hazard Register but shall at least include the following specific scenarios as applicable:

- Emergency evacuation of seriously injured persons from remote workplaces to a suitable medical trauma facility
- In situ medical 1st Aid treatment of Bitumen Burns by a suitably qualified person
- Procedures for rapid response and containment of Bitumen spills in remote sensitive Environment areas, including Road Tanker roll-overs
- 1st Aid fire fighting capabilities at remote locations

4.5.4.2 Each anticipated scenario of Emergency Response Plans shall be tested AT LEAST once per year during a planned practical exercise and the results recorded in a documented evaluation report. Plans shall be reviewed as defined in the Management of Change procedure and AT LEAST once per year as part of the Management HSE-MS review process

HSE-MS Element – Implementation, Monitoring, and Reporting

Core Expectation - Implement the HSE-MS processes and, monitor and report on performance

Process and/or actions to meet expectations:

Expectation 4.6.1 - Ultimate accountability for HSE Management rests with the CEO of the MO who shall designate a Senior Manager to assist with implementation of this HSE-MS:

4.6.1.1 The CEO formally appoints (in writing) a responsible person for coordinating overall implementation of the HSE-MS. (OHS Act Section 16.2 appointment)

4.6.1.2 No further formal appointments are required to designate responsibility for implementation of the HSE-MS expectations, unless otherwise explicitly provided for in the OHS Act and Regulations. Each MO Line Manager is assumed, by virtue of his/her position, to be responsible for implementation of the HSE-MS requirements applicable to the area of responsibility as defined in individual Job Descriptions

4.6.1.3 Contractors operate a management system consistent with the requirements and provisions of this HSE management system

HSE-MS Element – Implementation, Monitoring, and Reporting (Continued)

Core Expectation - Implement the HSE-MS processes and, monitor and report on performance

Process and/or actions to meet expectations:

Expectation 4.6.2 - Maintain procedures for reporting and recording information relevant to HSE key performance indicators:

4.6.2.1 Establish an Incident Notification, Investigation and Reporting procedure that addresses the requirements of Section 24 and 25 of the OHS Act as a minimum

4.6.2.2 Determine and clearly define the following in the procedure:-

- The appropriate level of management participation in incident investigations
- The process for tracking and close out of recommended corrective actions resulting from incident investigations
- The process for sharing learning's from internal and external incident investigations

Expectation 4.6.3 - Monitor and measure HSE performance and, take corrective action:

4.6.3.1 Establish inspection checklists and schedules for HSE critical processes, equipment and workplace conditions

4.6.3.2 Analyse inspection reports and assess compliance with HSE-MS expectations

4.6.3.3 Establish a remedial action plan for recording corrective actions for non-compliance findings

4.6.3.4 Establish a procedure for tracking and assessing progress with implementation and close-out of corrective actions

HSE-MS Element – Audit

Core Expectation – Conduct audits of HSE management and communicate the results effective

Process and/or actions to meet expectations:

Expectation 4.7.1 - Conduct self-assessments and internal audits to assure compliance internally:

4.7.1.1 Establish an audit policy and plan to cover all operations of the Organisation

(Note: Inspections referred to in 4.3.6.1 above are part of the annual audit planning and inspection schedules should be included in the audit plan. Auditing in this context refers to a more formal process performed by an Audit Team consisting of "suitably qualified auditors". The organisation shall define the competence requirements for Internal audits and self assessments)

4.7.1.2 Plan and conduct self-assessments and/or internal audits to cover each HSE critical operation/activity/process/task **AT LEAST ONCE** in every two year period. (MO participating in the SABITA HSE Certification Scheme shall conduct self-assessments once a year)

Expectation 4.7.2 - Conduct periodic independent audits of the HSE-MS:

4.7.2.1 The MO audit policy should include provision for periodic independent audit of the HSE-MS. Independent audits shall be conducted by a recognised external audit authority and could include certification to a recognised standard such as BSI – OHSAS 18001. The SABITA HSE Certification Scheme is, for purposes of this expectation, considered to be an independent audit. ***The frequency of audit for SABITA certification is currently ANNUALLY.***

Expectation 4.7.3 - Executive Management review and endorse audit reports and assign responsibility for close-out of corrective actions:

4.7.3.1 All HSE-MS self-assessments, internal audits and independent audit reports shall be personally reviewed and endorsed by the Executive Management team member responsible for the relevant operation, department or unit **AND** the Senior Manager responsible for HSE-MS implementation. Responsibility for close-out of SERIOUS (HIGH risk findings) shall be confirmed or escalated to a more senior level if necessary

HSE-MS Element – Audit (Continued)

Core Expectation – Conduct audits of HSE management and communicate the results effective

Process and/or actions to meet expectations:

Expectation 4.7.4 - Corrective actions for ALL audit findings are recorded in the MO HSE Remedial Action Plan and tracked to measure progress with implementation and close-out within assigned time-frames:

4.7.4.1 Maintain a central Remedial Action Plan to capture and track progress with close-out of corrective actions. Review of the Remedial Action Plan shall be included on the HSE agenda of Executive Management meetings

HSE-MS Element – Management review

Core Expectation – Management regularly and effectively review HSE

Process and/or actions to meet expectations:

Expectation 4.8.1 - Conduct an annual management review of the HSE-MS:

4.8.1.1 A formal Executive Management review of the HSE-MS is conducted at least once a year to ensure its continuing suitability, adequacy and effectiveness

4.8.1.2 The review shall be documented in minutes and specific corrective actions recorded in the Remedial Action Plan for tracking and close-out of actions

Supplementary

The Supplementary section contains additional advisory material under the same headings. An additional heading, S9 has been included to provide some working examples of the manner in which the HSE-MS core expectations may be applied. For convenience, the sections are numbered as in the HSE-MS framework, but with the prefix 'S'.

Acknowledgment
The information contained in this supplementary have been reproduced in whole or in part from the document titled *Guidelines for the Development and Application of Health, Safety and Environmental Management Systems, E & P Forum, Report No. 6.36/210, July 1994.*

S1 Leadership and commitment

The foundation of an HSE-MS is leadership and commitment from the top management of the company, and its readiness to provide adequate resources for HSE matters.

Particular attention is drawn to the importance of senior management providing a visible expression of commitment. Failure to do so will undermine the credibility of HSE policy and objectives. Demonstrations of commitment to the HSE-MS at different management levels include, amongst others:

- Allocating the necessary resources, such as time and money, to HSE matters.
- Setting a personal example in day-to-day work.
- Putting HSE matters high on the agenda of meetings, from the Board downwards.
- Being actively involved in HSE activities and reviews, at both local and remote sites.
- Communicating the importance of HSE considerations in business decisions.
- Recognition of performance when objectives are achieved.
- Encouragement of employees' suggestions for measures to improve HSE performance.
- Participation in internal and external initiatives.

Management leadership is also necessary to promote a company culture conducive to good HSE performance, in which the HSE-MS can function effectively. Senior management can foster active involvement of employees and contractors in improving HSE performance by encouraging a culture of belief, motivation, individual responsibility, participation and commitment:

- **Belief** in the company's will to improve its HSE performance—essential to open and supportive incident reporting, and to effective HSE-MS implementation.
- **Motivation** to improve personal HSE performance—based on awareness, understanding, acceptance of individual responsibility and positive recognition to reinforce desirable attitudes and behaviours.
- **Participation** of staff at all levels—through seeking their views and involvement in HSE-MS development, and energetically pursuing suggestions for improvement.
- **Commitment** of staff at all levels is essential if the HSE-MS is to be fully effective, and should follow from secure belief, personal motivation and active participation.

S2 Policy and strategic objectives

It is important that policy be initiated, developed, actively supported and endorsed by management at the highest level, and be made available in readily understood form to interested parties—e.g. through the company's annual report and in booklets and displays. The company will need to identify any regulatory requirements for HSE policies and to satisfy such requirements.

Health and safety policy may, for example, include commitments to:

- Establish safe and healthy procedures and practices in all operations, and strive towards an incident-free workplace.
- Provide properly engineered facilities, plant and equipment and maintain them in a safe and secure condition.
- Promote openness and participation in health and safety matters.
- Provide training to enable staff to work in a healthy and safe way.
- Undertake health and safety awareness and education campaigns.

The environmental policy may, for example, state commitments to:

Undertake all operations with proper regard for the environment, and strive to reduce environmental risk to a level that is as low as reasonably practicable.

- Reduce waste and the consumption of materials, fuel and energy.
- Reduce, and avoid where practicable, emissions and discharges.
- Provide staff training and awareness programmes.
- Participate in suitable environmental initiatives.
- Reduce the hazards and adverse environmental effects of new developments to a level that is as low as reasonably practicable.
- Work towards the goal of environmentally sustainable economic development.

The policies of companies with good HSE records typically also refer to, for example, the:

- Importance of effective organisation to successful HSE management.
- Importance of communication with interested parties.
- Need, as in other areas of the business, for a systematic, planned approach to HSE.
- Frequent role of management control failure in causing incidents.

S3 Organization, Responsibilities, Resources, Standards, & Documents

S3.1 Organisational structure and responsibilities.

The allocation of HSE responsibilities will depend upon the nature and structure of the individual company; some examples might be:

- **Senior management**— assume responsibility for developing, resourcing, reviewing and complying with the HSE policy.
- **Finance**—develop and maintain accounting procedures which enable identification and allocation of HSE costs and benefits.
- **All individual function, activity and operations/business unit managers** (e.g. Operations, Production, Engineering, Services, Marketing, Contracts, Research and Development, Procurement, Legal, Finance and Site Personnel)—implement the HSE-MS in their areas of responsibility (in consultation with employees) and effective two-way communication and training programmes on HSE matters.

S3.2 Management representative(s)

The management representative or representatives need to have sufficient knowledge of the company and its activities, and of HSE issues, to undertake the role effectively. Whilst maintaining overall responsibility for co-ordinating HSE management activities across all functions and groups, representative(s) will act in conjunction with line management in all functions, activities and processes. Line management remains fully accountable for developing and implementing the HSE-MS in its area of responsibility.

Some companies may divide the management role among several positions, such as health and safety manager and environment manager, or it may be a significant part of a line manager's duties. If the management representative has other functions to perform, care will need to be taken to ensure that there are no conflicts of interest with HSE responsibilities.

S3.3 Resources

Resource allocation should be considered as it applies to all parts of the HSE-MS; issues to consider include, among others:

- Facilities, plant and equipment to meet legislative and regulatory requirements.
- Personnel, equipment and infrastructure to respond to and mitigate emergency situations.
- Availability of management for HSE audits and reviews.
- Resource allocation for new developments.

Depending on the particular circumstances of the company, the management representative and other managers may need support from specialist advisers to accomplish their tasks effectively.

The allocation of necessary and justified resources for HSE matters is widely regarded by staff and other interested parties as indicative of corporate commitment to HSE policy and objectives.

S3.4 Competence

In addition to allocating responsibilities, management will need to determine the level of competence—based on personal abilities, skills, experience, formal qualification and training—necessary to ensure the capability of personnel to carry out HSE-critical functions. Activities and roles which affect the HSE performance should be included in job descriptions and performance appraisals.

Structured and documented competence assurance systems and procedures help to facilitate the processes of:

- determining the competence requirements of particular activities;
- defining and recording criteria for competence;
- assessing individuals against the defined criteria;
- documenting and certifying competence when necessary;
- identifying aspects where personnel are not yet judged competent;
- training individuals to increase competence in those areas;
- periodic re-assessing of competent personnel;
- assessing competence for job transfers and new activities and technologies.

Training—including refresher courses—helps ensure that:

- All personnel can make an appropriate contribution to good HSE performance.
- New recruits, and staff assigned to new tasks, equipment and procedures, understand their roles and responsibilities for HSE matters.
- Managers understand the HSE-MS, have the necessary knowledge to play their part in it, and appreciate the criteria by which its effectiveness will be judged.

S3.5 Contractors

Contractors and sub-contractors play a substantial role in general industry, often working within a facility and alongside a company's own workforce; the activities in which they are engaged (e.g. construction and major maintenance) are typically non-routine and are in exposed situations.

For those reasons, these Guidelines have been designed to apply equally to the operations of a principal or contracting company.

Records and safety statistics have generally indicated that contractors' employees are involved in incidents more frequently than are employees of the principal company. They may be less familiar with site-specific hazards than are the company's own employees. For these reasons it is particularly important to consider how the HSE-MS of a company (whether itself a principal or contracting organisation) is interfaced with that of its contractors and sub-contractors. In this context, particular attention is drawn to:

- establishing clear communication between company and contractor staff, at all levels;
- procedures for the management of change;
- Permit to Work systems;
- incident reporting and follow-up;
- emergency plans and their communication;
- audit and review;
- communication of hazards and individual risks, and roles in risk management.

However contracted activities will also need to be considered in other parts of the HSE-MS.

S3.6 Communication

Effective communication requires careful consideration of the message to be transmitted—or the information to be sought—and to the most appropriate medium for doing so.

Effective two-way communication on HSE issues, including awareness programmes and campaigns directed towards specific HSE concerns, are important means of motivating staff towards a proper regard for HSE issues.

The need to communicate in an appropriate language and style needs to be borne constantly in mind, particularly when transmitting technical information to non-specialists. HSE-critical procedures and instructions (such as emergency evacuation instructions, and recovery measures in the event of oil spillage) need to be in a language and style that is understood by site staff. Cultural and language barriers to communication (such as those for personnel whose mother tongue is not the main site language) need to be identified. Communications must be tested regularly.

Community awareness and consultation programmes may be effective for responding to legitimate community concerns about the HSE effects of facilities.

S3.7 Documentation and its control

The primary purpose of the documentation is to provide an adequate description of the HSE-MS, and to serve as a permanent reference to the implementation and maintenance of that system. Documentation may be in paper, electronic, or other format, but it is important to ensure consistency in approach and content, and in control, review and amendment of procedures.

Proper documentation enhances HSE management efficiency through:

- Channelling information efficiently to where it is used and needed by staff.
- Aiding awareness of responsibilities and correct task performance.
- Avoiding information-dependency on individuals.
- Reducing learning time on new tasks.
- Demonstrating the existence of systems and practices.

In determining the degree of detail of HSE-MS documentation, consideration will also need to be given to its use by system auditors to verify that the system exists, and that it is fit for its purpose, given the nature of the hazards and risks and environmental effects involved.

S4 Hazards and Effects Management Process

S4.1 Identification of hazards and effects

Identification of HSE hazards and effects typically requires the application of specialised techniques and systems, such as hazard and operability studies (HAZOPS), Job Hazard Analysis (JHA), event or fault tree analysis, failure mode and effect analysis (FMEA) or environmental impact assessment (EIA), and the involvement of staff with specific expertise in risk management, HSE issues, design and operations. HSE hazards and effects may also be identified using operational checklists and informal 'hazard hunts' at operating sites. The participation of operational employees in such activities is to be encouraged as a means of increasing their understanding of hazards, risks and effects.

Hazard identification is conducted at an early stage in the design and development of new facilities, equipment and processes. This permits sound HSE practices, systems and equipment to be 'designed-in', and allows a wider choice of risk prevention, mitigation and recovery measures to be employed than with existing facilities. Continuous hazard identification is required at existing facilities to maintain and improve HSE performance.

S4.2 Evaluation

Evaluation of the risks posed by the identified hazards, however sophisticated the detailed techniques employed (e.g. HAZOPS, QRA, health risk assessment, EIA), requires consideration of both the severity of the consequences of a potential event and the probability (likelihood) of its occurrence:

Risk = **Probability of occurrence x Severity of consequences**

Risks of different events can then be compared and considered against screening criteria. Such criteria are most often a range of considerations or values and can take a variety of quantitative or qualitative forms.

However, there may be considerable uncertainty attached to the estimate of the probability of an event; *the severity of the consequences if the hazard is realised may be more readily and precisely definable*. The recommended approach is therefore to accept the occurrence of an event as "a given" rather than wasting time and energy on attempting to determine the probability of occurrence of the event.

The evaluation of chronic effects on the environment arising out of a company's operations, however, will need to take account of some 'events' which are regular or continuous, and intentional—such as the discharge of effluent or emissions to the atmosphere. For such effects:

Risk = **Severity of consequences** = **Exposure** x **Degree of harmfulness** *(e.g. toxicity, disturbance to habitat)*

Similarly, in health risk assessment the probability of some degree of exposure may be 100%; thus:

Risk = **Severity of consequences** = **Exposure** x **Degree of harmfulness** *(e.g. toxicity)*

Regulatory controls, health surveillance programmes or epidemiological studies (within the company or externally) may indicate exposure to health hazards, chronic effects and the need for risk reduction measures. Harmful agents (agents capable of causing chronic and/or acute adverse health effects) include chemicals (e.g. hydrogen sulphide, hydrocarbon vapours, solvents, coating materials), biological agents (e.g. pathogenic organisms causing malaria and legionella) and physical agents (e.g. ionizing radiation, cold and heat stress, dust, noise and vibration).

Ergonomic factors (e.g. equipment design and cumulative effects of repetitive movements) relating to the manner in which tasks are performed will also need to be considered.

The results of formal risk evaluation facilitate:

- Assessment of the feasibility of the proposed activity, based on compliance with the defined screening criteria.
- Identification of the need for specific prevention, mitigation and/or recovery measures.
- Identification of permitted operations (e.g. simultaneous operations).
- Identification of monitoring requirements (e.g. for emission and exposure monitoring).
- Prioritisation of opportunities for improvement.

Evaluation of HSE risks requires access to information on the probabilities of specific events and/or on the nature and severity of likely consequences. Sources of such information include, for example:

- Internal knowledge and experience of managers and HSE experts.
- Industry frequency and failure rate databases and co-operative research programmes.
- Relevant international, national and company standards and codes of practice.
- Industry and trade association codes of practice and other guidance.

Company and external R&D aimed at identifying hazards and effects, and assessing and reducing the risks associated with them, is to be encouraged.

S4.3 Recording of hazards and effects

Results of the evaluation need to be recorded, together with the data sources and assumptions used. This record is used by operations personnel developing procedures and issuing work instructions and other key personnel to communicate the hazards that have been identified and the measures that are in place to prevent and mitigate the risks of occurrence.

The hazards and environmental effects documentation may be joint or separate documents. Inventories of routine emissions to air, water and land may be maintained to monitor and manage effects. Note that there may be legislative and regulatory requirements for such records as evidence of effective application of hazard management.

S4.4 Objectives and performance criteria

The setting and periodic revision of objectives and performance criteria and the continual enhancement of the HSE-MS underpins the company's commitment to improvement of HSE performance. Their quantification, and association with specific timetables, is important to establish the credibility of corporate intentions.

HSE objectives and performance criteria will need to take into account previous performance and to reflect any external changes of circumstances as well as any changes in the business itself.

The detailed objectives and performance criteria within the strategic objectives of the company should be developed with the active participation of those who will be responsible for their achievement.

Performance criteria describe the standards to which a particular activity or system element is to perform, and can apply at various levels within the HSE-MS. For example, in addition to specifying acceptable levels of outputs or parameters (e.g. effluent quality, occupational exposure levels, lost-time incidents frequency (LTIF), emission/discharge levels), such criteria may establish the nature and frequency of such tasks as:

- Plant maintenance.
- HSE-MS reviews and audits.
- Assessment of training needs.
- Hazard and effects identification and risk assessment.
- Testing of emergency plans.
- Testing emergency shut-down and blow-out prevention systems.
- Testing fire detection, protection and alarm systems.
- Process and emission monitoring.

As the basis for control and monitoring, and performance measurement, criteria need to be both readily measurable, and clearly and unambiguously documented. As a minimum, performance criteria satisfy any relevant regulations, although they may frequently be set in the absence of such regulations.

A hierarchy of HSE goals is thus formed, from company strategic objectives (e.g. to minimise adverse HSE effects), through organisational and more detailed local objectives (e.g. to increase efficiency of energy usage by a stated amount) to specific performance criteria (e.g. to ensure emissions of fumes resulting from bitumen loading or application remain below exposure limits).

S4.5 Risk reduction measures

Risk reduction measures can reduce HSE risks and effects in a number of ways, for example by:

- preventing acute and chronic incidents;
- reducing the exposure (concentration/duration) of people to harmful agents that are routinely present in the work area;
- reducing emissions/discharges to the environment.

A variety of risk reduction measures may be employed, appropriate to the nature, probability and severity of the HSE risk or effect (e.g. chronic or acute effects, routine or non-routine operations). Prevention measures are designed to prevent the realisation of hazards. Such measures include specific hardware to control hazardous operations and to maintain asset integrity, such as:

- pressure release systems;
- personal protective equipment;
- security systems.

It is important to realise that they also include organisational and system measures, such as:

- intrinsically safer designs;
- quality assurance, maintenance and inspection procedures;
- safe working practices;
- Permit to Work systems;
- plans that take account of human factors;
- clear and well-communicated work instructions;

- use of Material Safety Data Sheets (MSDS);
- prophylactic medical treatments such as vaccination/immunisation;
- alcohol and drug-use programmes.

Measures are also required to mitigate or lessen the adverse effects, in the event that a prevention measure fails, and are therefore employed during abnormal or emergency situations. Such measures include, amongst others:

- ignition control systems;
- secondary tank containments;
- passive fire protection;
- gas/fire/smoke detection.

Contingency and emergency planning is addressed more fully in section S5.5.

S5 Planning and procedures

S5.1 General

As the means of achieving the company's HSE policy and objectives, soundly-based improvement plans are key components of the HSE-MS. Such plans require adequate resources and visible commitment from all personnel. Ideally, such plans will form an integral part of the company's overall business plans.

HSE plans may require development for such activities as:

- Acquisitions.
- New developments.
- Existing operations.
- Modifications to existing facilities.
- Abandonment programmes.
- Geological surveys.

The resource requirements and timescales also require definition to ensure that manpower is available and that necessary budget commitments can be made. Consultation with regulatory authorities and other external bodies drafting legislation, regulations and standards is recommended to ensure that planning takes account (so far as is possible) of future legislative and regulatory requirements.

S5.2 Asset integrity

It is important that accepted codes of practice and standards for key equipment and related activities are followed. To help assure the integrity of existing and planned facilities, careful attention needs to be paid to the completeness of the engineering process—with specific reference to the design, manufacture, installation, maintenance, testing and inspection of key equipment.

In this context, key equipment refers to that identified in the evaluation process as being critical to the continued effectiveness of HSE controls. Particular emphasis needs to be placed on the design of new facilities, and hazard identification at an early stage allows the best risk reduction measures (those that prevent incidents through eliminating hazards at source) to be employed.

Quality assurance measures during the fabrication of key equipment help ensure that materials and construction are in accordance with design specifications. Installation processes need to be managed and inspected to check that design specifications and manufacturers' instructions are followed, and attention to effective maintenance, testing and inspection systems helps ensure the continuing integrity of key equipment.

All personnel who perform the activities described above, related to asset integrity, are HSE-critical staff and therefore require appropriate experience, qualifications and training to ensure their competence to undertake these important risk reduction measures.

S5.3 Procedures and work instructions

It is important to ensure that those who will be responsible for putting procedures and written instructions into effect are closely involved in their production. Clarity and simplicity of style and language are the characteristics to aim for in writing them, consistent with accurate coverage of the activities which they address.

Providing instruction on the conduct of worksite tasks can take many forms, depending on the complexity of the task, the competence of the people performing it, the inherent hazards and risks associated with it, and the effects that it might have on other aspects of the operation or facility.

Thus, verbal instructions will need to be supported with, or replaced by, written work instructions wherever the absence of written material could prejudice HSE performance. Written work instructions will outline the work scope and reference any particular direction that is to be followed; similar considerations to those for system procedures apply to their development.

Monitoring requirements and needs for personal protective equipment can be specified in the work instructions. For example, in a production facility where hydrocarbons are stored or produced, stringent controls are required and most work is conducted under a 'Permit to Work' system. Within this, the work is defined, the precautions specified, other parties whose activities may be affected are notified, and the permit signed off by all parties involved.

S5.4 Management of change

Any changes in the personnel, equipment, processes and procedures of the company have the potential for adverse effects on health, safety and the environment.

All changes should be considered. These will include not only equipment changes but also organisational restructurings—such as those that result from acquisitions, mergers, new joint ventures and alliances. Plans relating to changes need to address the HSE aspects arising at all stages of the development, to ensure that risks or adverse environmental effects are minimised by effective planning and design.

For the same reasons, plans relating to new installations or modifications to processes and plant need to cover all stages of the development, from feasibility studies, through planning and design, to construction, commissioning, operation, maintenance and eventual decommissioning and abandonment.

Changes which may be HSE-critical should be reviewed prior to implementation, and any necessary amendments made to the HSE-MS to ensure that their introduction does not prejudice sound HSE performance.

S5.5 Contingency and emergency planning

Foreseeable emergencies for which planning need to be undertaken may include:

- fire and explosion;
- failure of key controls, of power sources, or of services;
- structural failures;
- worksite injuries;
- spills and uncontrolled releases of product or other materials;
- loss of radioactive material;
- security breaches and sabotage;
- outbreaks of disease;
- civil disorder and military actions;
- geophysical and natural events; and
- other emergency events highlighted by hazards and effects identification.

Emergency response measures include, amongst others:

- emergency shut-down systems;
- fire-fighting devices;
- emergency evacuation procedures;
- rescue vehicles/craft;
- first-aid equipment and personnel;
- specialist medical treatment;
- product-spill clean-up systems.

An important point to note about recovery measures is that since they are only required to act in emergency situations—i.e. rarely—emphasis should be placed upon their reliability, which should be assessed through regular and thorough inspection and testing. Account should be taken of the increased risk involved in carrying out drills and testing of emergency procedures.

The emergency plans will need to:

- be clearly communicated;
- be well-rehearsed;
- co-ordinate internal and external emergency response teams;
- pay particular attention to external communication;
- include provision for the reporting and investigation of incidents;
- take account of the environmental effects of measures taken to manage escalating emergency situations (such as the effects of unconstrained fire-water run-off).

S6 Implementation

S6.1 Activities and tasks

Previous sections have described the planning process, from the development of procedures covering broad areas of activity down to the level of issuing work-site instructions for the conduct of specific tasks.

The effective practical implementation of these planned arrangements requires that procedures and instructions are followed, at all levels. Company and contractor personnel need to be familiar with relevant procedures and instructions before they start work.

S6.2 Monitoring

Monitoring provides the means of measuring performance against established requirements, including objectives, targets and performance criteria. Thus, monitoring may include such activities as:

- Regular monitoring of progress towards objectives and targets achieved by implementation of HSE plans.
- Regular inspection of facilities, plant and equipment against specific performance criteria.
- Systematic observation of the work and behaviour of first line supervisors to assess compliance with procedures and work instructions.
- Regular analysis of discharges, emissions and waste disposal.
- Health surveillance of staff, including exposure monitoring and medical surveillance.

Monitoring facilitates control of HSE-critical activities and processes, and the detail and frequency of measurement needs to reflect the nature and extent of the risks involved, and concentrate on the areas where it produces the most benefit. Thus 'higher-risk' facilities, plant, activities and tasks require monitoring in more detail and at a greater frequency.

S6.3 Records

Records are the evidence of the ongoing operation of the HSE-MS. Care is to be taken to limit them to the extent necessary for the specific application, but they need to be kept in order and designed to enable assessment of compliance with policy and of the extent to which objectives are being achieved.

Relevant records compiled under other parts of the overall management system need not be duplicated, but means of access to them is to be specified. In addition to legislative and regulatory requirements, and of significant hazards and environmental effects, records should include:

- Reports of audits and reviews.
- Situations of non-compliance with HSE policy, and of improvement actions.
- Any incidents and follow-up actions.
- Any complaints and follow-up actions.
- Appropriate supplier and contractor information.
- Inspection and maintenance reports.
- Product identification and composition data.
- Monitoring data.
- Training records.

Records provide historic information on reported incidents and cases of non-compliance with the HSE-MS, and can thus provide useful information on long-term trends. For example, analysis of records of medical treatments might show an increasing frequency of stomach complaints, suggesting a possible problem in the food handling area or potable water system.

S6.4 Non-compliance and corrective action

Incidents of non-compliance with specified requirements may be sudden and temporary, or they may persist for a long period.

They may result from deficiencies or failures in the management system itself, or in plant or equipment, or from human error. In the investigation of non-compliance the causative mechanism(s) should be fully established and reported, including factors within the management system.

Such investigation will enable planning of corrective action, including measures for:

- Restoring compliance as quickly as practicable.
- Preventing recurrence.
- Evaluating and mitigating any adverse HSE effects.
- Ensuring satisfactory interaction with other components of the management system, such as quality management.
- Assessing the effectiveness of the above measures.

The implementation of the corrective action will not be deemed to have been completed until the effectiveness of all the above has been demonstrated and the appropriate changes made in the procedures, documentation and records. Where corrective action may involve the initiation of a project over a significant time scale, this will form part of the management plan.

S6.5 Incident reporting

It is important that staff report all incidents so that lessons can be learnt and the HSE-MS improved. This requires an open approach to communication and a 'blame-free' approach to reporting and follow-up.

The key data which reporting systems acquire includes, as appropriate:

- Details of any injuries, occupational illness or adverse environmental effects.

- Details of involved and/or injured person(s).
- A description of the circumstances.
- Details of the event.
- Details of the outcomes.
- Potential consequences.
- The contribution made to the incident by any failures of the HSE-MS.

Generally, reporting of incidents resulting in injury or property damage is prompt and comprehensive. However, incidents which do not result in injury or property damage (so-called 'near-misses') are more frequent and their causes may have the potential to bring about a major incident under slightly different circumstances.

Such near-misses—and the valuable information they encapsulate—often go unreported, either because their potential significance is not realised or because staff are discouraged from reporting them by, for example, the fear of blame or the complexity of the reporting system.

Thus, reporting systems need to be kept simple to encourage reporting of near-misses and identification of higher-potential near-misses, consistent with the acquisition of key data.

S6.6 Incident follow-up

All incidents, including higher-potential near-misses, require appropriate investigation in order to:

- Establish their root cause and identify actions to minimise the chance of recurrence.
- Satisfy any statutory requirements for reporting and investigation.
- Provide a factual record of the circumstances of the incident.

The investigation process comprises the following basic steps:

- Notification, initial assessment and incident report.
- Decision on the need for further investigation, and appointment of investigation team.
- The investigation itself, comprising review of the incident site and circumstances, interview of witnesses, and analysis of operating conditions, data and other evidence.
- Preparation of investigation report and agreement of remedial actions.
- Issue of report and plan of action for follow-up.

The first step following the report of the initial assessment of an incident is to decide the appropriate level of investigation. This will depend on the seriousness of the incident and its actual or potential consequences.

The significance of the actual consequences should be clear, but that of the potential consequences may not. The potential significance of an incident can be established by asking 'what if' questions.

The size and composition of the investigating team will depend on the particular incident. It is important that the team members are properly trained to carry out the task objectively, impartially and effectively. It should be noted that the investigation may be conducted in parallel to an external investigation by the authorities.

The primary function of an investigation is to identify the likely cause(s) of an incident and identify appropriate remedial actions. Thus the team will need to have the support and authority of company management to obtain the necessary information, and to secure agreement for any remedial action identified.

Progress in implementing remedial actions will need to be monitored, and will not be deemed to have been completed until their effectiveness has been demonstrated. Where action may involve the instigation of a project over a significant timescale, this will be integrated into the HSE plan.

S7 Audit

S7.1 Auditing

Audits may be internal (carried out by personnel from within the company, but independent of the part being audited) or external (carried out using resources selected by the company). In either case the persons conducting the audit will require training to carry out the task objectively, impartially and effectively. The company should identify and make arrangements for independent, external verification of audits where required.

The audit team will require broad knowledge of HSE matters and experience in auditing practices and disciplines; specialist HSE or other technical expertise may also be necessary. Audit teams require personnel with operational experience in the area being audited, or access to such personnel.

To ensure audit effectiveness, the company will need to ensure that audit personnel have the support and authority to procure the necessary information. Audits may suggest remedial measures to overcome problems, or they may simply note the nature of the problems and require the management of the audited function to devise and implement an appropriate solution.

In either case, the recommendations should be agreed and followed-up in the next audit cycle, to ensure that necessary improvements have been made. The audit report will be submitted to line management of the activity/area being audited and to the management representative for distribution and action as appropriate.

In addition to establishing an independent audit procedure, companies may find it beneficial to encourage line management to carry out similar self-assessment procedures.

S8 Management review

S8.1 Reviewing

The scope of reviews includes the company and its activities, products and services with a focus on HSE-MS and HSE-critical activities. Thus, for example, a review of the HSE-MS elements for designing a new facility would examine the extent to which the HSE objectives for the project required revision, judge whether or not resource allocation to the project was satisfactory in relation to HSE matters, and determine the extent to which any audit recommendations had been successfully implemented.

Reviews are to be carried out by appropriate members of, or competent independent personnel appointed by, the company's senior management.

Issues to be addressed as part of the process will typically include:

- Any recommendations which have been made in audit reports, and whether or not these have been implemented.
- The continuing suitability of HSE policy, and possible revision to address, for example:
  - Emerging/growing HSE concerns in specific areas.
  - Developing understanding of HSE issues.
  - Potential regulatory developments.
  - Concerns of employees, contractors, customers, government agencies and the public.
  - Market pressures.
  - Changing company activities and locations.
  - Changes in the sensitivity of the environment.
  - The continuing suitability of and possible revisions to, HSE objectives, and consequent amendments to the HSE plan and other HSE-MS elements and documentation.

Reports of reviews need to make clear why they were conducted (e.g. routine procedure, organisational changes, developments in understanding of HSE issues, changes in environmental sensitivity, regulatory developments and reported deficiencies in HSE-MS).

Reviews should be used to reinforce the continuous efforts to improve HSE performance.

S9 Examples of document formats, forms, registers and processes

S9.1 Documentation of HSE objectives and targets

XYZ Company
Health Safety and Environment Management

Health and Safety Objectives and Targets for 2010 (Example)

Management expectation or issue: Incident investigations frequently reveal that personnel are not fully competent to perform their tasks.

Objective: To ensure that HSE training needs are determined and fully integrated with staff operational training

Target: Determine training needs for HSE critical positions and develop training plan by end of November 2010

Actions required	Action by	Review date
Compile a list of HSE Critical tasks and positions	Line managers HSE Dept	31 March
Determine training needs to assure competence of staff in HSE critical jobs	Training manager HSE Dept	30 June
Develop training plan to deliver training to identified individuals	Training manager	30 November

Management expectation or issue: To achieve a higher level of health and safety the behavioural safety aspect will be an ongoing theme for all employed on our operations.

Objective: To continue an emphasis on behavioural safety

Target: An additional behaviour related training programme to be introduced by end April 2010

Actions required	Action by	Review date
To appoint a training provider	HR Dept & MD	28 February
Support training programme	Directors	May/June

Management expectation or issue: It is recognised that the management of some occupational health issues require specialist expertise not currently available within the company.

Objective: To improve the standard of occupational health care for our employees

Target: Review the standard of company provider of occupational health issues and health surveillance by end June 2010

Actions required	Action by	Review date
Search for an occupational health provider appropriate for the business	HSE & HR Dept	31 March
Appoint specialist	MD	30 June

Management expectation or issue: It is important that HSE non-conformance trends are identified and acted on. The process for monitoring of compliance with health and safety standards is not sufficiently robust.

Objective: To improve the monitoring of trends identified through audits, inspections and incident investigations

Target: To provide a quarterly report for all regions by the end of 2010

Actions required	Action by	Review date
Reports to be collated	HSE Dept	Ongoing
Review and decide on action required	MD & HSE Dept	Quarterly
Act on review of trends	Directors	Ongoing

S9.2 Example of a typical register of legal requirements, codes of practice and relevant industry HSE standards

XYZ Company Occupational Health Safety and Environment Management System					
Register of legal requirements, codes of practice and relevant industry HSE standards applicable to the business activities of XYZ Company					
Legislation; or Code of Practice; or Standard	Regulator	Applicable to: (activity/location)	HSE-MS controls in place	Responsibility	Training requirements
Occupational Health and Safety Act, 1993 and Regulations	Dept of Labour	Whole organisation	This register Compliance audits/inspections Legal appointments Incident notification, investigation and reporting procedure Hazard register Staff training programs	CEO HSE Department Line Managers	1. 4 Hour OHS Act: Management Legal Liability - Sec 16(2) Course (Managers) 2. 2 Day OHS Act and Regulations Specific Training (HSE staff) 3. 2 Day Hazard Identification and Risk Assessment (Risk assessors) 4. 1 Day H & S Representatives Course 5. 2 Day Advanced HSE Incident Investigation Course (HSE staff and Line Managers)
Code of Practice: Loading of Bitumen at Refineries	SABITA: and Oil Refineries	Loading Bitumen into a Bulk Road Tanker at the various Refineries	Various procedures as detailed in the Code of Practice	Transport Managers BRT Drivers Loaders	Specified in Section 8 of the Code of Practice
National Road Traffic Act, 1996 ,	Dept of Transport	All activities in connection with the operation of road vehicles and transport of Bitumen on public roads	Design standards and specifications for vehicles Vehicle “fitness” inspections and audits Recruitment policy and standards for drivers Defensive Driving Training programs for drivers Ongoing evaluation of driver competence	Transport Managers Driver trainers BRT Drivers	1. Defensive driver training 2. Training in terms of NRTA Chapter VIII. 280 at an approved institution
Compensation for Occupational Injuries and Diseases Act, 1993	Dept of Labour	All employees as defined in Chapter I.1 of the Act	Personnel Policies and Procedures Incident notification, investigation and reporting procedure	HSE Department HR Department Line Managers Injured employee	1. Employee induction 2. 1 Day OHS Act & COID Act Link (Line Managers and Relevant HR personnel)

S9.3 Example and recommended layout of a Hazard Register as defined in the Shell Group procedure for the Hazards and Effects Management Process

Hazard No	Hazard	Activity	Location	Threats	Top Event	Consequences or Incident considered for RAM rating	RISK POTENTIAL				ALARP Documentation
							P	A	E	R	
H-01.12	Hydrocarbon fuels – Cutback Bitumens (Flammable vapour)	Bulk fuel (Bitumen) load & deliveries; Bulk fuel storage & handling; Storage and handling of fuel samples; Hot work in a hazardous area; Operation of Bitumen heating system	Loading gantries Laboratories	• Equipment Failure • The potential of ignition not recognised • Static electricity • Lack of Work Procedures • Procedures not followed	Loss of Containment	Asset damage: Fire in loading gantry	4B	4C	2C	1C	Bow Tie Hazard Control Sheet PTWS EIA Design standards Ops standards and procedures Site ERP
							Comments: Fire partially destroyed loading gantry at the XYZ refinery in April 2009				
H-08.01	Moving transport on land	Movement of Vehicles / Mobile Plant on site	Loading facilities Storage sites Construction sites	• Operator error • Lack of Site planning • Site work instructions not followed	Loss of Control	Injury/fatality: Vehicle collision at road construction traffic control point	4D	3D	1B	2B	Hazard Control Sheet Site work instructions Design standards Site ERP
							Comments: Several fatal incident have occurred on SA roads during road construction projects				

Notes: The development of Hazard Registers should be done by a carefully selected team with relevant engineering, operational and HSE experience under guidance of a competent HEMP Practitioner.

S9.4 An example of a Risk Assessment Matrix

This example is the Shell Group Risk Assessment Matrix (RAM), used to determine the risk potential in the Hazard Register example.

The RAM is applied for general risk assessment and the classification of incidents and audit findings. People who do HSE risk assessments must have the competence to apply the RAM to HSE management processes. It is strongly recommended that persons responsible for leading risk assessment teams in the organisation undergo the necessary training.

The required competence is acquired via a Hazards and Effects Management Process (HEMP) training program that can be arranged by contacting the SABITA head office.

SEVERITY	CONSEQUENCES				INCREASING LIKELIHOOD				
	People	Assets	Environment	Reputation	A	B	C	D	E
					Never heard of in the Industry	Heard of in the Industry	Has happened in the Organisation or more than once per year in the Industry	Has happened at the Location or more than once per year in the Organisation	Has happened more than once per year at the Location
0	No injury or health effect	No damage	No effect	No impact					
1	Slight injury or health effect	Slight damage	Slight effect	Slight impact					
2	Minor injury or health effect	Minor damage	Minor effect	Minor impact					
3	Major injury or health effect	Moderate damage	Moderate effect	Moderate impact					
4	PTD or up to 3 fatalities	Major damage	Major effect	Major impact					
5	More than 3 fatalities	Massive damage	Massive effect	Massive impact					

For practical application the four areas (Colours) of the RAM describe the level of control required to manage risk:

Blue: Manage for continuous improvement through the effective implementation of the HSE Management System.

Light Blue: Manage for continuous improvement, although the Organisation may set lower priority for further Risk reduction.

Yellow: Identify and implement controls and recovery measures to reduce Risk to ALARP.

Red: Identify and implement Controls and Recovery Measures to reduce the Risk to ALARP and provide a documented demonstration of ALARP.

Note: The Organisation defines the parameters and criteria in each of the Consequence and Likelihood categories as well as the process and methodology for determination of ALARP.

SECTION 3

H-S-E Certification Scheme

Overview of the Certification Scheme

1. Introduction

The certification scheme was, first and foremost, developed to assist the bituminous products industry to assure compliance with the minimum legal requirements for the health and safety of persons at work and environmental conservation.

Another important objective of the certification scheme is to encourage members to build upon their own HSE initiatives by adopting the tools developed by Sabita to ensure a greater level of safety awareness within the bituminous products industry.

Benefits to members participating in the Scheme will be amongst others:

- Certification through an independent audit process;
- Offering 'peace of mind' for management and shareholders by assuring legal compliance;
- Certification will be promoted as an Industry 'license to operate' and thus become an important "pre-qualification" for participation in government tenders;
- Benchmarking and sharing of valuable lessons learnt from incident investigations;
- Ensuring the future sustainability of the industry by protecting our people and preserving our environment whilst in pursuit of corporate objectives.

2. The Certification Process

2.1 Audit preparation

- Members use the Certification Pre-Audit Checklist (Sections 4 & 5) to conduct a self assessment of compliance with the certification requirements; (One checklist for each participating site)
- Compliance gaps are recorded in the Site Remedial Action Plan to facilitate tracking of progress to address gaps;
- Progress is reviewed regularly at determined intervals and when full compliance can be demonstrated the member is ready to apply for independent audit and certification if successful.

2.2 Application to be audited

- Sections 1, 2 & 3 of the Pre-Audit Checklist are completed and the declaration in Section 5 signed by the authorized Company/Site representative;
- The completed form is e-mailed or faxed to the SABITA office as notification of "readiness" to participate in an independent certification audit;
- SABITA office checks and verifies information returned in Sections 1, 2 & 3 and that confirmation of full compliance with all certification requirements have been indicated by the applicant in Sections 4 & 5 of the Checklist.

2.3 Audit planning

- SABITA liaises with the Member/Site to agree on a mutually acceptable date for the audit;
- SABITA notifies the contracted independent auditor to include the Member/Site in the current audit cycle planning;
- The auditor records the planned audit and agreed date in the audit schedule; (The audit shall take place as soon as is reasonably practicable and not later than 1 (One) month after the date that the auditor received notification from SABITA;

2.4 Audit execution

- A certification audit shall consist of a site visit to the applicable site and assessment of the measurable criteria as prescribed in the current version of SABITA HSE Certification Scheme Audit Checklist;

- The auditor shall verify that FULL compliance with certification requirements has been achieved and is visibly and adequately demonstrated by the auditee (Member/Site being audited).
- The only acceptable audit outcome for certification purposes shall be FULL compliance with ALL requirements. Any NON-COMPLIANCE finding/s shall require reassessment at a later stage and certification shall not be granted before FULL compliance with these items have been verified;
- NON-COMPLIANCE findings shall be recorded in the audit report which will be compiled by the auditor;
- The auditor shall provide the auditee with a written audit report containing all the recorded audit findings with recommendations on how to achieve full compliance;
- The auditor shall hand over the audit report to the auditee immediately after completion of the audit, or otherwise forward same to the auditee within 3 (three) working days of the audit;
- The auditor shall notify SABITA office of the audit result within 3 (three) working days of the completion of the audit report and a copy of the audit report shall accompany such notification.

2.5 Reassessment procedure for a 'not-yet-compliant' audit result

- A site that is declared not-yet-compliant at the end of a certification audit will be granted a 3 (three) month remediation period from date of audit to address the non-compliances recorded in the audit report;
- A review and reassessment date shall be agreed by the auditee and the auditor and this date shall not be later than within 14 (fourteen) days from the end of the 3 month remediation period ;
- The process/method of review shall be agreed between the auditee and the auditor and may, or may not, include a site visit ;
- The auditor shall compile and forward a reassessment audit report to SABITA office;
- In the event that the Site is still not-yet-compliant certification shall not be granted and a period of at least six months shall elapse before the Company/Site may reapply for certification;
- The cost of the reassessment review will be bourn solely by the auditee.

2.6 Issuing of and validity of certificates

- SABITA office will verify that all requirements for certification have been achieved and inform the Member/Site that certification will be forthcoming;
- A certificate in the form of Appendix 1 of this document shall be prepared and signed by the SABITA CEO for presentation to the successful Company/Site management at an appropriate opportunity;
- Certification in terms of this Scheme will be valid for a period of TWO YEARS and re-certification must be applied for not later than 3 (Three months) before expiry of current certification;
- Re-certification must occur within 1 (One month) of expiry of the current certificate and failing this the current certificate will expire permanently and the Company/Site will be notified by SABITA that certification is revoked and that all reference to certification in terms of this Scheme must be removed from the Company/Site notice boards, publications, correspondence, etc.
- SABITA office shall maintain a Certification Register and track validity and re-certification dates to ensure that misrepresentation of a Company/Site certification status does not occur.

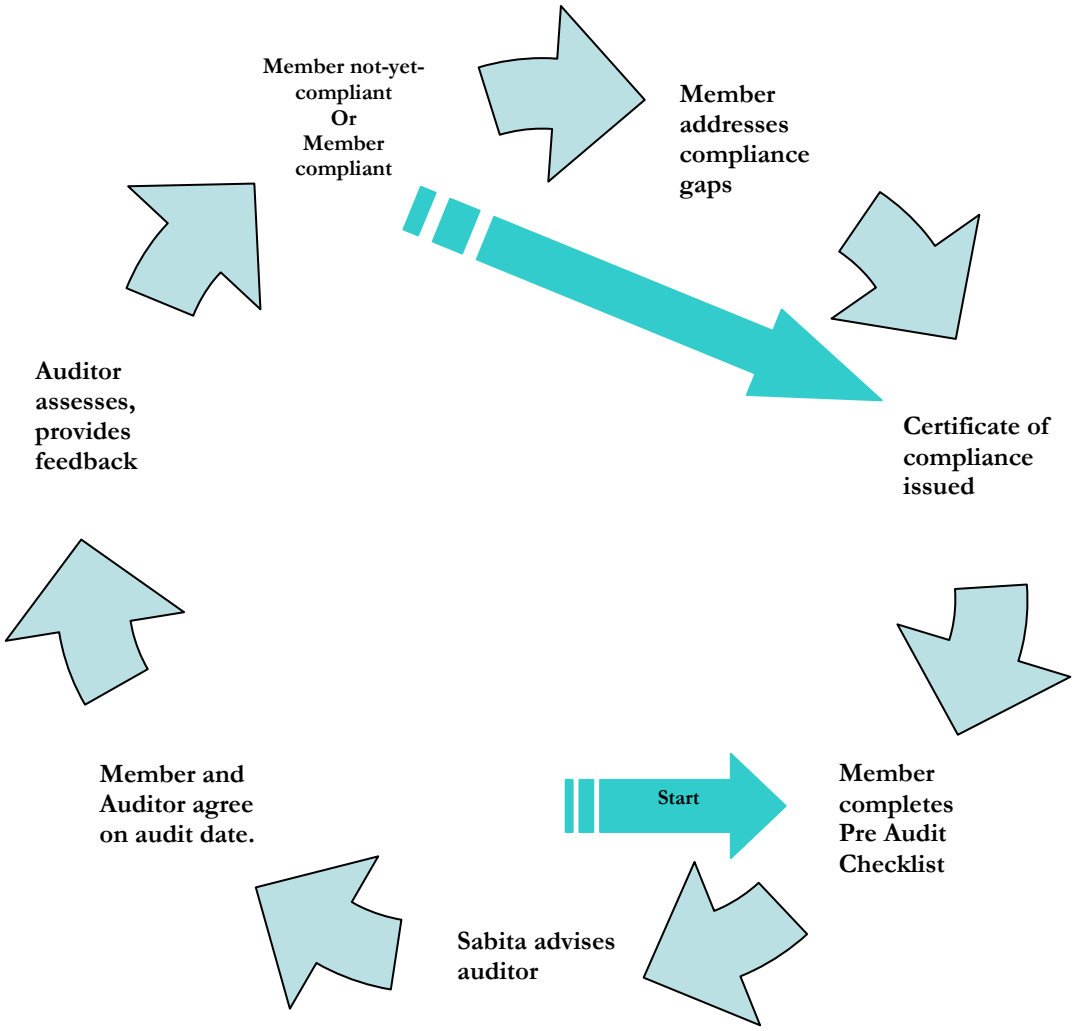


Figure 1 – Certification Process Flow

CERTIFICATION PRE-AUDIT CHECKLIST

Completion of this form is a pre-requisite to SABITA HSE certification and on completion must be emailed to info@sabita.co.za or faxed to 021 531 2606. A certification audit will be undertaken by an independent auditor (appointed by SABITA) once all the requirements indicated on the form are in place.

Section 1 – Company Details

Company: _____ Company site: _____

Site address: _____

Contact person: _____ ☎ E-mail: _____

Type of bitumen manufactured, processed or used: _____

Section 2 – Site Activity Profile

Activity category: Mark with X: (See category definitions below)

Category A [ ] Category B [ ] Category C [ ]

Category A - A fixed facility where storage, processing, testing and distribution of bitumen takes place; such as a refinery, depot, emulsion plant, blending plant or asphalt mixing plant

Category B - A semi-fixed facility where bitumen is stored, processed, tested and distributed for road paving application for a specific project and usually for a set contract duration

Category C - Premises from which vehicles involved in the transportation of bituminous materials operate

Section 3 – Site Staff and Injury Statistics

Number of staff employed on Site:

Operational [ ] Administrative [ ] Total staff on site [ ]

Safety Statistics: (See **Incident Management *(Notification, Investigation and Reporting)* process for SABITA Members)**

Has a reportable fatal incident occurred on site during the last 12 month period	YES	NO
Number of Total Reportable Cases recorded on site during the last 12 month period		
Current Total Reportable Case Frequency for the Site		

Section 4 – Minimum Statutory Documentation Requirements

The Company must retain ON SITE the following documentation and appointments as required by applicable legislation:

Reference	Requirement	Yes	No	N/A
COID Act: Section 80	Proof of registration and Letter of Good Standing with Compensation Fund and Unemployment Insurance Fund			
OHS Act: G.A.R. 4	An up-to-date copy of the Act and Regulations is readily available on site for perusal by employees			
OHS Act: Section 17 (1)	Designation in writing of Health and Safety Representatives, specifying the period and area of responsibility			
OHS Act: Section 19 (3)	Designation in writing of Health and Safety Committee members			
OHS Act: Section 20 (1) & (2); and G.A.R. 9	Record of each recommendation made in terms of subsection (1) (a) and incidents discussed in terms of subsection (1) (b). (Minutes of meetings)			
OHS Act: Section 24; &G.A.R. 8	Records (copies of WCL 1 or WCL 2 forms) of notification of incidents reportable in terms of section 24(1)(a) of the Act			
OHS Act: G.A.R. 8	Records in the form of Annexure 1 of the G.A.R. for recording and investigation of incidents reportable in terms of section 24(1)(a) of the Act			
OHS Act: G.S.R. 3 (4) and (6)	1. Copies of valid certificate/s of competency of first aid persons on site; 2. Notice or sign in a conspicuous place on site, indicating where the first aid box or boxes are kept as well as the name of the person in charge of such first aid box or boxes			
OHS Act: G.M.R. 2 (1) Supervision of Machinery	Designation in writing of a person in a full-time capacity in respect of every site on or in which machinery is being used			
OHS Act: G.M.R. 9 (2) (a) &(b)	Notices in respect of Boilers and Other Machinery displayed as applicable			
OHS Act: N.I.H.L.R. 4 (6)	Records of training given to employees exposed to noise at or above the noise-rating limit (85 dBA)			
OHS Act: N.I.H.L.R. 11 (a)	Records of the results of all assessments, noise monitoring and medical surveillance reports and of maintenance of control measures required by regulation			
OHS Act: H.C.S.R. 5 (1) (2) & (3)	Records of Health Risk Assessments, to determine if any employee may be exposed to HCS			
OHS Act: H.C.S.R. 9 (1)	Records of the results of all assessments, air monitoring, and medical surveillance reports required			
OHS Act: H.C.S.R. 9A (1)	Copies of MSDS of all HCS used on site			

Reference	Requirement	Yes	No	N/A
OHS Act: P.E.R. 14 (1) Pressure Equipment	A register in which the certificate of manufacture , and the results of all inspections, tests, modifications and repairs have been recorded			
OHS Act: D.M.R. 18 (7) & (10) (e)	Records of inspection and testing of lifting machines and lifting tackle			
OHS Act: D.M.R. 18 (11)	Certificates of training of lifting machine operators			
(OHS Act: E.I.R. 7 (1)	Certificate of compliance for electrical installations			

Section 5 – General Legal and Operational HSE Requirements

The Company/Site must demonstrate full compliance with the following:

Reference	Requirement	Yes	No	N/A
SABITA HSE-MS: 4.2.1	A written Health Safety and Environmental Policy is prominently displayed			
SABITA HSE Charter	The current version of the SABITA HSE Charter Poster is prominently displayed			
OHS Act: Section 8 SABITA HSE-MS: 4.4.1	Application of a Hazards and Effects Management Process to identify hazards; assess the associated risks and develop controls to manage the risks to As Low as Reasonably Practicable (A Risk/Hazard Register)			
OHS Act: Section 13 SABITA HSE-MS: 4.4.5	A documented process/procedure to ensure that all new employees receive **BitSafe** induction			
OHS Act: Section 13 SABITA HSE-MS: 4.4.5	A documented training plan/schedule to ensure that all employees in HSE Critical positions/jobs receive appropriate training and at least complete the **BitSafe** training program within two years of employment. Records of all training must be maintained			
BitSafe "train-the-trainer" certification program	**BitSafe** trainers have valid/current "Certificate of Competence" (Not older than 2 years)			
OHS Act: G.S.R. 2	Records of issue, training and maintenance of Personal Protective Equipment issued to employees			
OHS Act: G.S.R. 3 (3) (a)	**BitSafe** First Aid Kits are used on sites and bulk transport vehicles that handle hot bituminous products			
OHS Act: G.S.R. 5 & 9 SABITA HSE-MS: 4.4.1	A written procedure (Permit To Work system) to control Confined Space and Hot Work			
SABITA HSE Charter	The Company does not use, sell or market Coal Tar Products			
OHS Act: H.C.S.R. 15 (d)	A written procedure for the disposal of hazardous waste			
OHS Act: H.C.S.R. 15 (f)	The Company uses approved hazardous waste disposal contractors and keeps records of disposal certificates			
SABITA Manual 23	Loading, off-loading and transport of Bitumen is conducted in accordance with the SABITA code of practice "Loading of Bitumen at Refineries" and other SABITA endorsed codes of practice			

Reference	Requirement	Yes	No	N/A
SANS 10089-1:2008, Edition 4.3	Bulk flammable liquid storage areas have adequate bund walls to confine product spillage to the bunded area			
SABITA Manual 8	Bitumen storage tanks are numbered and clearly marked to identify product content			
	Drip trays are provided and used for on-site testing of sprayers prior to spraying			
	All hot bitumen transfer lines are adequately lagged			
OHS Act: **Construction Regulations** **Note: This section does not have to be completed for pre-audit review. The auditee must however be aware that construction activities will be assessed for compliance and must ensure that arrangements are in place to assure compliance.**	**Where 'Construction work' (as defined) is performed on site at the time of the audit the auditor shall assess compliance as applicable. All legal requirements in connection with construction activities involving contractors shall, by default, be included in the audit scope at the time of audit.**			

DECLARATION

I _____ (Name) confirm that:

- I am authorised to provide this information and sign this form;
- The information provided in this form is true and correct.

Signature: _____ Date: _____

HSE Manager/CEO/MD

Appendix 1 Certificate

Appendix 2 SABITA H-S-E Certification Scheme - Independent auditor's report on findings of a Certification Audit

Company Site

Auditee:

Name Tel no E-mail

Auditor Tel no E-mail Date of audit

AUDIT REPORT		
Certification requirement	Reason why not-yet-compliant	Recommended action to achieve compliance

AUDIT REPORT		
Certification requirement	Reason why not-yet-compliant	Recommended action to achieve compliance

SECTION 4

Incident Management process for SABITA Members

(Notification, Investigation and Reporting)

1. Introduction

In pursuit of its mission "of advancing best practice" in the Bitumen industry in Southern Africa, SABITA is desirous to promote an "incident reporting culture" amongst its Members.

Currently there are no industry specific records or statistics available in South Africa. While individual companies might record such incidents, this information is not shared within the industry. Regulatory sources (Government and Insurance) are also not helpful as the information is very fragmented and difficult to extract and collate from available reports. The goal is therefore to establish a centralised notification process to facilitate the capture of information in connection with HSE incidents related to the handling and application of Bitumen.

The benefits of a coordinated notification and recording effort are as follows:

- Members comply with Section 24 of the Occupational Health and Safety Act, 1993 in connection with the reporting of certain incidents to an Inspector;
- The calculation of incident frequency rates, and the development of Key Performance Indicators against which HSE performance can be measured and benchmarked;
- Sharing, amongst Members and other interested parties, the lessons learnt from incident investigations and especially those incidents with actual, or the potential for, significant impact;
- Enabling SABITA to provide Members with information in connection with incident causation trends, evaluation of work place hazards and advice on recommended practices to manage risks associated with the handling and application of Bitumen;
- Members can make informed decisions in connection with policies and strategic objectives in pursuit of sustainable improved HSE performance.

2. Objectives of this document

SABITA acknowledges that some Member organisations may have established procedures for incident reporting. However, SABITA is also aware that there is a need to assist the broader Member body with guidance and direction on best practice in this regard. This document therefore aims to achieve the following objectives:

2.1 General guidance on establishing and maintaining an Incident Notification, Investigation and Reporting Procedure that can be adopted as the minimum standard within the Bitumen Industry in Southern Africa;

2.2 Establishing a stanard for notification (by Members) of selected HSE incidents and statistical information to SABITA.

2.3 Establishing and maintaining a SABITA central incident data base that will enable SABITA to provide a service to Members and realise the benefits as outlined in the Introduction.

3. Definitions and explanation of terms

Asset Damage
A direct loss of or damage to, plant, equipment, tools or materials resulting from an incident.

Company
Company means a Member of SABITA that has agreed to report its HSE performance and incident data to SABITA following the reporting methodology detailed in this guide.

Contractor
All parties working for the company either as direct contractors or as subcontractors.

Corrective action

An action/s taken after an incident to correct the problem and to reduce the risk of a similar incident occurring.

Environmental Impact
The negative impact on the environment resulting from an incident.

Exposure Hours
The total number of hours of employment including paid overtime and training but excluding leave, sickness and unpaid overtime hours. Exposure hours should be calculated separately for company and contractor personnel.

Time off duty, even if this time is spent on company premises, is not included in the calculation of exposure hours, but incidents during this time are included in statistics if they are the result of failure or absence of management controls.

In many company sites the number of exposure hours can be calculated from computer controlled access or time keeping records. In the absence of more accurate methods exposure hours can also be calculated from a headcount and nominal working hours per person.

Fatality
Death, resulting from a work related injury or occupational illness, regardless of the time intervening between the incident causing the injury or exposure or causing illness and the death.

Fires and Explosions
Normally taken to mean all fires that necessitated the use of a fire extinguisher or other extinguishing means, e.g. shut off fuel or switch off electricity supply.

All flammable explosions or overpressure explosions should be included, irrespective of the extent of containment.

First aid
First Aid is the treatment of the resultant injury or illness using one or more of 14 specific treatments:

- Non-prescription medication at non-prescription strength;
- Tetanus immunizations;
- Cleaning, flushing or soaking wounds on the surface of the skin;
- Applying wound coverings such as bandages, Band-Aids™ or gauze pads; or using butterfly bandages or Steri-Strips™;
- Hot or cold therapy;
- Applying non-rigid means of support, such as elastic bandages, wraps, non-rigid back belts, etc;
- Using temporary immobilization devices while transporting the victim, such as splints, slings, neck collars or back boards;
- Drilling a fingernail or toenail to relieve pressure, or draining fluid from a blister;
- Applying eye patches;
- Removing foreign bodies from the eye using irrigation or cotton swab;
- Removing splinters or foreign material from areas other than the eye by irrigation, tweezers, cotton swabs or other simple means;
- Applying finger guards;
- Giving massages; or
- Drinking fluid for relief of heat stress.

First Aid Case (FAC) (See definition of First Aid)
Any single treatment and subsequent observation of minor scratches, cuts, burns, splinters, etc. that do not normally require medical care by a physician. Such treatment and observation is considered a first aid case even if provided by a physician or registered professional personnel.

High Risk Incident (HRI) (Read in conjunction with definition of Significant Incidents)
An incident for which the actual or probability of consequences are assessed to be in the high risk (red shaded) area of the RAM. HRIs can be incidents that result in injuries, illnesses or damage to assets, the environment or company reputation, or they can be Potential Incidents (PI) or Near Misses (NM).

Incident
As a minimum reporting requirement, any incident as defined in Section 24 of the Occupational Health and Safety Act, 1993.

In general, an event or chain of events that has, or could have, resulted in injury or illness or damage to assets, the environment or company reputation that should be reported to SABITA in terms of this procedure.

Injury
Any injury such as a cut, fracture, sprain, amputation etc. that results from a single instantaneous exposure. Injuries occurring in the course of work related activities are work related injuries.

Lost Time Injuries (LTI)
The sum of injuries resulting in fatalities, permanent total disabilities and lost workday cases, but excluding restricted work cases and medical treatment cases.

Lost Time Injury Frequency (LTIF)
The number of lost time injuries per million exposure hours for the reporting period. Usually calculated for 1 month, 1 calendar year, or 12 months "rolling" periods.

Formula = $\frac{\text{Number of LTI } \mathbf{X} \text{ 1,000,000}}{\text{Exposure hours}}$

Lost Workday Case (LWC)
Any work related injury that renders the injured person temporarily unable to perform their normal work or restricted work on any day after the day on which the injury occurred. Any day includes rest day, weekend day, scheduled holiday, public holiday or subsequent day after ceasing employment.

A single incident can give rise to several lost workday cases, depending on the number of people injured as a result of that incident.

Lost Workdays (LWD)
The total number of calendar days on which the injured person was temporarily unable to work as a result of a lost workday case. ***Note:*** In the case of a fatality or permanent total disability no lost workdays are recorded.

Medical Treatment Case (MTC)
Any work related injury that involves neither lost workdays or restricted workdays, but which requires treatment by a physician or other medical specialist.

Medical treatment does not include first aid even if a physician or registered professional personnel provide this.

Near Miss
An incident that could have caused illness, injury or damage to assets, the environment or company reputation, but did not.

Occupational Illness
Any work related abnormal condition or disorder, other than one resulting from an injury that is caused by or mainly caused by exposures at work. (50% or more probability that the illness was caused by exposures at work).
Occupational illnesses include acute and chronic illness or diseases that may be caused by inhalation, absorption, ingestion or direct contact.

Permanent Total Disability (PTD)
Any work related injury that permanently incapacitates an employee and results in termination of employment.

Potential Incident
An unsafe practice or a hazardous situation that could result in an incident (incident has not occurred). Companies should encourage the reporting and analysis of potential incidents as they provide a valuable source of learning that can be applied to prevent future incidents.

Reputation Impact
The negative impact on Company or SABITA reputation resulting from an incident. The negative impact can be in the form of adverse attention from media, politicians or action groups, or in public concern about Company activities.

Restricted Work Case (RWC)
Any work related injury which renders the injured person temporarily unable to perform all, but still some, ***of their normal work*** on any day after the day on which the injury occurred.

Restricted Workdays (RWD)
The total number of calendar days counting from the day of starting restricted work until the person returns to his normal work.

When restricted workdays follow a period of lost workdays, the restricted workdays are recorded in addition to the lost workdays, but the injury is recorded as a lost workday case only.

Risk Assessment Matrix (RAM)
A tool that standardises qualitative risk assessment and facilitates the categorisation of risk from threats to people, assets, environment and company reputation. (A tool similar to that described in the SABITA HSE Management System).

Road Transport Incident
An incident involving a vehicle driven by a company or contractor employee, whether on or off the road, that has resulted in injury, illness or damage to assets, the environment or the company's reputation, irrespective of the cost of repair or responsibility for cause.

A vehicle is defined as a car, van, light vehicle, heavy goods vehicle, road tanker, bus, motorcycle or any unit under tow, e.g. trailers, caravans, mobile generators.

Significant Incidents
Incidents with actual consequences or potential impact that rate 4 or 5 on the RAM. Significant incidents include Major Incident/s defined in the OHS Act as "an occurrence of catastrophic proportions, resulting from the use of plant and machinery, or from activities at a workplace".

Third Parties
Persons or organisations that are not employed by or contracted to a company or contractor.

Total Reportable Cases (TRC)
The sum of injuries resulting in fatalities, permanent total disabilities, lost workday cases, restricted work cases and medical treatment cases.

Total Reportable Case Frequency (TRCF)

The number of total reportable cases per million exposure hours.

Formula = $\frac{\text{Number of TRC } \mathbf{X} \text{ 1,000,000}}{\text{Exposure hours}}$

Vehicle Kilometres Driven
The number of vehicle kilometres travelled during work related activities whilst being driven by a company or contractor employee.

Work Related Activities
An injury or illness is considered work related if an event or exposure in the work environment caused or contributed to the resulting condition or significantly aggravated a pre-existing injury or illness. Work relatedness is presumed for injuries and illnesses resulting from events or exposures occurring in the work environment unless one of the following exceptions applies in its entirety:

- It occurs when an employee or contractor is present in the work environment as a member of the general public. In this case it will be included in the third party statistics.
- It results solely from voluntary participation in a wellness program or in a medical, fitness, or recreational activity such as blood donation, physical examination, flu shot, exercise class, etc. On the other hand, if the employee was injured by a trip or fall hazard present in the employer's canteen, the case would be considered work-related.
- It involves signs or symptoms that surface at work but result solely from a non-work related event or exposure.
- It is solely the result of eating, drinking, or preparing food or drink for personal consumption (whether bought on the employer's premises or brought in). For example, if the employee is injured by choking on a sandwich while in the employer's establishment, the case would not be considered work-related.

  However if the employee is made ill by ingesting food contaminated by workplace contaminants (such as lead), or gets food poisoning from food supplied by the employer, the case would be considered work-related.
- It is solely the result of doing personal tasks at the establishment outside of the employee's assigned working hours
- It is solely the result of personal grooming, self medication for a non-work-related condition, or is intentionally self-inflicted
- It is caused by a vehicle accident and it occurs on a company owned parking lot or road while the employee is commuting
- It is the common cold or flu. However contagious diseases such as tuberculosis, brucellosis, hepatitis A, or plague are considered work-related if the employee is infected at work.

4. Incident management process

The incident management process consists of the following steps:

- Immediate response and notification
- Incident investigation
- Incident reporting and follow-up
- Communication of lessons learnt

4.1 Immediate response and notification

4.1.1 Attend to injured persons and activate Medical Emergency Response Plans as necessary;

4.1.2 Notify the appropriate supervisor/manager immediately;

4.1.3 Secure the incident site: In the event of an incident in which a person died, or was injured to such an extent that he/she is likely to die, or suffered the loss of a limb or part of a limb, no person shall without the consent of an inspector disturb the site at which the incident occurred or remove any article or substance involved in the incident there from: Provided that such action may be taken as is necessary to prevent a further incident, to remove the injured or dead, or to rescue persons from danger;

4.1.4 Inform the health and safety representative/s (designated for the workplace or section of the workplace) as soon as reasonably practicable of the occurrence of the incident;

4.1.5 If possible take photographs and make sketches of the incident site/scene and record names and contact details of witnesses;

4.1.6 Notify, as appropriate in accordance with section 24 of the OHS Act, the Provincial Director of the Dept. of Labour as prescribed in General Administration Regulations, 2003, 8;

4.2 Incident investigation

Investigation of incidents is a line responsibility. All investigations should be led by a line manager or supervisor. HSE and other specialists should be employed as required in a support or facilitating role.

Incidents occurring during activities controlled by contractors should be investigated by the contractor, supported where necessary by company HSE and other specialist advisers. The incident investigation report submitted by the contractor should be reviewed and agreed by the company.

The extent of investigation and responsibility level should be based on a consideration of:

- **Actual consequences**.
  As a minimum, the requirements of sub-regulation (2*)* of the *Occupational Health and Safety Act, 1993, General Administration Regulations, 2003: 9. Recording and investigation of incidents,* shall be used to determine the team composition for investigation of incidents;
- **Risk rating as determined by the RAM**.
  In addition to the minimum legal requirement it is strongly recommended that the **POTENTIAL SEVERITY and LIKELIHOOD OF CONSEQUENCES** are determined by the RAM and that the investigation team composition is based on the RAM classification.

4.2.1 Recommended team composition based on RAM classification

4.2.1.1 RAM 4/5 incidents (significant incidents)

Lead investigator:

- The most senior person in the organisation charged with the responsibility of implementing the HSE Management System. (Ideally this should be the CEO or the HSE Director appointed by the CEO)

Team members:

- The Health and Safety representative/s designated for the section of the workplace where the incident occurred;
- The Supervisor/Line Manager of the section of the workplace where the incident occurred;
- The injured person/s if available;
- All witnesses
- HSE and other specialists

4.2.1.2 RAM 3 incidents

Lead investigator:

- The Line Manager of the Supervisor of the section of the workplace where the incident occurred;

Team members:

- The Health and Safety representative/s designated for the section of the workplace where the incident occurred;
- The Supervisor of the section of the workplace where the incident occurred;
- The injured person/s if available;
- All witnesses
- HSE and other specialists

4.2.1.3 RAM 1/2 incidents (including "near miss" and Potential Incidents)

Lead investigator:

- The Supervisor of the section of the workplace where the incident occurred;

Team members:

- The Health and Safety representative/s designated for the section of the workplace where the incident occurred;
- The injured person/s if applicable;
- All witnesses
- HSE and other specialists as deemed necessary

4.2.2 Investigation process

The investigation should be carried out as soon as possible after an incident. (The legal requirement is within 7 days from the date of the incident and finalised as soon as is reasonably practicable, or within the contracted period in the case of contracted workers).

The quality of evidence will deteriorate rapidly with time therefore delayed investigations are usually not as conclusive as those performed promptly.

The investigation should include the following activities:

- Conducting interviews;
- Inspecting the location and gathering physical evidence;
- Collecting background information;
- Fact finding;
- Reviewing records and procedures;
- Conducting specialist studies;
- Resolving conflicts in evidence.

Annexure 4 provides guidance on the incident investigation process.

Establishing the Sequence of Events

Documenting the sequence of events is a crucial step that provides the starting point for analysis of underlying causes. A number of techniques are available to help visualise the sequence of events.

As a minimum at least a **Timeline** should be documented. A timeline is simply a list of the events in chronological order. For straightforward incidents a timeline and narrative will suffice as a description of the sequence of events.

Analysis of Underlying Causes and Weaknesses in Management System

The purpose of this analysis is to establish the underlying causes of the incident, so that actions can be taken to prevent recurrence, and also to understand the failures and weaknesses in management systems that led to the incident. Although this analysis is a separate activity from investigation of the incident, it is recommended to carry out the investigation and analysis concurrently, so that they can support and build on each other.

Many methods are available for analysing the underlying causes of incidents, and Companies are encouraged to invest in one of the recognized methods and supporting software available in the market to conduct an in-depth analysis of Significant Incidents.

The investigation and analysis of less serious incidents, where an in-depth analysis is not being undertaken, should at least include an analysis of factors such as:

- type of incident;
- type of injury;
- phase of operation or activity;
- cause of incident;

This type of analysis of all the incidents occurring over a period of time can provide valuable input to an incident prevention programme.

4.3 Incident reporting and follow-up

4.3.1 Incident Report

The incident report presents the investigation findings, analysis and corrective action plan. The incident report shall be reviewed at the workplace Health and Safety Committee meeting and an appropriate management level as a check on the completeness and quality of the investigation and to obtain agreement to the proposed actions.

Annexure 3 shows the recommended report format for an investigation of a significant incident.

4.3.2 Reporting requirements

Each Company shall determine and clearly define own internal incident reporting procedures and at a minimum make provision for the following:

4.3.2.1 Compliance with Section 24 and General Administration Regulations, 2003: 9, of the Occupational Health and Safety Act, 1993.

4.3.2.2 Reporting and review of incident investigations at appropriate management levels commensurate with the incident severity as determined by a Risk Assessment Matrix.

4.3.2.3 Voluntary reporting of certain incidents and incident frequency rates to SABITA. Although voluntary, this is a prerequisite requirement for participation in the SABITA HSE Certification and SABITA HSE Awards Scheme.

Annexure 1 provides a template in the form of Annexure 1 of the General Administrative Regulations and represents the minimum standard for reporting of incidents.

4.3.3 Reporting HSE Incident information to SABITA

4.3.3.1 Voluntary reporting categories

Refer to definitions in section 3 of this document and report information on ALL incidents in the following consequence severity categories:

- Total Reportable Cases (Injuries, including Occupational Illness)
- Asset Damage (Loss value >R200,000)
- Environmental Impact (A spillage of ANY quantity of a Hazardous Chemical Substance that was not contained on the work site and necessitated a specific environmental clean-up operation as a result of migration off-site)
- Fires and Explosions
- Reputation Impact (Any incident that resulted in National Media coverage)

4.3.3.2 Mandatory reporting requirements

Reporting of Total Reportable Case injuries and calculation of a 12 month rolling Total Reportable Case Frequency is mandatory for Member participation in the SABITA HSE Certification and Awards Scheme.

4.3.3.3 Method of reporting

Reporting shall be done by fax or e-mail within 30 days of the date of the incident on the form provided in Annexure 6A of this document. Annexure 6 provides an explanation of the incident reporting input codes and descriptions for reporting to SABITA.

4.3.4 Follow-up to review progress with implementation of corrective action

The corrective action plan should include a review date to follow up on implementation of recommended action. Review of the corrective action plans should be included in the HSE agenda of Executive Management meetings to assure appropriate intervention in cases where action items have not been closed out.

4.3.5 Legal advice

When compiling incident reports that may be required by authorities and other third parties outside the company, it is recommended to seek legal advice before finalising the reports. Requests for copies of incident reports should be considered individually taking into consideration the potential risks and exposures for the company, its directors and employees and the possibility of criminal or civil liability.

4.4 Communication of lessons learnt

When the investigation of significant or high risk incidents reveals a significant learning potential the lessons learned should be communicated within the Company. An incident is considered to have significant learning potential when all the following criteria are met:

- The required controls are not standard industry practice or the incident involved a combination of factors that are not commonly recognised;
- There has not been a previous communication in the past 3 years on the same subject;
- The learning is widely applicable in the Company or across Industry.

Similarly, the Company HSE adviser should decide if the lessons learned have value to other SABITA Members or the Bituminous Industry in general. The learning should be communicated through news forums, newsletters, cross industry working parties etc.

Additionally, when Company HSE advisers receive the initial notification of a significant incident, within 24 hours, they should consider the need to communicate **the facts known so far** to other SABITA Members or the Bituminous Industry in general.

Annexure 5 shows an example of an HSE Alert bulletin that could be used by SABITA Members to communicate lessons learnt from investigation of significant or high risk incidents including Potential Incidents.

ANNEXURE 1 RECORDING AND INVESTIGATION OF INCIDENTS

(Occupational Health and Safety Act, No 85 of 1993. Regulation 9 of the General Administrative Regulations)

A. RECORDING OF INCIDENT

1. Name of employer .....…….
2. Name of affected person …….....…….....
3. Identity number of affected person ……..……..
4. Date of incident ..... 5. Time of incident …….....…….
6. Part of body affected

Head or Neck	Eye	Trunk	Finger	Hand
Arm	Foot	Leg	Internal	Multiple

7. Effect on person

Sprains or strains	Contusion or wounds	Fractures	Burns	Amputation
Electric shock	Asphyxiation	Unconsciousness	Poisoning	Occupational Disease

8. Expected period of disablement

0-13 days	2-4 weeks	>4-16 weeks	>16-52 weeks	>52 weeks or permanent disablement
Killed				

9. Description of occupational disease……..
10. Machine/process involved/type of work performed/exposure*

……
*(in case of a hazardous chemical substance, indicate substance exposed to)

11. Was the incident reported to the Compensation Commissioner and Provincial Director?

Yes	No

12. Was the incident reported to the police? **

Yes	No

13. SAPS office and reference ……..……
** (To be completed in case of a fatal incident.)

B. INVESTIGATION OF THE ABOVE INCIDENT BY A PERSON DESIGNATED THERETO

1. Date of investigation ……..……

2. Name of investigator ....…..……..

3. Designation of investigator.……...

4. Investigator assisted by: a) …… b) ……..

c) ……... d) ……. e) …….

5. Short description of incident ……..…….

……..

……..

6. Suspected cause of incident

…….....…….....

.....

.....……..…….....……...

7. Recommended steps to prevent a recurrence

…….....…….....……

……

.....……..…...

…….....…….

…… ……..

Signature of Investigator ……..Date ……..

C. ACTION TAKEN BY EMPLOYER TO PREVENT THE RECURRENCE OF A SIMILAR INCIDENT

.....…….....

…….....……

.....……..……

…….. …….....

Signature of employer ……..Date ……

D. REMARKS BY HEALTH AND SAFETY COMMITTEE

.....

.....

……...……...……..

……. ……..

Signature of Chairperson of Health and Safety Committee ……. …..

Date ……

ANNEXURE 2 RISK ASSESSMENT MATRIX

SEVERITY	CONSEQUENCES				INCREASING LIKELIHOOD				
	People	Assets	Environment	Reputation	A	B	C	D	E
					Never heard of in the Industry	Heard of in the Industry	Has happened in the Organisation or more than once per year in the Industry	Has happened at the Location or more than once per year in the Organisation	Has happened more than once per year at the Location
0	No injury or health effect	No damage	No effect	No impact					
1	Slight injury or health effect	Slight damage	Slight effect	Slight impact					
2	Minor injury or health effect	Minor damage	Minor effect	Minor impact					
3	Major injury or health effect	Moderate damage	Moderate effect	Moderate impact					
4	PTD or up to 3 fatalities	Major damage	Major effect	Major impact					
5	More than 3 fatalities	Massive damage	Massive effect	Massive impact					

Explanation of terms used for increasing likelihood:

Industry:

1. In connection with consequences of incidents involving bituminous products means the Bitumen Industry in Southern Africa.
2. In connection with consequences of all other incidents in general means the Construction Industry in Southern Africa.

Note: The application of “Industry” for assessment purposes could also be extended to include the Global Bitumen Industry and/or Global Construction Industry if very similar or identical process hazards are being analysed.

Organisation:

Means the entire organisation of a specific Company (SABITA Member Organisation), including all its operational units, branches, and joint ventures.

Location:

Means a specific operational unit or plant (functioning separately from other units) within an Organisation. A typical Member Organisation is likely to have several Locations across Southern Africa.

ANNEXURE 3 INCIDENT REPORT LAYOUT FOR A SIGNIFICANT INCIDENT

This annexure lists the headings and provides guidance on the content of a report of a significant incident. When a computer based tool is used to analyse the incident the report can be generated automatically from the data inputted to the software.

Summary
A brief summary of the report, giving the background of the incident, a description of the incident, description of injuries, damage and loss, and outlining the causes established and the agreed actions.

Place, time and date of incident

Consequences
Details of persons injured and a description of injuries, damage and loss, including an estimate of the cost of direct and consequential losses.

Events leading up to the incident
A short narrative that sets the scene of the incident:
- Description of the operation in progress;
- Preparations made for the work, including work procedures, instructions, permits and supervision;
- Personnel involved including work and shift patterns;
- Equipment involved;
- Environmental and weather conditions;
- Activities taking place at the scene of the incident;
- Activities of key persons prior to the day of the incident that could have affected their actions.

Description of the Incident
A statement of the facts immediately surrounding the incident, covering the period from the initiating events until the situation was under control. The statement should include photographs, drawings or maps to illustrate the narrative. It should also include a presentation of the sequence of events.

Results of the investigation
This section should demonstrate that the investigation was carried out in sufficient depth to support the conclusions that follow. Where relevant, it should include references to:
- Environmental conditions;
- Condition of equipment and facilities, including inspection and maintenance history, operating mode;
- Procedures relating to the operation;
- Information about the training and experience of persons involved;
- Work instructions and communications;
- Records and documentation;
- Information derived from the nature of the damage;
- Witness statements;
- Medical records;
- Factors affecting alertness or judgement, e.g. fatigue, social pressures, alcohol, medication or drugs;
- Working conditions;
- Survival aspects;
- Results of special investigations and tests;
- Rescue and damage containment activities;
- Emergency response and recovery activities.

Results of analysis
This section should include the results of the analysis of the findings, identifying the immediate and underlying causes and weaknesses in the management system. The results are normally presented as an event tree. When certain conclusions have not been fully established by the available evidence these should be highlighted as tentative conclusions.

Action items
This section should include corrective actions for immediate causes (breached defences) and improvement actions addressing the underlying causes and management system weaknesses (latent failures). Action items should be achievable and measurable, and should specify action parties, implementation times and follow-up review dates.

ANNEXURE 4 INCIDENT INVESTIGATION GUIDANCE

This annexure provides a checklist of subjects to be addressed during the investigation of incidents.

Conducting Interviews

Interviews with witnesses should be carried out as soon as possible after the incident, as intervening time and discussions with others can influence a person's recollection of events. The value of a witness's input can be greatly influenced by the style of the interviewer, whose main task is to listen to the witness's story and not to influence it by making comments or asking leading questions. This requires patience and understanding.

An investigation team is often seen in a prosecuting role, and witnesses may be reluctant to talk freely if they think they may incriminate themselves or their colleagues. An investigator is not in a position to give immunity in return for information, but must try to convince interviewees of the purpose of the investigation and the need for frankness. The following are some points of good practice when conducting an interview:

- Prepare the questions you need answered beforehand;
- Avoid interviews by the whole investigation team that may intimidate the witness;
- The optimum is two interviewers and a single witness. Also avoid interviews by immediate supervisors;
- Allow the witness to be accompanied by a colleague or friend or a safety representative;
- Conduct the interview in private and start off with a general discussion to put the witness at ease before asking questions about the incident;
- Make sure that the witness understands that he or she will not be required to sign a statement;
- Ask the witness to go step by step through the events surrounding the incident, describing both own actions and the actions of others. Do not ask leading questions;
- Separate facts from opinions. Ask further questions to confirm the facts, and note the opinions;
- Summarise the discussion at the end of the interview to make sure that there is no misunderstanding. Afterwards, prepare notes of the discussion and agree them with the witness. Clarify any anomalies and any conflicts with other evidence;
- Assess the need for the witness to receive counselling.

Inspecting the Location

Important facts and data can be gained from observations made at the scene of the incident, particularly if the location is kept undisturbed until the preliminary investigation has taken place.

Rescue operations or the presence of residual hazards may necessitate moving some of the equipment, but this should be kept to a minimum. Before disturbing the incident location photographs and/or video film should be taken.

Sketches can be used to document the physical relationship and distance between people, tools and equipment. All relevant equipment, tools, clothing, PPE and other material evidence should be identified and labelled. If critical equipment or tools have been damaged or have failed they should be kept in a secure place pending more detailed analysis.

Local legislation may prescribe that for certain classes of incident, e.g. fatality or motor vehicle accident; nothing may be moved without prior permission from the relevant authorities.

Investigators should look for any conditions or factors at the location that could have contributed to the incident. Factors to check include:

- Position of all equipment in relation to other equipment and people;
- Position of valves, spades, set points, recorders, override switches, etc.;
- Samples of process materials, products of reaction/combustion, drain water etc.;
- Process control and safeguarding instrument status. Check that records are retained beyond 24 hours;
- Procedures, vehicle tachographs, training records, log books, process logs and test records;
- Condition of load-bearing surfaces;
- Accessibility and evidence of congestion;
- Lighting, visibility and audibility at the location;
- State of housekeeping;
- Condition of all plant, vehicles, equipment and tools;
- Effects of weather;
- Presence of witnesses;
- Evidence of spills or release;

ANNEXURE 4 INCIDENT INVESTIGATION GUIDANCE (Continued)

- Odours, discoloration, tyre marks;
- Presence of unauthorised people;
- Evidence of excessive forces;
- Presence of warning signs and notices.

Collecting Background Information

Background information will include:

- Process design and operating manuals;
- Procedures for the type of operation involved;
- Records of instructions and briefings given on the particular job being investigated;
- Location plans;
- Organisation and persons involved;
- Product information and MSDS.

Fact Finding

During the initial stages of every investigation, investigators should collect and record all the facts that may add to the understanding of the incident and the events surrounding it. They should be aware of the danger of reaching conclusions too early and of failing to keep an open mind to the full range of possibilities. They should ask the questions who?, what?, when?, where?, why?, and how? about the circumstances of the incident. Here is a checklist of specific questions that should be answered during the fact-finding process:

- What operations were in progress?
- What equipment was in use? Had any of the equipment failed?
- Where were the key personnel and; what were their actions immediately before the incident?
- What instructions were given that is related to the incident?
- What energy sources and flows were not controlled?
- Were there any operational deviations, equipment defects or inappropriate use of resources and equipment?
- Were there any changes of personnel, procedures, processes or equipment that could have contributed to the incident?
- What were the weather conditions?
- What action did any third parties take that contributed to the incident?
- Were the individuals involved physically fit and competent to perform the job?
- Could alcohol or drugs have been a contributory factor? Should tests be done?
- Could the effect of fatigue, work cycles and stress be contributory factors?
- Could social or domestic pressure have had an impact on an individual's behaviour?
- Could time of day, age of people involved, length of service, training received etc. be contributory factors?

After a first round of fact finding it should be possible to give a precise description, supported by the documented facts, of the events leading to the incident, the incident itself and the initial response to the incident. It should be possible to:

- Describe the consequences of the incident in terms of injury, damage and loss, environmental and reputation impact;
- Identify what defences (controls and recovery measures) were in place to prevent the incident;
- Identify the substandard acts which breached these defences;
- Identify the preconditions which led to the substandard acts;
- Identify what additional information and specialist resources are needed to confirm the immediate causes and to establish the underlying causes (latent failures);

Comment on response to the incident, including first aid, emergency medical treatment, rescue, shutdown of the process and fire fighting.

ANNEXURE 4 INCIDENT INVESTIGATION GUIDANCE (Continued)

Records and Procedures

Documentation such as drawings, inspection records, instrument and tachograph records, printouts, log sheets/books, maintenance records, work permits and load/time sheets may provide information relevant to the investigation.

Written instructions and procedures may provide evidence of pre-planning and individual responsibilities. The investigation should try to establish the extent to which these procedures and instructions were understood and acted upon, as this can indicate the effectiveness of training and supervision. The relevance and extent of application of procedures should be assessed during the investigation.

Special Studies

Incidents of a technical or complex nature often require specialist input and further studies to determine causes of failure. Aircraft crashes, crane failures and plant explosions are examples of such incidents, where specialist advice may be required. This should be rapidly identified and the specialists involved early in the site assessment.

Conflicting Evidence

It is not unusual for witnesses to give differing accounts of an incident. Human memory can be unreliable and, even if not motivated by self-protection or other subjective arguments, one person's recollection of an incident can differ from another person's in important details. Investigators should note any significant differences in accounts of an event.

Faced with conflicting witness statements, investigators should look for the similarities between the statements and commonality with other evidence. The objective is to use the evidence to understand the incident and not to prove the accuracy of individual statements, nor to apportion blame.

ANNEXURE 5 TEMPLATE FOR SHARING LESSONS LEARNT FROM INCIDENT INVESTIGATIONS

Southern African Bitumen Association Page 1 of

SAFETY ALERT

Purpose

Description

Lessons learnt

Recommended action

ANNEXURE 6 Incident reporting input codes and descriptions

Input category:	**Incident type**						
Code	**Description**	**Code**	**Description**	**Code**	**Description**	**Code**	**Description**
01	Injury	02	Asset Damage	03	Environmental Impact	04	Fires and Explosions
05	Reputation Impact	06	Other				

Input category:	**Activity**						
Code	**Description**	**Code**	**Description**	**Code**	**Description**	**Code**	**Description**
07	Refining	08	Loading	09	Off –loading	10	Storage
11	Heating	12	Binding Manufacture	13	HMA Manufacture	14	Spraying
15	Paving	16	Sampling	17	Testing	18	Chip Spreading
19	Transporting	20	Compacting	21	Cleaning	22	Road Maintenance
23	Plant Maintenance	24	Other				

Input category:	**Product involved**						
Code	**Description**	**Code**	**Description**	**Code**	**Description**	**Code**	**Description**
25	Penetration Bitumen	26	Cutback Bitumen	27	Bitumen Emulsion	28	Hot-mix Bitumen
29	Bitumen rubber	30	Polymer modified	31	Cutter / Solvent	32	Other

Input category:	**Injury severity**						
Code	**Description**	**Code**	**Description**	**Code**	**Description**	**Code**	**Description**
33	Multiple Fatalities	34	Single Fatality	35	Permanent Disability	36	Lost Workday Case
37	Restricted Workday Case	38	Medical Treatment Case				

Input category:	**Part of body injured**						
Code	**Description**	**Code**	**Description**	**Code**	**Description**	**Code**	**Description**
39	Skull and Face	40	Eye	41	Ear	42	Nose
43	Mouth	44	Neck	45	Upper back	46	Lower back
47	Chest	48	Stomach	49	Arm	50	Hands
51	Leg	52	Feet	53	Respiratory system	54	Other

Input category:	**Injury type**						
Code	**Description**	**Code**	**Description**	**Code**	**Description**	**Code**	**Description**
55	Sprain	56	Dislocation	57	Fracture	**58**	Cut / Puncture wound
59	Concussion	**60**	Amputation	**61**	Major burn	**62**	Minor burn
63	Poisoning	**64**	Asphyxiation	**65**	Muscular	**66**	**Internal**

Input category:	**Occupation of injured**						
Code	**Description**	**Code**	**Description**	**Code**	**Description**	**Code**	**Description**
67	Labourer	**68**	Operator	**69**	Driver	**70**	Mechanic
71	Supervisory	**72**	Laboratory staff	**73**	**Contractor staff**	**74**	**3rd Party visitor**

Input category:	**Incident cause/s**		
Code	**Description**	**Code**	**Description**
75	Operating equipment improperly	76	Failure to secure
77	Operating at improper speed	78	Inadequate guards or barriers
79	Servicing equipment in operation	80	Safety devices removed or made inoperable
81	Using defective equipment	82	Inadequate or incorrect personal protective equipment
83	Failing to use personal protective equipment	84	Improper lifting/loading/placement
85	Improper position for task	86	Failing to follow Safe Work Procedure

Input category:	**When did the incident occur**						
Code	**Description**	**Code**	**Description**	**Code**	**Description**	**Code**	**Description**
87	**Normal time**	**88**	**Overtime**	**89**	**Night work**	**90**	**Weekend overtime**
91	**Public holiday**	**92**	**Off duty**				

ANNEXURE 6A Members report of HSE incident information to SABITA

Note to compiler:

1) Refer to Annexure 6 for descriptions and input codes.
2) Complete one form for each incident
3) Fill in the applicable codes or **x** in the empty box as appropriate.
4) Incidents usually have more than one cause. Please indicate ALL of the likely causes identified during the incident investigation.

Company name		Site		City	

Reporting period

Year		Quarter 1		Quarter 2		Quarter 3		Quarter 4	

Incident details

Incident type	Code		Activity	Code		Product involved	Code	
Injury severity	Code		Part of body injured	Code		Injury type	Code	
Occupation of injured	Code		When did incident occur	Code		Incident cause 1	Code	
Incident cause 2	Code		Incident cause 3	Code		Incident cause 4	Code	

I…… in my capacity as …….. (Position) declare that the information submitted in the above form is correct.

Signature:…….. Date: ……

Fax or email this form to Lorraine at Sabita on 021 5312606 or Lorraine@sabita.co.za

Section 5

Code of Practice-Loading of bitumen at Refineries

Introduction

The Southern African Bitumen Association (SABITA) and its members acknowledge that they have an obligation to provide for the health and safety of their employees, society in general, and to protect and conserve the environment in which they operate.

As a leading industry association, SABITA has therefore taken the initiative to ensure that the manufacturing, marketing and transportation of bitumen products take place in accordance with the highest acceptable standards. In such cases where adequate standards do not exist, SABITA has undertaken to develop and promote the required standards.

The transportation of dangerous goods by road is governed by a number of statutory requirements. Many of these are often written in very wide and generic terms and compliance with the standards is poorly enforced. SABITA will therefore ensure, through this document, that operations take place in compliance with all statutory and industry-specific requirements. For this reason, all SABITA members that operate Bitumen Bulk Road Tanker loading facilities, and members that are Bitumen Transport Providers, have pledged their commitment by becoming signatories to this Code of Practice.

Signatories have also agreed that no organisation will be allowed to partake in any of the relevant activities or operations if such organisation is not willing to declare compliance.

List of signatories to this Code of Practice

1. Sapref, Refinery Road, Prospecton, Durban
2. Natref, Jan Haak Rd, Sasolburg,
3. Enref, Tara Road, Wentworth, Durban
4. Chevron Refinery (Calref), Koeberg Road, Milnerton, Cape Town
5. Unitrans Fuel and Chemical

1. General

1.1 Objective

The general overall objective of this Code of Practice is to provide a single uniform standard, specifications and procedures for the loading of Bitumen into Bulk Road Tankers.

The procedures contained in this document are stated in generic terms and the intention is not to force standard forms, operating systems and procedures at individual loading facilities. It is however expected that the principles will be applied universally whilst each facility will still retain its own identity and specific additional requirements if necessary.

However as much standardisation as possible is desired and the signatories to this document have agreed that this Code of Practice constitutes the MINIMUM requirements for loading bitumen at facilities under their operational control.

The specific objectives of this document are to:

a) Provide standards and procedures in connection with the loading of bitumen into Bulk Road Tankers at bitumen bulk loading facilities throughout Southern Africa.

b) Provide minimum standards for the training of those involved.

c) Provide standards and procedures regarding the handling of incidences of non-compliance with the requirements of this Code of Practice (CoP).

d) Ensure that Health Safety and Environmental risks associated with bitumen loading and transport operations are managed to a level of As Low as is Reasonably Practicable.

e) Provide all involved with the required information, knowledge, guidance and assistance in order to develop a culture of operating at best-practice levels.

f) Provide background information regarding certain principles and philosophies employed.

1.2 Scope

This CoP applies to all Bulk Road Tanker operators that load bitumen at any of the bulk Bitumen loading facilities in Southern Africa. The CoP also covers all relevant Bulk Road Tankers including (but not restricted to) the following categories:

i) Contractor vehicles carrying on behalf of SABITA members

ii) Contractor vehicles carrying on behalf of any other client of the manufacturer or marketer

iii) Vehicles owned by SABITA members

1.3 Statutory compliance

a) The requirements and application of this CoP may not be in contravention with any applicable Act or regulations.

b) All vehicles, equipment and the application and use thereof will be in accordance with current South African legislation.

c) All drivers referred to or implied in this document will comply with current relevant South African legislation in regards to their actions and the requirements set for a driver of a Dangerous Goods vehicle.

1.4 Definitions and abbreviations

1.4.1 Definitions

bonding
With reference to ‘static electricity’ bonding means the interconnection of two bodies, so that any potential difference between them is eliminated.

bottom outlet valve (BOV)
Often also referred to as an Emergency valve. This valve opens into the compartment and has spring-return. It seals the compartment off at tank floor level. In an accident, the external valve body can shear off, leaving the valve seat and product intact.

bitumen
A generic term including the following products:

Penetration grade, R-grade or Hard grade bitumen – UN 3257; Polymer modified bitumen – UN 3257; Cutback or Fluxed Bitumen – UN 1999; Bitumen emulsion – UN 1999

bulk road tanker

A vehicle designed, manufactured and equipped in accordance with recognised and acceptable standards and specifications, and in this context specifically for the transport of Bitumen.

contractor

See Transport Provider

converter dolly

A suspension set that converts a semi-trailer into a drawbar trailer by coupling to the semi-trailer kingpin. By law it is a separate vehicle and requires lights, a chevron and a number plate.

drawbar trailer

A trailer drawn in such a manner that it transfers no load to the drawing vehicle.

driver

In the context of this CoP, the person who is sole responsible and accountable for the safe operation of a Bulk Road Tanker loading at a Bitumen loading facility.

dry-break adaptor (coupling)

The "male" coupling which, when disconnected from the female, seals itself to prevent spillage of the liquid.

dust-cap

Relative to a dry-break adaptor, it is regarded as the third method of closure as required by ADR. Therefore it cannot be simply a gadget to keep someone from pilfering product. It physically has to seal the loading adaptor to provide a liquid tight seal.

earthing

The connecting of an insulated object to earth, so that external electric charges are conducted away and do not accumulate on the object.

emergency release

A mechanism used to shut, primarily the compartment bottom vales simultaneously, in an emergency from a position of least danger. In practice it is used to shut the complete product delivery control system down.

emergency vent

A vent fitted to the tank to relieve abnormal pressure build-up inside the compartment. (For instance, when the tanker is involved in a fire.) This vent releases the pressure to atmosphere and prevents the tank from rupturing due to the internal pressure build-up exceeding the tank design pressure.

employer

In the context of this document means the Transport Contractor, Oil Company or a Marketer loading his own product.

gland

A fitting used where electrical cables enter into enclosures. The fitting grips the cable and seals the cable entry.

gross capacity

The overall capacity of the compartment or tank when filled to a point where there is no free space left above the liquid.

inter-link tanker combination

Two semi-trailers operated in combination. The rear semi-trailer is coupled to the front semi-trailer in the same manner as the front is coupled to the truck tractor.

junction box

An enclosure used to make electrical connections.

loading facility

Any of the recognised Bitumen loading facilities being: SAPREF – Shell/BP refinery, Prospecton, Durban; CALREF – Caltex/Chevron refinery, Milnerton, Cape Town; NATREF – Sasol/Total refinery, Jan Haak road, Sasolburg; ENREF - Engen Refinery – Tara road, Wentworth, Durban

loading area

The area known as the “loading gantry” and where Bitumen is loaded into a Bulk Road Tanker.

loading process

This includes the total process from the time that the driver and vehicle first reports for loading until the driver and vehicle exits the gate

normal office hours

07h30 to 17h00 Monday to Fridays

oil company

One of the major Oil Companies operating in South Africa, namely, BP SA (Pty)Ltd; Caltex Oil Sa (Pty)Ltd; Engen Oil (Pty)Ltd; Sasol Oil (Pty)Ltd; Shell Oil SA (Pty)Ltd; Total Oil SA (Pty)Ltd

operating passport (OP)

A document issued to the driver that will acknowledge that he/she meets the requirements and will allow him/her access into the loading facility in order to load a Bulk Road Tanker. May be known by different titles at the various loading facilities.

professional driving permit – dangerous goods (PrDP-D)

Issued by the Department of Transport as a driving licence and is valid for two years

pup tanker

A small trailer, usually with a fixed, non-articulating drawbar, drawn by a semi-trailer by means of a suitable hitch. It often transfers load to the semi-trailer and is thus technically also a semi-trailer.

pressure and vacuum (PV)

Refers to a device that can “breathe in and out” to maintain pressure equilibrium in a tank

rigid tank truck

A Bulk Road Tanker that has a fixed tank fitted to a freight carrier chassis.

safe loading pass (SLP)

A pass issued by an Oil Company to acknowledge that the tanker meets the minimum technical, roadworthiness and ‘fit-for-loading’ standards.

semi-trailer tanker

A trailer that transfers part of its mass to the drawing vehicle. It is drawn by a truck tractor.

side under-run protection

These are lightweight rails, parallel to the ground and fitted along the sides of a vehicle, to prevent pedestrians and cyclists from being trapped in front of the wheels of the vehicle. The rails are normally fitted in areas where no other equipment is fitted such as fuel tanks that could serve the same purpose.

switch loading

When loading a product of intermediate or high flash point or low vapour pressure into a compartment that contained a product of low flash point or high pressure on the previous load.

transport provider (TP)

Synonymous with haulier, transport operator or transport contractor. Any company operating Bulk Road Tankers from or at a Bitumen bulk vehicle loading facility.

truck tractor

Vehicle used to draw a semi-trailer (or combination of tankers of which the one coupled to the truck tractor is a semi-trailer). Often incorrectly referred to as a "Horse"

ullage

The free space above a liquid inside a tank or compartment.

vehicle

A Bulk Road Tanker including a:

Truck Tractor; Semi-trailer; Pup tanker; Front interlink tanker; Rear interlink tanker; Rigid tank truck; Drawbar trailer tanker; Convertor dolly; All of these are all separate vehicles.

4-pole battery isolator

A battery isolator switch that will isolate both the "Live" and "Earth" circuits. Often called a double pole isolator.

5th wheel

The coupling fitted to a truck tractor used to attach the semi-trailer to for drawing purposes.

1.4.2 Abbreviations

ADR European Agreement Concerning the International Carriage of Dangerous Goods by Road.

ALARP As Low as is Reasonably Practicable

API American Petroleum Institute

SABS South African Bureau of Standards

SANS South African national standards

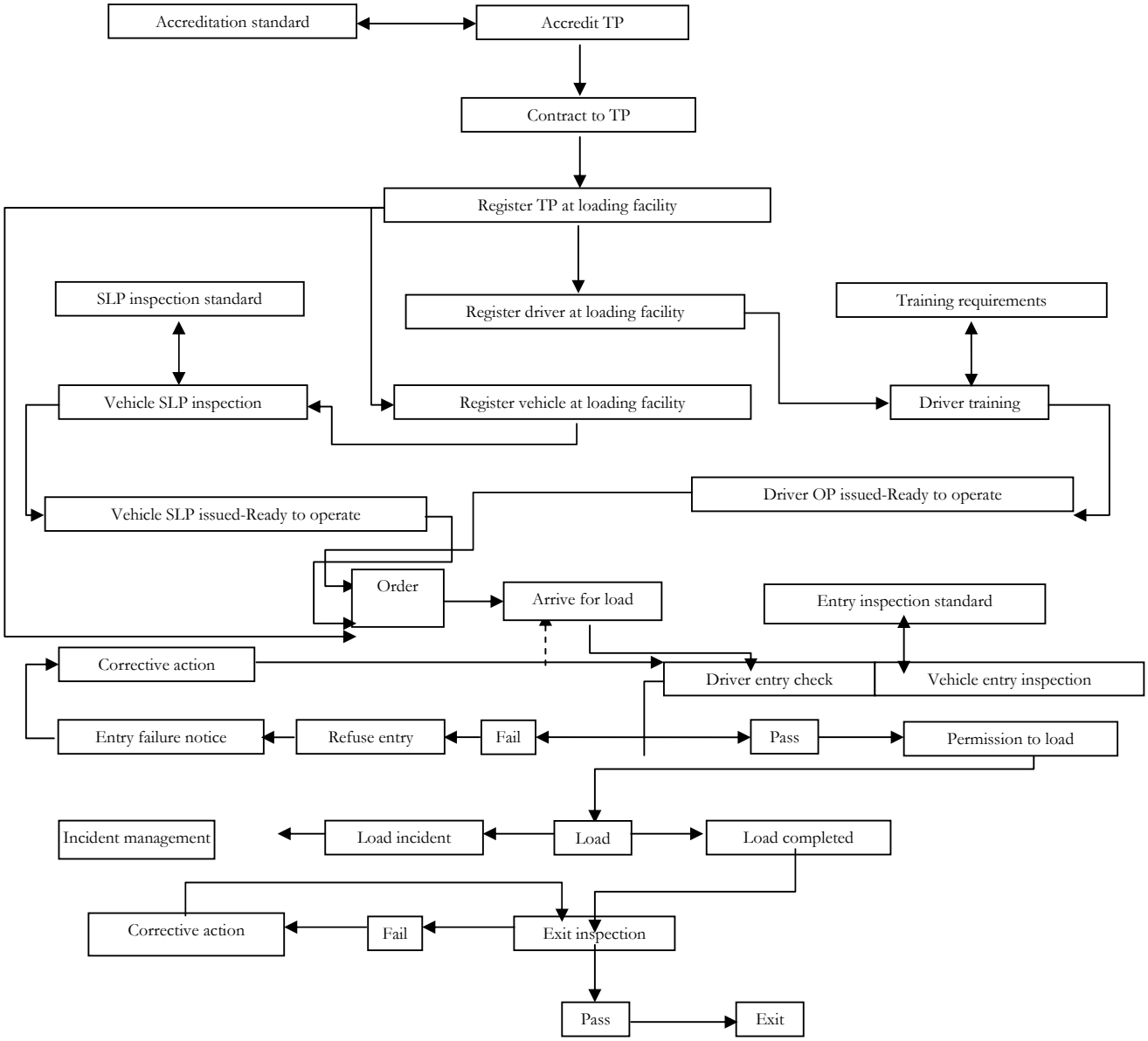
MSDS Material Safety Data Sheet

UN United Nations

IP IP Code or IP Rating: **International Protection Rating**, (sometimes also interpreted as **Ingress Protection Rating**)

1.5 Process diagram

1.5.1 The following diagram provides an overview of the process flow of this Code of Practice:



2. Registration requirements

2.1 Objective

The objective of this section is to describe the requirements and process for registration of a Transport Provider; Bulk Road Tankers; and drivers that shall be authorised to operate at and from a bitumen bulk loading facility.

2.2 Registration of drivers

2.2.1 Requirements

A mandatory prerequisite condition for registration is that the employer of the driver (or owner of the vehicle if the driver is an independent contractor) shall be registered as a Transport Provider at the loading facility. In order to register a driver MUST:

i) Be in possession of a valid SA Identification document or Passport.

ii) Be in possession of a valid PrDR-D or the applicable document if the driver is not resident in South Africa.

iii) Be competent in operating the Bulk Road Tanker and the equipment thereon, for which he/she will be responsible.

iv) Be able to read and write in English with a reasonable degree of competency.

v) Successfully complete the applicable site specific induction and other training as required.

2.2.2 Registration process

a) The employer of the driver must apply for registration to the responsible person at the loading facility by completing the specified application form. The following documents will accompany the application:

   i) A copy of the valid SA Identification document or Passport

   ii) A copy of the valid PrDP-D or the applicable document if the driver is not resident in South Africa.

   iii) A certificate from the employer confirming the competence of the driver in operating the vehicle and the equipment thereon. Inclusion of a recent relevant employment- and experience record is strongly recommended in order to assist in determining the training requirements.

b) All documentation will be presented in the form of either certified copies or original documents.

c) Upon receipt of the application and relevant documentation, the driver will be registered at the loading facility, but will not be issued with the OP until such time as the relevant training has been completed successfully.

d) Upon completion of the training, an individual OP applicable to the specific loading facility will be issued thus allowing the driver to enter and operate at the facility.

2.2.3 Validity, suspension and withdrawal of driver registration

a) The driver will remain registered at the loading facility for as long as required provided that all conditions for registration are maintained.

b) The OP will be suspended and withdrawn in the event of expiry of the required documents (e.g. the PrDP, etc) or an incident or transgression that the driver was found to have been responsible for.

c) The OP will only be reinstated once the necessary proof of compliance has been submitted or the conditions stated at the time of withdrawal have been met. This will include presentation of the valid renewed documents, proof of disciplinary action taken by the employer and proof of appropriate re-training.

d) The OP will be suspended after a period of inactivity by the driver of six months at the loading facility. In such case, validity of all documentation will be verified and the site-specific induction and other training will be repeated before the OP is reinstated.

e) The OP may be cancelled (withdrawn permanently) in which case the driver will not be allowed to operate at the loading facility again.

2.2.4 Documentation required

Driver Registration Application

Operating Passport applicable to facility

2.3 Registration of a Bulk Road Tanker (BRT)

2.3.1 BRT registration requirements

To be registered at the loading facility the BRT must:

a) Have a valid licence.

b) Have a valid Operator card.

c) The company operating the vehicle must be registered as a Transport Provider at the loading facility.

2.3.2 Vehicle registration process

a) Each vehicle will be registered individually. Vehicles registered may include:

i) Truck tractors
ii) Rigid tank trucks
iii) Semi-trailer tankers
iv) Pup tankers
v) Drawbar trailer tankers
vi) Front interlink tankers
vii) Rear interlink tankers
viii) Converter dollies

b) The application must be made on the specified application form to the responsible person at the loading facility. The following documents will be submitted with the application:

i) The loading facility application form completed and signed by the operator.
ii) A certified copy of the valid license disc
iii) A certified copy of the operator card
iv) If the operator is not the owner, i.e. the vehicle is on loan/hire from a third party, a signed acknowledgement by the owner that the vehicle is on loan and may be used and registered by the operator at the loading facility.
v) A certified copy of a weighbridge certificate clearly showing the 'un-laden' mass of the vehicle with a driver and a full fuel tank/s
vi) A completed Vehicle Data Sheet containing the following information:

- Make of chassis (e.g. Nissan, Mercedes Benz, Tank Clinic, GRW, etc)
- Chassis model designation (e.g. 2628, R460, etc. Not required for a trailer)
- Vehicle type (Rigid tank truck, truck tractor, semi-trailer tanker, pup tanker, drawbar trailer tanker, front interlink tanker, rear interlink tanker, converter dolly)
- Manufacturer of tank (e.g. GRW, Tank Clinic, etc)
- Year of first registration for tanker
- Tank manufactured date
- Tank design standard
- Main material of manufacture for tank (e.g. aluminium, stainless steel, etc)
- Product type suitable for (e.g. solvents, fuels, black products, etc)
- Drive configuration or suspension layout (6x4, 4x2, 6x2, single/single, single/tandem, tandem/tandem, tandem, tridem)
- Registration Number (Licence number)
- Operator Fleet Number
- Operator
- Owner
- Contract for (e.g. Sasol/Shell/Total etc) or ad-hoc used to sub-contract for which contractor
- Gross volume of tank and compartments
- Number of compartments
- Allowable Volume by compartment, by product
- Un-laden mass of complete vehicle
- Permissible mass by axle/axle unit

- ✍ Manufacturer's rating by axle/axle unit and GVM
- ✍ Design pressure
- ✍ Date of last pressure test
- ✍ Maximum loading flow rates
- ✍ Licence expiry date

c) It is the responsibility of the operator to ensure that information regarding the vehicle is updated as required. It might occur that a vehicle be denied entry if physical information displayed on the vehicle does not match that as submitted at the time of registration. Such changes of information will also take place by means of the specified application form.

d) Registration of the vehicle at the loading facility does not mean that it will be allowed to operate. For this, a successful SLP inspection will be required.

2.3.3 Withdrawal or suspension of vehicle registration

Once registered, a vehicle will remain registered at the facility for as long as required provided that vehicle "fitness to operate" is maintained in accordance with these requirements.

2.3.4 Documentation required

Vehicle Registration Application and Data Sheet.

2.4 Registration of Transport Providers (TP)

2.4.1 Requirements for the registration of Transport Providers

b) The TP must submit a relevant completed application together with the required supporting documents.

c) The TP must provide proof of HSE accreditation from the appropriate Bitumen marketing companies.

d) Should a TP not hold the main transport contract from a company and is used as a sub-contractor by a TP who does hold the main contract, the same proof of accreditation will be submitted as if he is the main contractor.

2.4.2 Registration procedure for Transport Providers

a) The TP will complete the appropriate loading facility application and attach the following documents:

i) The Bitumen marketing company HSE Accreditation

ii) A schedule with the following information:

- ✍ Registered name of the company with registration number
- ✍ Physical address
- ✍ Postal Address
- ✍ Telephone and fax number
- ✍ Name and contact details (telephone, mobile, fax and e-mail) of the responsible person
- ✍ Names and contact details of at least two other contacts.
- ✍ Details of Company/Client for whom Bitumen will be loaded at the facility
- ✍ The contact details of the clients responsible person.

iii) Proof of registration in terms of Workmen's Compensation

2.4.3 Change in details of Transport Provider

It is the responsibility of the Transport Provider to advise the loading facility of any changes in the relevant required details.

2.4.4 Documentation

Application for registration – Transport Provider

3. Entry and Exit Requirements

3.1 Objective

The objectives of this section are:

a) To detail the standard and procedure related to a Safe Loading Pass inspection and the awarding thereof.

b) To detail the requirements to be met by drivers and vehicles when entering the facility to load.

c) To detail the standard and procedure for the vehicle inspection that will be applied at every entry.

3. 2 Safe Loading Pass (SLP) requirements and procedures

3.2.1 Purpose of the Safe Loading Pass inspection

The purpose of the SLP inspection is:

a) To ensure that the vehicle complies with the SABITA minimum technical specification for a BRT that transports bitumen.

b) To inspect the general condition of the tanker in terms of "fitness-for-loading" and road-worthiness.

3.2.2 Pre-requisites for a Safe Loading Pass inspection

The vehicle must be registered at the loading facility or an application for registration at the loading facility must have been submitted.

3.2.3 Safe loading pass inspection standard

a) The vehicle will be inspected for compliance with the SABITA minimum technical specification and in accordance with the items as listed in the specification.

b) The vehicle will be inspected for general condition, "fit-for-loading" and roadworthiness.

c) The inspection standard and criteria are detailed in the SLP inspection sheet annexed to this CoP

3.2.4 Procedure

a) The SLP inspection will take place at the location as designated by the responsible person at the applicable loading facility.

b) The vehicle will be presented in a clean state.

c) Upon completion of a successful SLP inspection, an SLP will be awarded (one for each vehicle in a combination).

d) The SLP will be displayed in an easily accessible position and will be reasonably protected from damage.

e) Each vehicle will display only the SLP applicable to THAT VEHICLE.

(E.G., the truck tractor will not display SLP's for the trailers in a combination. These will be displayed on each individual trailer)

3.2.5 SLP validity and withdrawal

a) The SLP will remain valid for a period of 12 calendar months.

b) The vehicle will be presented for an SLP inspection prior to the expiry date of the current SLP.

c) The new SLP will be valid for twelve months from the first day of the month following the month during which the inspection took place.

d) An SLP may be suspended or withdrawn in the event that the vehicle is found to be in breach of the technical requirements, has been involved in certain incidents or has been regularly rejected at entry inspections.

e) If an SLP is suspended, certain conditions will be attached to the suspension. These conditions will determine what corrective action has to be taken, whether the SLP will be re-instated after inspection of the corrective action only or whether the vehicle has to undergo a complete SLP re-inspection.

3.2.6 Documentation

SLP inspection sheet

SLP disc

3.3 Driver entry requirements and procedure

3.3.1 Driver entry requirements

a) The driver will:

i) Be registered at the loading facility.

ii) Be in possession of his PrDP-D if South African or applicable driving licence if a non-resident.

iii) Be in possession of a valid SA ID document or Passport

iv) Present a copy (not a photocopy) of the Bitumen loading order.

v) Be in possession of the required personal protection equipment that will include:
- Heavy duty PVC gloves
- A heavy duty fire retardant type overall
- Petroleum resistant safety shoes with non-skid soles
- A suitable hard hat
- Face shield

b) Not be under the influence of alcohol or drugs.

c) Be the holder of a valid OP for the relevant facility and applicable to the category of Bitumen that will be loaded.

(Some facilities could have a driver registered with an OP for loading white products, e.g. at Natref. This does not automatically make the driver suitable for loading of black products)

3.3.2 Driver entry procedure

a) The entry procedure will be in accordance with the applicable site-specific requirements. At a minimum the site-specific procedure will include the following elements:
   i) Verification of driver credentials
   ii) Inspection of safety equipment
   iii) Verification of Loading Order/authority to load
   iv) Checking for alcohol or drug usage

3.3.3 Documentation requirement

Driver entry checklist and declaration

3.4 Vehicle entry requirements and procedure

3.4.1 Vehicle entry requirements

a) The vehicle will:
   ii) Be registered at the loading facility.
   iii) Display a valid licence disc.
   iv) Display a valid operator card.
   v) Display a valid SABITA SLP which must not carry a “suspended” or "withdrawn" status
   vi) Be fully compliant with all LSC items at entry inspection.

3.4.2 Vehicle entry procedure

a) Upon arrival at the loading facility, the vehicle will be inspected with regards to “fit-for-loading” condition in accordance with the requirements of the applicable entry inspection sheet.

b) If the inspection result is **GO**, the vehicle may enter the loading facility.

c) If the inspection result is **NO GO,** the vehicle will not be allowed to enter and a report given detailing the reason for rejection.

3.4.3 Documentation requirement

Vehicle entry inspection sheet

3.5 Vehicle entry and “fit-for-loading” inspection standard

3.5.1 Purpose of the vehicle entry inspection

The purpose of the vehicle entry inspection is as follows:

a) To ensure that the vehicle is in a “fit-for-loading” condition prior to loading

b) To ensure the vehicle is generally fit for operation and does not present any safety hazards for the road-using public.

3.5.2 Standards and Criteria of the vehicle entry inspection

The vehicle will be inspected against the criteria detailed below. Note that non-compliance with items marked ‘LSC’ (Load Safety Critical) will result in a **NO GO** decision and vehicle entry will be refused:

Vehicle entry inspection criteria		
Item	**Requirement**	**Remarks**
A	**Signage and documentation**	
i	Display of valid Safe Loading Pass (for each vehicle in the combination)	**LSC**
ii	Display of valid roadworthy certificate disc	
iii	Display of valid Fire Certificate (Fire Permit) if applicable	
iv	Display of Dangerous Goods (Hazchem labels) notices, appropriate for product to be loaded, in good condition and with required telephone numbers.	**LSC**
v	Display of "No smoking", "No naked lights" and "No cell phone" signage.	
vi	Document holder in cab with TREM card, Material Safety Data sheets for relevant products and Dangerous Goods manifest.	
vii	Verification of Left-on-Board (LOB) product	**LSC**
viii	Valid “order and authorisation to load” documents	**LSC**
ix	Certificate of cleanliness, including water free check	**LSC**
B	**General vehicle roadworthiness**	
i	All road lights in place and in good working order	
ii	Tyres in good condition and no signs of obvious under-inflated tyres	**LSC**
iii	Windscreen in sound condition and the driver line-of-sight not impeded by any damage	
iv	External rear-view mirrors present and in good condition	
v	Starting of engine under own power	**LSC**
vi	Chevron in place and visible	
vii	Red reflective triangles in place	
viii	Presence and condition of reflective marking tape on sides and rear of vehicle	
ix	Number plates and the rear number plate light in place and operational	
x	Tank manufacturer's plate, chassis plate and compartment load plates	**LSC**
xi	Signs of severe oil leaks from engine or driveline	**LSC**
xii	Hooter in working order	**LSC**
xiii	No visible/audible signs of defective exhaust system	**LSC**
C	**Vehicle ‘fit-for-loading’ condition**	
i	Battery isolator in place and suitably marked	**LSC**
ii	Condition of electrical wiring, especially cable entries to junction points	
iii	Correct number of fire extinguishers in working order, securely stowed	**LSC**
iv	Two wheel chocks	
v	Battery cover in place and in good condition	
vi	Bonding points (earth lugs) in place and clearly marked	**LSC**
vii	Condition of fixed tank-top access ladder	**LSC**
viii	Tank-top handrail fitted and operational	**LSC**
ix	Presence and condition of spill-box drains (Check for signs of blockage)	
x	Drains terminate away from ignition sources (hot vehicle components)	**LSC**
xi	Dust caps of bottom outlet couplings in place	
xii	Bottom valves closed	
xiii	Manholes closed and latched	
xiv	Check for signs of leaks on the tank body	
xv	Vehicle generally in a reasonably clean condition	
xvi	No loose items on tanker top or vehicle chassis	

3.5.3 Permission to enter and load - GO/NO GO decision criteria

The ultimate decision to allow or refuse entry to a vehicle shall always be at the discretion of the loading facility. However, in order to establish clear unambiguous minimum criteria for compliance in terms of this CoP the following **GO/NO GO** criteria shall be applied:

a) **ALL** items listed as “Load Safety Critical” (LSC) on the Vehicle Entry Inspection Sheet shall always be fully compliant.

b) **GO – Vehicle may proceed to loading area**

This means that all LSC items on the inspection sheet were found to be **IN ORDER** (fully compliant).

c) **NO GO – Entry refused. Vehicle may not proceed to loading area**

This means that one or more of the LSC items on the inspection sheet were **NOT IN ORDER** (not compliant) and shall be rectified before entry to the loading area may be reconsidered.

d) A **NO GO** decision and refusal to enter will not automatically result in the withdrawal of the vehicles Safe Loading Pass. However, a **NO GO** sanction against a vehicle is in effect a suspension of the SLP. An endorsement to such effect shall be recorded by the Loading Facility representative (in register maintained for this purpose) and the Transport Provider shall be informed as soon as possible by e-mail or other appropriate means of communication.

e) The vehicle must be presented for re-inspection, to the loading facility that refused entry, to verify that the defective items have been rectified. Results of the inspection and reviewed status shall be communicated to the affected Transport Provider.

3.5.4 Documentation

Vehicle Entry Inspection Sheet.
Vehicle Safe Loading Pass

3.6 Vehicle Exit requirements and Inspection

3.6.1 Purpose of the exit inspection

The purpose of the exit inspection is:

To ensure that the vehicle leaves the loading facility premises in a safe condition and that all of the documentary requirements and requirements specific to the load have been attended to.

3.6.2 Requirements for exit after loading

Before a vehicle exits the loading facility, the following requirements must be met:

a) The vehicle must 'pass' the exit inspection

b) The loading of Bitumen was completed in accordance with the Trip and Loading instruction and all requirements stated thereon have been met.

c) All required system and documentation requirements have been duly completed.

3.6.3 Exit inspection criteria and requirements

At a minimum the exit inspection will cover the following:

i) Permissible vehicle and axle mass-loads have not been exceeded
ii) Tank and bottom outlet integrity with regards to leaks
iii) All loose equipment stowed safely
iv) Fire extinguishers stowed
v) Bottom outlet dust caps fitted and sealed if required
vi) Bottom outlet valve closed and sealed if required
vii) Tyres in visually sound condition
viii) Vehicle lights in operational condition
ix) Dangerous Goods signage as required for product on-board
x) In the case of a vehicle that had to discharge (off-load) on-board product due to a spillage or incident, verification that the compartments are empty as per the system off-loading reconciliation

3.6.4 Exit documentation and system requirements

a) Product-specific sampling and testing done and certificates available

b) Gantry control system reconciliation that product has been loaded on specific vehicle/s and the final volume loaded per compartment by product

c) In the case of a vehicle that had to discharge (off-load) on-board product due to a spillage or incident, the system off-loading reconciliation.

d) Where a load has not been completed due to an incident, the completed incident report.

3.6.5 Procedures for vehicle not meeting exit requirements

In a case where the vehicle does not pass the exit inspection (for reasons described below), the following will apply:

a) Product certification outstanding

Action: Obtain product certification before release

b) Sealing requirements not carried out in accordance with load instruction

Action: Carry out sealing as per requirements prior to release

c) Visible leakage/seepage from vehicle compartments and or product pipes

Action: Loading facility Shift Supervisor shall investigate and evaluate the situation. If leaks are minor and can be repaired in situ, this must be done and the tanker can be released. If the situation is regarded as unsafe, the shift supervisor will act accordingly and pump product back as required and then release the vehicle.

d) Loose equipment, hoses not stowed, dust-caps not fitted.

Action: Driver to rectify the situation. If equipment went astray whilst the vehicle was in the facility, driver to search and if unsuccessful, the missing equipment will be noted on the load instruction and the vehicle released.

e) Fire extinguisher missing/not in place.

Action: Under no circumstances may a vehicle be released if the requisite number of fire extinguishers is not on-board. The vehicle shall remain at the facility until a replacement extinguisher is available.

f) Lights not working, and flat tyre/s

Action: Vehicle brought to a safe area and the situation rectified prior to release.

g) Dangerous Goods signage incorrect

Action: Driver corrects the situation prior to release

3.6.6 Documentation

Vehicle exit inspection checklist

3.7 Load authorisation and confirmation

Each loading facility and marketing company has its own unique accounting system and manner of authorising and recording product loading transactions. As a general rule an electronic order is generated by the marketer and placed on the Transport Provider of choice.

The Transport Provider makes arrangements (in some cases by prior appointment with the loading facility) to load and deliver the product to the customer/consumer. It is therefore the responsibility of the Transport Provider to establish and maintain a secure process for providing BRT drivers with documentation that adequately authorises the loading of Bitumen at a loading facility.

This load authorisation documentation shall at least contain the following information:

a) Name of the Transport Provider (as registered with the loading facility)

b) Identification of the vehicle to be loaded (as registered with the loading facility)

c) Name of the vehicle driver that will load at the facility (as registered with the loading facility)

d) Product name/code and quantity to be loaded

e) Contact details of the Transport Provider representative that may be contacted for verification purposes

4. Design Standards and Technical Specifications for BRT's

4.1 Objective

The objective of this section is:

a) To reference the minimum acceptable Legal and Industry design standards and technical specifications for Bitumen Bulk Road Tankers and the associated equipment operating from or loaded at any bitumen bulk vehicle loading facility.

b) To provide additional guidance, and highlight as appropriate, selected 'safety critical' requirements to ensure that all Bitumen BRT's are operationally suitable prior to a contract being awarded or the vehicle registered to operate.

c) To provide a standard for on-going operational inspections of BRT's and equipment.

4.2 Minimum technical specifications for Bulk Road Tankers

4.2.1 Requirements

General:

a) The BRT will be suitable for the product to be carried in all respects. Products carried may include:

Product name	Trade names	UN number
TARS, LIQUID, including road asphalt and oils, bitumen and cut backs	Cutback bitumen, Bitumen emulsion	1999
ELEVATED TEMPERATURE LIQUID, N.O.S., at or above 100°C and below its flashpoint (including molten metals, molten salts, etc.), filled at a temperature higher than 190°C	Bitumen, Penetration grade bitumen, Modified Bitumen	3257

Note: The correct identification of the product is of critical importance as it determines the BRT design requirements. For example, there is a significant difference in design requirements between using UN 1999 and UN 3257

b) The tanker will be suitable for top loading at an installation loading hot product at 25°C to 230°C.

c) Positioning of all equipment and fittings requiring periodic operation will not pose a safety risk to operating personnel.

d) Areas of unintended product- and vapour entrapment will be avoided.

e) Where no specific requirement is stated in this standard, all equipment and systems installed will be in conformance with the latest industry practices and any applicable statutory requirements.

f) It is recommended that the tanker design be such as to take all reasonable precautions to prevent overloading and obvious room for abuse by constructing the tanker at a capacity far in excess of that required to carry the intended product. Are these covered in the specs in the next paragraph?

4.2.2 General design standards and specifications

a) The vehicle will comply with relevant statutory standard at the time of construction with regards to Vessel design, tank fittings, openings and closures, plating and Bitumen heating systems.

These are:

i) SABS 1518-1996 if first registered prior and up to 31 March 2004.
ii) SANS 1518-2004 if first registered from 1 April 2004 onwards until the publication of SANS 1518-2008.
iii) SANS 1518-2008 from the effective date thereof.
iv) Any future standard from the effective date

b) Other design features and equipment will be as specified in this document. This includes items such as mudguards, spray suppression, spill containment, ladders, handrails, side under-run protection, bonding, electrical installations and fire extinguishers.

c) Specific attention will be paid to material thickness requirements in order to prevent metal fatigue and deformation caused by the top loading and carriage of hot products.

4.2.3 Manhole covers

a) Each compartment will be fitted with a hinged or bolted manhole cover designed and manufactured to an acceptable industry standard.

b) The manhole cover will comply with the requirements of the relevant tanker design specification. If no specific requirements are contained in the design specification, the compartments will be fitted with manhole covers that:

i) Provide an opening into the tank compartment of at least 500 mm diameter.

ii) Will form a liquid tight seal when closed by a single person without having to employ undue force or additional mechanical means.

iii) Will remain tightly sealed in a tanker roll-over situation.

c) The manhole cover will be fitted with a suitable PV vent with roll-over protection, meaning that it will maintain a tight seal should the tank be in a roll-over situation. Such vent may however also be fitted directly to the highest point of the tank shell.

d) An ullage marker, showing the maximum load level, will be fitted inside the compartment in such a position that the maximum load level will be clearly visible by the operator whilst standing on the tank top, at the manhole cover opening.

4.2.4 Insulation and temperature control

a) Insulation will be provided to ensure that in-transit temperature loss will be restricted to a minimum. Typically this would be a maximum of 1°c per hour whilst taking into account the variance between product and operational ambient temperature.

b) Cladding overlap and sealing will be such as to prevent the ingress of water and product into the insulation material.

c) Each tank compartment will be provided with an easily accessible and readable externally mounted thermometer to display the product temperature inside the tank.

d) The tank shell and frame must be protected against external corrosion caused by condensation and moisture ingress and contact between dissimilar metals.

4.2.5 Bottom discharge adaptors

a) Each bottom discharge point of the tanker will be fitted with a 100 mm (4") Mil spec/cam-in groove male adaptor.

b) Each bottom loading adaptor will be equipped with a suitable lockable dust-cap attached to the adaptor by means of a suitable retaining cable or chain.

Note: For a product classed as a Flammable liquid (Class 3), SANS 1518-2008 requires three closures on a pipeline; the BOV being one, a second isolating valve being another and the dust-cap being the third. A proper "sealing" dust-cap is therefore always required.

4.2.6 Compartment bottom valves and pipelines

a) Each compartment will be fitted with a bottom outlet valve suitable for the product and in compliance with the relevant tanker design specification.

The valve will preferably be fitted directly to the lowest point of the tank. If this is not possible, the pipe connecting the draw-off point at the bottom of the tank to the valve will be kept as short as possible.

The valve will be suitably and reasonably protected from accidental damage that could result in a loss of sealing ability.

Note: SANS 1518-2008/ADR actually requires an internally opening and self-closing valve. Due to the viscous nature of the product, it does however allow for the valve to be fitted as close as possible to the bottom of the tank (i.e. no need for an internal valve) and it can be a standard stop valve. It however needs to be provided with protection against accidental damage.

b) The bottom outlet valve actuator will be easily accessible to the operator. Any suitable means of actuation may be used that will minimise the occurrence of the outlet becoming clogged when the product sets.

c) The bottom valve actuator will be provided with clear indication of the direction of operation and will be protected from inadvertent or accidental operation.

d) An additional stop valve will be fitted downstream of the bottom outlet valve. *(Only if the UN number used is for a Flammable liquid. If UN 1999 is used, the tanker requires three closures. If UN 3257 is used, it requires two closures only. That is why it is important to decide under which number and MSDS transportation will take place)*

e) Wherever possible, the bottom valve will be provided with an external, easily visible indicator that will show whether the valve is in the closed or open (even partly open) position.

4.2.7 Tank top access

a) The tank will be provided with a suitable fixed access ladder to the tank-top. The ladder will be of safe construction with non-skid rungs.

b) The area on top of the tank must be kept free from obstructions and tripping hazards and the walking surface will be of a non-skid type.

c) A retractable handrail will be fitted over the length of the tank top walking area. The handrail will be provided with a positive lock when in the raised position. It will be easily raised by a person still standing on the upper part of the access ladder.

d) The raising of the handrail will not be used to activate the handbrake. It may however be fitted with an interlock that will require the handbrake to be applied before the handrail can be raised.

4.2.8 Spill containment

a) The area around the manhole covers and vents at the top of the tank must be completely enclosed along the sides, front and rear in order to form a liquid tight spill containment dam, more commonly known as a spill box.

b) The spill box will be provided with suitable drain pipes, preferable at the front and rear, extending down to the bottom of the vehicle allowing drainage in a safe area (i.e. away from the engine, exhaust pipe, electrical fittings and junction boxes and running gear). The material and size used for flexible tank-top drains must be compatible with the products carried.

4.2.9 Bonding

a) A sturdy brass earth lug will be securely bolted to the tank frame in the proximity of the centre of the tank on the left hand side bottom or at the tank-top access ladder. The surface of the earth lug must be free from paint. The position of the earth lug will be at such a height that it can be reached by a person standing on the ground and will be clearly indicated by a suitable label.

b) For tanks mounted on rubber mounting pockets, at least one suitably sized bonding cable will be fitted between the tank frame and the chassis.

4.2.10 Fire extinguishers

a) The vehicle will be fitted with fire extinguishers as follows:

i) A rigid tank truck: 1 x 2 kg Dry powder type extinguishers inside the cab
2 x 9 kg Dry powder type extinguishers fitted externally

ii) A truck tractor: 1 x 2 kg Dry powder type extinguisher inside the truck cab
1 x 9 kg Dry powder type extinguisher fitted externally

iii) A trailer: 2 x 9 kg Dry powder type extinguishers

b) Fire extinguishers will be housed in sturdy quick-release type holders.

Note: Dry powder type fire extinguishers should be mounted at an angle of between 30 and 60 degrees from the horizontal. This will allow the powder to be agitated every time that an extinguisher is removed (such as during deliveries). If it is mounted in a vertical position, the powder can become compacted rendering the extinguisher inefficient. (In-cab extinguishers need not comply with this requirement as the cab is not subjected to the same vibrations as the vehicle chassis)

c) Fire extinguishers will be fitted with service decals in a position where they can be observed without having to remove the extinguisher from its holder.

Note: It is recommended that the service decal be applied to the shoulder (the rounded area between the side and neck) of the extinguisher and not the side in order to make inspection possible without having to remove the extinguisher from the holder.

d) Placement of fire extinguishers will be such as to allow easy access, in a position that will not pose an injury risk to the operator during routine removal and replacement.

4.2.11 Electrical

a) Electrical wiring will conform to the requirements of the relevant tanker design specification.

b) All electrical connections will be made in suitable junction boxes with cable entries through suitable glands.

c) Truck tractors and rigid tank trucks will be fitted with a suitable switch as close as practicably possible to the batteries. The means of actuating the switch must be in an easily accessible position and will be clearly marked and the "On" and "Off" positions will also be clearly indicated. The switch may be provided with an actuation device fitted directly to the body of the switch or mounted remotely.

A four pole (also called double pole) isolator or a two pole (also called a single pole) isolator may be used. In the case of a two-pole isolator, it must isolate the “Live” supply from the battery. The switch will be of IP 65 rating and if not housed inside the battery enclosure, the electrical connections will be protected to IP 54. *Activation of the battery isolator should result in shutting the engine down.*

Note: Vehicles built to SANS 1518-2008 (ADR 2005 or later) must be fitted with a remote actuation device inside the cab.

i) All external circuits requiring electrical power whilst the battery isolator is in the "Off" position (such as tracking systems), will be provided with suitable protection through a fuse or a re-settable breaker.

ii) The truck batteries will be housed in a suitable battery enclosure fitted with a cover made of a non-conductive material (i.e. it will not cause sparking if it makes accidental contact with the battery terminals.

4.2.12 Miscellaneous and loose equipment

a) Each tanker (rigid tank truck, and/or each trailer), will be equipped with two suitable wheel chocks. Wheel chocks will be made from a non-sparking material.

b) Each truck tractor or rigid tank truck will be equipped with a front charge line with an F+J male coupler. This connection will be used to supply plant air to the vehicle should it run out of air in the loading bay and for removing it from the bay should it fail to start.

c) All vehicles will be fitted with suitable dual-rail side under-run protection devices where practical. The purpose of the side under-run protection is to fend pedestrians and cyclists off and away from the wheels of the vehicle.

d) All loose or removable equipment, such as ladders, hoses and chocks, will be provided with proper stowage and retention methods.

e) The truck exhaust system will be properly shielded to prevent any product spillage from coming into direct contact with the exhaust. The exhaust outlet will also be positioned such that is not within one meter from any product outlet or in a hazardous area.

f) A vehicle will be fitted with effective mudguards over all wheel positions. If a truck tractor does not have mudguards over the drive wheels, the semi-trailer will have the mudguards fitted for that position and visa versa. Suitable mud flaps (or stone guards) will be fitted behind the rearmost wheels of each axle or axle unit.

g) Where interlocks are fitted, they may not interfere with the vehicle braking system. Interlocks may be used to release a locking bar only once the handbrake has been applied or to prevent the handbrake from being released before stowage of an item has taken place, but they may not be used to apply the brake.

h) The required Dangerous Goods documentation holder in compliance with the applicable standard will be fitted in an easily accessible position inside the truck cab.

i) At least two red reflective triangles will be carried.

4.2.13 Plating

a) The tank will be fitted with the manufacturer's plate as required by the tanker design standard indicating amongst others the manufacturer's serial number, the compartment gross capacities, the test pressure, last test date, maximum flow rates, product density and manufacturing date.

b) For a compartmented tank, a compartment load plate will be fitted in close proximity to the top loading position and in an easily readable position. The load plate will show the maximum permissible volume that can be loaded into the compartment taking into account the ullage requirements, for the product of least density and the product of highest density for which the tanker has been designed.

c) All plates and licence holders will be placed in such a position that they are easily accessible and can be easily read.

4.2.14 Signage

a) All tanks must be fitted with the required Dangerous Goods placards bearing the required contact details, in accordance with the applicable standard.

b) All tanks will be fitted with No naked lights, No naked flames and No Cell phone decals on the sides and rear of the tank.

c) Truck cabs will be fitted with the required Dangerous Goods Orange diamond at the front in accordance with the relevant standard.

4.3 Deviations from the standard

a) No deviation from this minimum specification may be applied unless agreed to in writing by SABITA.

b) No deviation will be granted on a permanent basis. A deviation will only be sanctioned for a specified period until either the equipment has been brought into compliance with the standard or the standard has been amended.

5. Operating Procedures

5.1 Objective

a) The objective of this section is to detail the general operating procedures in connection with the bulk loading of bitumen road tankers.

b) This section will also detail the operating procedures for associated functions and activities that have not been included under specific parts elsewhere in the CoP.

5.2 Bulk Loading of Bitumen Bulk Road Tankers

5.2.1 Before entering the loading gantry

a) Ensure that loading documents/load authorisation is in order before proceeding to load.

b) Ensure that the vehicle is in a safe operating condition.

c) Ensure that on-board bitumen heating systems have been completely shut down and isolated.

d) Ensure that all the required Personal Protective Equipment is available and worn as necessary.

e) Where applicable, stop at the designated/demarcated stop line and ensure that air tanks are full.

f) DO NOT enter the gantry if any obvious safety hazards are observed.

5.2.2 Arriving at the loading gantry

a) Stop the vehicle in the designated loading bay in such a position that the loading arm can be inserted safely and without undue effort.

b) Apply the handbrake.

c) Put the transmission into **Neutral**.

d) Shut the engine down.

e) Switch the battery isolator switch to the "Off" position.

f) Locate the loading gantry's fire alarm switch, emergency switches and fire extinguishers.

g) Observe safety signs and read gantry operating instructions. If instructions are not clear, ask for assistance.

h) Place the wheel chocks ahead and behind the wheels of the vehicle as a precaution to prevent any accidental forward or backward movement of the vehicle.

i) Perform a walk-around inspection of the combination to ensure that no unsafe situations exist.

j) **USE BARE HANDS** and attach the gantry earth clamp securely to the earth lug of the vehicle.

k) Put on safety gloves.

l) Access the tank top safely in accordance with the site-specific requirements.

m) Open the manhole covers and ensure that compartments are free of any visible water.

n) If applicable, ensure that correct switch loading procedures are followed.

5.2.3 Loading the vehicle

a) Loading will always be attended by two persons. The gantry loading operator will operate the gantry pump and metering equipment whilst the driver will remain at the top of the tanker to perform the necessary manoeuvring and placement of the loading arm assembly.

b) Remove any drip trays/buckets and place the loading arm and drop tube into the manhole opening. Ensure that the positioning is secure and at the required depth.

c) Open the loading valve slowly until fully open.

d) Observe for steam escaping from the manhole opening. Stop loading immediately if steam is observed as this is an indication of water in the compartment. Should water be present, the vehicle must be removed to be cleaned and dried prior to accepting further loads.

e) When loading of the required quantity has been completed, stop the loading pump and close the loading valve.

f) If the vehicle has to be moved to continue loading (such as for a combination of vehicles), it can now be moved to the new position. Repeat loading steps as above.

g) Extract the drop tube and funnel to a safe height and allow it to drip any remaining product into the compartment.

h) Withdraw the drop tube completely and position the drip tray/bucket underneath and stow in the loading arm as required.

i) Check that the maximum load level has not been exceeded. If it has, revert to the incident management procedure.

j) Perform any further dipping and sampling requirements.

k) Close and latch the manhole covers securely and alight from the tank top.

5.2.4 After loading

a) Disconnect and stow the earth clamp and cable

b) Remove and stow the wheel chocks

c) Complete a walk-around inspection to see that all is safe to move the vehicle.

d) Switch the battery isolator to the "On" position.

e) Attend to required documentation.

f) Move the vehicle out of the loading bay with due caution and proceed to the exit inspection point.

5.2.5 Documentation

Gantry load meter ticket or other verification as appropriate

5.3 Switch loading of Bitumen

a) Switch loading shall be controlled in accordance with the following table:

Previous load	Next load			
	Pen, R-grade or Hard Bitumen	Polymer Modified Bitumen	Cutback or Fluxed Bitumen	Bitumen emulsion
Pen, R-grade or Hard Bitumen	Yes	Yes	Yes	Yes
Polymer Modified Bitumen	Yes	Yes	Yes	Yes
Cutback or Fluxed Bitumen	No	No	Yes	Yes
Bitumen emulsion	No	No	No	No

b) Tanks carrying bitumen emulsion should be dedicated to that product. If switch loading cannot be avoided, the tank must first be cleaned. If this cannot be done, the tank must be treated as for a tank with suspected water content.

5.4 Product pump-back procedure

5.4.1 Pump-back decision

a) The decision to pump-back shall always be based on safety and operational requirements with safety being paramount.

b) The decision to pump-back will be taken after consultation between the driver of the vehicle and the Shift/Gantry Supervisor of the loading facility.

c) The following table provides the rationale to be used for each incident or occurrence and the action to be taken:

Incident	Action
Tanker leaking	Full off-load
Product off-spec	Full off-load
Vehicle overloaded or overfilled	Endeavour to balance load and if that is not possible, partial off-load until correct level is reached
Product spillage from tank due to overfill	Endeavour to balance load and if that is not possible, partial off-load until correct level is reached

d) In the event of a spillage, the vehicle must first be weighed to determine the amount of product spilt/lost. Calculating the quantity of lost product is done as follows:

Product spilt = Un-laden vehicle mass on entry ***plus*** mass of product loaded ***minus*** vehicle mass after incident.

e) If hot work or confined space (compartment) entry is necessary all such work shall be strictly controlled in accordance with appropriate Permit to Work procedures. The role of the driver in such instances shall be limited to the complete discharge of all product prior to handing over the vehicle for repair work.

f) A vehicle will not be off-loaded, either in part or in full, due to a product return (i.e. once the vehicle has left the gate and the order is closed.) Returned product will be treated as LOB product and will be accounted for in the generation of the load instruction for the following load.

5.4.2 Pump-back procedure

a) When the decision has been made (and taking into account the site emergency response procedures in case of a spill) move the vehicle safely to the designated pump-back area.

b) Position the vehicle at the pump-back facility, ensuring that the off-loading couplers can be connected safely and easily.

c) Apply the handbrake.

d) Put the transmission into **Neutral**.

e) Shut the engine down.

f) Ensure that the required Personal Protection Equipment is being worn.

g) Switch the battery isolator switch to the "Off" position.

h) Locate the loading gantry's fire alarm switch, emergency switches and fire extinguishers.

i) Observe safety signs and read operating instructions. If instructions are not clear, ask for assistance.

j) Place the wheel chocks ahead and behind the wheels of the vehicle as a precaution to prevent any accidental forward or backward movement of the vehicle.

k) Perform a walk-around inspection of the combination to ensure that no unsafe situations exist.

l) Attach the earth clamp securely to the earth lug of the vehicle.

m) Remove the dust-cap from the applicable loading/off-loading adaptor and connect the off-loading coupler ensuring that a proper connection occurs. Make sure that the correct adaptor has been selected on the vehicle and likewise that the correct off-loading coupler has been selected. Open the bottom outlet valves.

n) Start the off-load pump (Reset the meter to Zero if the facility is equipped with a meter).

o) Continue pumping until the required level is reached (for a partial pump-back), or until the compartment is empty. Visually verify that the compartments have drained completely.

p) Close the applicable compartment operators.

q) Close the bottom outlet valves.

r) Disconnect and stow the off-loading hose.

s) Disconnect the plant air connection, if attached.

t) Disconnect and stow the earth clamp and cable.

u) Remove and stow the wheel chocks.

v) Complete a walk-around inspection to see that all is safe to move the vehicle.

w) Switch the battery isolator to the "On" position.

x) If the vehicle has to be moved to continue off-loading (such as for a combination of vehicles), it can now be moved to the new position.

y) Repeat pump-back steps as above.

5.5 Weighbridge procedures

The procedures governing the use of the weighbridge upon entry and exit of vehicles will be dictated by site-specific requirements. However, in order to achieve a measure of standardisation in the approach, any such site specific procedures should include at least the following steps:

a) Weigh the empty combination upon arrival to determine the entry mass.

b) Compare to the un-laden mass of the combination (as held on the loading facility system), to determine any major deviation and thus the allowable payload.

c) Calculate the allowable payload by subtracting the entry mass from the maximum permissible mass for the combination (as held on the loading facility system).

d) Calculate the payload in kilograms and compare with the order quantity.

e) Adjust the order quantity to ensure that it does not exceed the calculated payload by more than 1%.

f) Convert the allowable payload to litres and compare this with the maximum payload in litres of the tank (as held on the loading facility system).

g) Ensure that the tank is not loaded to less than 75% or more than 100% of the payload capacity in litres (as held on the loading facility system).

h) Weigh the combination on completion of loading to determine the actual mass and volume of product loaded.

i) Incident management to prevent overloaded tankers from exiting the facility.

5.6 General conditions of operation

5.6.1 Conditions

All Transport Providers operating from or at the loading facility will do so in full compliance of the following conditions:

a) No company will be allowed to operate Bitumen Bulk Road Tankers at of from any loading facility unless a commitment to compliance with these conditions has been confirmed in writing.

b) Transport Provider employees entering a loading facility premises shall adhere to the applicable general safety rules and requirements.

c) Transport Provider employees shall obey the reasonable instructions of the loading facility employees responsible for particular areas of operation or functions.

d) The Transport Provider accepts full responsibility for the acts or omissions of its employees whilst operating at a loading facility.

e) The BRT driver is responsible for the safe loading of his/her vehicle. The loading facility staff will provide assistance as necessary to ensure that all safety rules and procedures are adhered to.

f) The Transport Provider is responsible for ensuring that the vehicle and associated equipment used is suitable for the operation both in terms of the product being carried and the loading operation.

g) The Transport Provider will ensure that its employees are sufficiently skilled, trained and experienced in order to safely operate the equipment used and react to any emergencies.

h) The Transport Provider accepts sole custodianship of the product loaded, once the vehicle has been allowed to exit the facility.

i) The Transport Provider is responsible to ensure that all of the required product change-over procedures have been adhered to in order to ensure that the vehicle is suitable for the load to be carried.

j) The BRT driver is responsible for the accurate and correct reporting and accounting of any product left on board.

k) The inspections performed by the loading facility prior to entry and upon exit, do not guarantee absolutely that the vehicle, associated equipment and driver are suitable and qualified for the operation and tasks and it therefore does not transfer the responsibility onto the loading facility.

l) The Transport Provider is solely responsible to ensure that the loaded vehicle does not contravene any of the applicable legislation with regards to axle- or vehicle mass loads.

6. Health, Safety and Environment (HSE)

6.1 Objective

The objective of this section is to provide guidance and some basic rules to ensure that generally acceptable practice is adhered to in connection with aspects of Health, Safety and Environment management at Bitumen loading facilities.

6.2 General HSE considerations

6.2.1 The operating environment

Oil Refineries are generally considered to be HIGH RISK operations and as such associated operational activities are usually strictly governed by well designed and structured HSE Management Systems. A mature HSE culture is also usually prevalent in Refineries and Refinery Management expects visitors to its facilities to respect this culture and behave in a similar manner whilst resident on the premises.

Bitumen is a hazardous product and loading of Bitumen is a hazardous and potentially HIGH RISK task performed in a HIGH RISK operational facility. Bitumen Transport Providers and employees must therefore expect, and be prepared for, firm and strict HSE governance whilst operating at Bitumen loading facilities.

6.2.2 Bitumen loading hazards and effects management

SABITA has developed a generic HSE Management System (HSE-MS) for its members and the expectation is that members (including Transport Providers) shall adopt and implement this (or a similar) system to demonstrate that HSE within the (member) organisation is managed to an acceptable standard. The Hazards and Effects Management Process for Bitumen hazards is described in greater detail in the Hazard Register appended to the SABITA HSE-MS.

Herewith follows a brief summary of the most critical HSE considerations in connection with the loading of Bitumen:

a) The loading gantry is a high risk area and the products handled are all flammable or potentially flammable when conditions are favourable. Employees of Transport Providers shall familiarise themselves with the site/loading facility operating procedures, rules and instructions AND OBEY these rules - ALWAYS.

b) The loading operation involves the moving and manoeuvring of heavy vehicles in an area where personnel also move around on foot. NEVER move a vehicle backwards in a loading gantry. If moving backwards is absolutely necessary it shall be done with the assistance of guide person positioned behind the vehicle in clear view of the rear view mirrors.

c) During the process of loading Bitumen a number of MEDIUM and HIGH risk scenarios are present and the following hazards and threats require specific controls:

   i) Personnel working at height (Falls from tank top resulting in serious or fatal injuries)

   ii) Personnel exposed to Bitumen vapour or fume (Inhalation may cause acute health effects)

   iii) Flammable liquids/Static electricity (Ignition of flammable mixture results in fire or explosion)

   iv) Extreme temperature (Overfilling/Hose rupture/Coupling failure could result in serious injury or death from hot Bitumen burns)

   Transport Providers shall assure that specific attention is directed to these risks by conducting comprehensive risk assessments and proper Job Hazard Analysis to ensure that vehicle drivers receive the necessary training to manage the risks.

d) HSE is everyone's responsibility. You have an obligation to report unsafe acts and conditions without delay to the gantry supervisor and/or to your immediate supervisor.

6.2.3 Specific safety rules to be observed in the loading area

a) All signage, procedures, and control measures shall be adhered to – ALWAYS.

b) No person shall remain inside the cab of the vehicle during the loading process.

c) The BRT driver is responsible for the safe loading of his vehicle. He shall be in full control of the process at all times and ensure that he is fully familiar with the operation of the vehicle, the loading equipment and control systems, the loading gantry meter, bonding and earth equipment. If the loading facility provides load operators the driver will act as loading assistant but his responsibility for the safety of his vehicle may never be delegated.

d) The driver shall remain at the loading point at all times whilst loading. If the driver has to leave the load area for whatever reason, the process must be stopped and re-started on his return.

e) Whenever in doubt about any rule or procedure, terminate the operation and call for assistance.

f) During the loading process, the driver must constantly be aware of product flow progress and load levels and check for equipment malfunctions and other obvious abnormalities. If any unsafe situation develops or is eminent, loading must be terminated immediately and the situation attended to.

g) The driver shall ensure that the correct product is loaded into the correct compartment.

h) The driver shall ensure that the requested load quantity does not exceed the allowable quantities applicable to the vehicle combination.

i) The driver shall not allow any unauthorised person to operate any equipment on the vehicle or the loading facility under any circumstances.

j) Unnecessary manoeuvring of vehicles will be avoided. The loading bay will not to be used as a thoroughfare.

k) Vehicles shall **not** be reversed in or around the loading facility designated area.

l) Repair work to the vehicle shall **not** take place inside the loading facility designated area.

m) A vehicle shall **not** be "Jump-started" inside the loading facility designated area.

n) Personal Protective Equipment shall be worn as indicated in areas designated by signage.

o) When required to queue upon entry to the loading bay, such queuing will take place not closer than the demarcated stop line. Keep a proper following distance of the vehicle ahead. Radios/CD players must be switched off when queuing in this area.

p) Do not enter the loading bay if an obvious hazardous situation is present.

q) Do not knowingly operate or use faulty equipment and report faulty equipment immediately.

r) Adhere to the product change-over procedures.

s) A vehicle may not be moved whilst any form of connection between it and the gantry is in place.

t) Overriding of any safety- or overfill prevention system systems is **STRICTLY PROHIBITED**.

u) Any overfill situation that occurred during loading will be rectified prior to departure. This will take place either by means of transferring product from one compartment to another or by pumping the product back to storage.

v) The following access controls are generally strictly enforced at Refineries:

   i) Site speed limits.

   ii) Smoking in designated areas only. Smoking is not allowed inside vehicles.

   iii) Pedestrians always have the right of way and vehicles shall proceed with due caution.

   iv) The use of or being under the influence of alcohol is not permitted.

   v) Cell phones may not be taken into the loading area. Vehicle drivers will hand cell phones in for safekeeping at reception.

   vi) Firearms, weapons, explosives, incendiary devices, intoxicating beverages, illegal narcotics, dangerous drugs, controlled dangerous substances and unauthorised cameras are strictly forbidden on the premises.

   vii) All persons, vehicles and hand-carried items are subject to security inspection when entering the refinery, and may also be inspected whilst on the premises or upon departure.

7. Training requirements for Bitumen loading personnel

7.1 Objective

It is acknowledged that Transport Providers may have there own internal standards, competence requirements and processes for training of Bulk Vehicle operators/drivers over and above the legal requirements for PrDP-D. The purpose of this section is to detail the minimum training requirements that shall be included in the training programs in order to be fully compliant with this CoP.

The following persons are identified as 'critical' to the safe execution of loading a Bitumen Bulk Road Tanker (BRT) at a bulk loading facility:

i) The bulk loading facility 'Gantry Operator'. (Note: This position may be known by different Job Titles in the various organisations that operate bulk loading facilities.)

ii) The BRT driver. (Could also be known as Bulk Vehicle Operator and various other titles)

7.2 Training and experience requirements

7.2.1 Loading facility personnel

Each bulk loading facility provides training for its gantry operators and it is accepted in good faith that such training is appropriate and sufficient to assure the competence of operators. It is therefore not appropriate, or intended, to prescribe training requirements to operators of loading facilities.

7.2.2 Training syllabus and experience requirements for a BRT driver

7.2.2.1 The training modules shall include and adequately address the expected outcomes as detailed below:

Topic	Expected outcome
Operation of BRT and equipment	Comprehensive understanding of the functions and operation of the equipment fitted to a Bitumen BRT. An awareness of possible system variations between different BRT's in the company fleet.
Emergency response procedures	Can explain how to act in various emergencies, response to alarms, evacuation procedures.
General Loading Gantry HSE standards and procedures	Comprehensive understanding of the Loading Gantry HSE standards and procedures and the implications if these are not adhered to.
Product knowledge	Knowledge of the product that will be handled, the risks involved, colour codes and consequences of exposure and special handling precautions.
Pre-loading site entry requirements	Comprehensive understanding of requirements, the procedure and documentation involved with driver and vehicle entry at the loading facility.
Vehicle inspection	Basic understanding of the contents of the vehicle inspection checklist, the procedure and documentation involved, and can identify items that are not compliant with minimum technical specifications.
Loading procedure	Comprehensive understanding of the loading procedure and any documentation involved. To include consequences of non-conformance and accounting for Left-on-Board.
Incident management procedure	Basic understanding of the incident management procedure (for gantry incidents), the actions to be taken and the documentation involved.
Operation of loading Gantry equipment	Comprehensive knowledge of the functions and operation of the Loading Gantry equipment.
Exit requirements and procedure	Comprehensive understanding of the post-loading exit requirements and procedure, inspection and any associated documentation.
Static electricity	Basic understanding of the causes, effects and control of static electricity associated with Bitumen loading.
Product change-over procedures	Comprehensive understanding of the procedure for product change-over.
Product pump-back procedure	Basic understanding of the product pump-back procedure.

7.2.3 Competence assurance process

A Transport Provider (employer) of a BRT driver shall provide for a basic competence assurance process to evaluate the effectiveness of training and the ongoing maintenance of the required knowledge and skills. This process shall include as a minimum the following:

a) A written or (documented) oral examination to test the knowledge of trainees at the completion of theory training

b) Practical “on-the-job” coaching/mentoring of ‘new’ drivers by an experienced driver. This process shall comprise AT LEAST THREE separate occasions of loading Bitumen at a loading facility.

c) At the completion of above the trainee may be accompanied by a CERTIFIED trainer and evaluated whilst loading Bitumen at a loading facility. If the competence criteria are met an Operating Passport is awarded to the trainee driver.

d) If the trainee driver fails the evaluation by the trainer the trainee shall be re-trained, as appropriate, and re-evaluated. This process will be repeated until the trainee demonstrates full competence or is otherwise dealt with in terms of internal Personnel Policy.

e) UNDER NO CIRCUMSTANCES shall a driver, who fails to produce a valid Operating Passport, be permitted to enter and load a vehicle at a Bitumen loading facility. The obvious, and only exception to this rule is a trainee driver accompanied by a certified trainer or a driver with a valid Operating Passport.

7.2.4 Ongoing evaluation and re-training

a) After the initial awarding of the Operating Passport every driver shall be subjected to at least TWO practical evaluations in every 12 month period of loading Bitumen.

b) If a driver has not loaded Bitumen at a loading facility for a period in excess of six months, the OP will be withdrawn and complete re-training will have to be undergone.

c) Re-training may also be instituted as corrective action due to an incident attributed to a failure of a driver to comply with HSE requirements.

7.2.5 Documentation

BRT driver training course

Competence evaluation records of drivers

8. Documentation

8.1 Process documentation and forms

The documentation and forms necessary for proper administration of this Code of Practice are listed in the table below:

Document ID	Document description
BL/ARTP	Application for registration as Transport Provider (Schedule of information)
BL/ADR	Application for driver registration
BL/AVR	Application for vehicle registration
BL/OP	Operating Passport (Suggested layout)
BL/VEIR	Vehicle entry inspection record
BL/SLPIR	Safe Loading Pass inspection record
BL/SLP	Safe Loading Pass (Suggested layout)
BL/BLIP	Bitumen Loading-Incident Report

8.2 Content and format of documentation and forms

SABITA recognises that the various Bitumen loading facilities may already have some or all of the necessary documents and forms in place. However, as the purpose of this CoP is to standardise as far as possible, it is strongly recommended that the forms in use are reviewed and, if necessary re-designed to at least include the content as detailed in the appendices to this Code of Practice.

9. Reference documentation

9.1 Normative references

a) Road Traffic Act – Act 93 of 1996
b) SABS 1398 -1993 – Bulk Road Tankers for petroleum-based flammable liquids
c) SANS 1518-2004 – Transportation of dangerous goods – Design requirements for road tankers
d) SANS 1518-2008 - Transport of dangerous goods — Design requirements for road vehicles and portable tanks
e) SANS 10231 – Transportation of dangerous goods – Operational requirements for road vehicles
f) SANS 10232 – Transportation of dangerous goods – Emergency information systems
g) SANS 10228 – The Identification and classification of dangerous substances and goods
h) SANS 1142-1979 – Diesel engines modified for operation in a hazardous location
i) SANS 60079/IEC 60079 – Electrical apparatus for explosive atmospheres – All relevant parts
j) SANS 10108-2005 – The classification of hazardous locations and the selection of apparatus for use in such locations

Please note that each of the above standards may contain its own normative references

9.2 Informative references

a) SABITA Health Safety and Environment Charter, December 2009
b) SABITA Health Safety and Environment Management System, Issue no. 1, revision 1, February 2010
c) SABITA Health Safety and Environmental Guidelines, Revised Edition July 1998 (Currently under revision)
d) Guidelines for Handling and Transportation of Bitumen, Shell Oil Products Africa, April 2006

10. Supplementary

This section is intentionally left blank and is reserved for future use to incorporate Load Facility-specific requirements that may not currently be addressed in this document.

11. Appendices

Annexure 1 BL/ARTP - Application for registration as a Transport Provider Page 1 of 2

Schedule of information in support of an application for registration as a Transport Provider and Operator of Bulk Road Tankers for the Loading of Bitumen at the Bulk Loading Facility of:

(Insert the Oil Company/Refinery)

A. Applicant particulars

Company name				
Company registration number				
Postal address				
			Postal code	
Business address				
			Postal code	
Business contact details	**Tel no**		**Fax no**	
			E-mail address	
Responsible persons name				
Contact responsible person at	**Tel no**		**Fax no**	
	Mobile no		**E-mail**	
Alternative contact persons				
Name				
	Tel no		**Fax no**	
	Mobile no		**E-mail**	
Name				
	Tel no		**Fax no**	
	Mobile no		**E-mail**	

B. Particulars of Companies/Clients for whom Bitumen will be loaded

Company/Client name				
Responsible persons name				
Contact responsible person at	**Tel no**		**Mobile no**	
Company/Client name				
Responsible persons name				
Contact responsible person at	**Tel no**		**Mobile no**	
Company/Client name				
Responsible persons name				
Contact responsible person at	**Tel no**		**Mobile no**	

Annexure 1 BL/ARTP - Application for registration as a Transport Provider Page 2 of 2

Particulars of Companies/Clients for whom Bitumen will be loaded

Company/Client name				
Responsible persons name				
Contact responsible person at	**Tel no**		**Mobile no**	
Company/Client name				
Responsible persons name				
Contact responsible person at	**Tel no**		**Mobile no**	
Company/Client name				
Responsible persons name				
Contact responsible person at	**Tel no**		**Mobile no**	

C. Attachments

Have the following documents been attached to the application for registration?	**Yes**	**No**
Proof of HSE accreditation with the relevant Oil Company		
Workers Compensation registration (copy of latest "Letter of good standing")		
?		
?		
?		
?		

Annexure 2 BL/ADR - Application for driver registration

Application for registration of a Bulk Road Tanker driver to load Bitumen at the Bulk Loading Facility of:

(Insert the Oil Company/Refinery)

A. Applicant particulars

Company name				
Company registration number				
Business address				
		Postal code		
Application submitted by				
Contact details of applicant	Tel no		Fax no	
	Mobile no		E-mail	

B. Driver particulars

Surname													
Full names													
Known by name of													
Identity number													
Other (eg. Passport)													
Nationality													
Date of birth (year/month/day)													

C. Attachments

Certified copies of the following documents are attached to this application	✓
Drivers professional driving permit (PrDP-D)	
Drivers "foreign" driving licence (if applicable)	
Drivers RSA identity document	
Drivers passport	
Drivers certificate of competence (Operating Passport)	

C. Verification signatures of applicants

Signature of applicant		Signature of driver	
		Date of application	

D. Consideration of application by the Loading Facility

Name of authorised person		Application is	Approved	Rejected
Reason for rejection				
Signature of authorised person		Date		

Annexure 3 BL/AVR - Application for vehicle registration

Application for registration of a Bulk Road Tanker to load Bitumen at the Bulk Loading Facility of:

(Insert the Oil Company/Refinery)

A. Applicant particulars

Company name (Operator)				
Company registration number				
Business address				
			Postal code	
Application submitted by	Name		Job title	
Contact details of applicant	Tel no		Fax no	
	Mobile no		E-mail	

B. Vehicle particulars

Item	Information
Owner	
Registration number	
License expiry date	
Operator fleet number	
Contracted for (Marketing Company)	
Sub-contracted to	
Chassis make	
Model	
Vehicle type	
Tank manufacturer	
Year of first registration	
Year of tank manufacture	
Tank design standard	
Tank material	
Tank test pressure	
Last pressure test date	
Product tank is suitable for	
Vehicle drive/wheel configuration	

BL/AVR - Application for vehicle registration

B. Vehicle particulars (Continued)

Compartment capacities (litres)			
No	**Gross**	**Payload allowable (1)**	**Payload allowable (2)**
1			
2			
3			
Total			

Mass data			
	Un-laden/Tare	**Manufacturers rating**	**Permissible mass**
Front Axle/Unit	**NA**		
Rear Axle/Unit	**NA**		
Total			

C. Attachments

Certified copies of the following documents are attached to this application	✓
Vehicle license disc	
Operator card	
Weighbridge certificate	
Permission from owner to register (if applicant is not owner)	

C. Verification signature of applicant

Signature of applicant _____ Date of application _____

D. Consideration of application by the Loading Facility

Name of authorised person _____ Application is | Approved | Rejected |

Reason for rejection _____

Signature of authorised person _____ Date _____

Annexure 4 BL/OP – Operating Passport

Suggested layout and format for BRT driver Operating Passport

Page size: 11 mm high x 80 mm wide

Front laminated for security and wear protection.

Front

OP no ☐

Operating Passport

Authorisation to operate a Bulk Road Tanker at a Bitumen bulk loading facility.

Issued to:

Surname:

First names:

ID no. ☐☐☐☐☐☐☐☐☐☐☐☐☐

Employer company:

ID size photo

Name of authorised issuer

Signature of issuer

Date issued

Issued in accordance with the requirements of the SABITA Code of Practice – Loading of Bitumen at Refineries.

Back

Restrictions and endorsements

This passport is issued subject to the following operating restrictions:

Endorsements:

Annexure 5 BL/VEIR - Vehicle entry inspection record

Loading facility		**Date of inspection**	
Inspected by		**Time of inspection**	
Vehicle Operator		**Registration no**	
Fleet number		**Vehicle type**	
Driver name		**Driver OP number**	

Item	Requirement	Load Safety Critical Item	Condition of item	
A	**Signage and documentation**		☺ = ✓	☹ = ✕
i	Display of valid Safe Loading Pass (for each vehicle in the combination)	**Yes**		
ii	Display of valid roadworthy certificate disc			
iii	Display of valid Fire Certificate (Fire Permit) if applicable			
iv	Display of Dangerous Goods (Hazchem labels) notices, appropriate for product to be loaded, in good condition and with required telephone numbers.	**Yes**		
v	Display of "No smoking", "No naked lights" and "No cell phone" signage.			
vi	Document holder in cab with TREM card, Material Safety Data sheets for relevant products and Dangerous Goods manifest.			
vii	Verification of Left-on-Board (LOB) product	**Yes**		
viii	Valid "order and authorisation to load" documents	**Yes**		
ix	Certificate of cleanliness, including water free check	**Yes**		
B	**General vehicle roadworthiness**			
i	All road lights in place and in good working order			
ii	Tyres in good condition and no signs of obvious under-inflated tyres	**Yes**		
iii	Windscreen in sound condition and the driver line-of-sight not impeded by any damage			
iv	External rear-view mirrors present and in good condition			
v	Starting of engine under own power	**Yes**		
vi	Chevron in place and visible			
vii	Red reflective triangles in place			
viii	Presence and condition of reflective marking tape on sides and rear of vehicle			
ix	Number plates and the rear number plate light in place and operational			
x	Tank manufacturer's plate, chassis plate and compartment load plates	**Yes**		
xi	Signs of severe oil leaks from engine or driveline	**Yes**		
xii	Hooter in working order	**Yes**		
xiii	No visible/audible signs of defective exhaust system	**Yes**		
C	**Vehicle 'fit-for-loading' condition**			
i	Battery isolator in place and suitably marked	**Yes**		
ii	Condition of electrical wiring, especially cable entries to junction points			
iii	Correct number of fire extinguishers in working order, securely stowed	**Yes**		
iv	Two wheel chocks			
v	Battery cover in place and in good condition			
vi	Bonding points (earth lugs) in place and clearly marked	**Yes**		
vii	Condition of fixed tank-top access ladder	**Yes**		
viii	Tank-top handrail fitted and operational	**Yes**		
ix	Presence and condition of spill-box drains (Check for signs of blockage)			
x	Drains terminate away from ignition sources (hot vehicle components)	**Yes**		

BL/VEIR - Vehicle entry inspection checklist

Item	Requirement	Load Safety Critical Item	Condition of item	
C	**Vehicle 'fit-for-loading' condition (continued)**		☺ = ✓	☹ = ✕
xi	Dust caps of bottom outlet couplings in place			
xii	Bottom valves closed			
xiii	Manholes closed and latched			
xiv	Check for signs of leaks on the tank body			
xv	Vehicle generally in a reasonably clean condition			
xvi	No loose items on tanker top or vehicle chassis			

D	**Product left on board (LOB)**			
i	Product quantity LOB confirmed as			
ii	How was LOB quantity determined			

E	GO/NO GO decision (Mark with ✓ or ✕ as appropriate)		
i	☺ = GO		**Vehicle is fully compliant and may proceed to loading gantry**
ii	☹ = NO GO		**Vehicle is not compliant and entry to the loading facility is refused**
iii	**Reasons for refusing entry**		
	(a)		
	(b)		
	(c)		
iv	**Immediate action taken**		

F	Inspection verification

Signature of inspector _____ **Signature of driver** _____

Date and time signed _____ **Date and time signed** _____

Annexure 6 BL/SLPIR – Bulk Road Tanker Safe Loading Pass inspection record

Loading facility		**Date of inspection**	
Inspected by		**New or Renewal SLP**	
Vehicle Operator		**Registration no**	
Fleet number		**Vehicle type**	

Item	In place Yes/No	Condition (✓ or ✕)	Reference/Comment
Design specification			
Tank Manufacturer's plate			
Compartment load plate/s			
Chassis plate			
Valid licence disc			
Valid operator disc			
Valid fire permit			
Manhole covers			
Manhole cover PV vents			
Loading adaptors with dust caps			
Bottom outlet valves			
Tank-top access ladder			
Tank-top walking area			
Tank-top handrail			
Spill containment area/Spill box			
Spill box drain pipes			
Bonding/Earth lugs			
External tank-chassis bonding cables			
Fire extinguishers			
Electrical wiring			
Battery cover			
Battery isolator			
Triangles			
Wheel chocks			
Front charge line			
Side under-run			
Rear under-run			
Exhaust system position and shielding			
Mudguards			
Mud flaps			
Tyres			
Service fuel tank cap, sender unit wiring			
Headlights			
Directional indicators			
Stop/Tail lights			
Windscreen			
Rear view mirrors (external)			
Reflective chevron (rear)			
Reflective tape (vehicle sides)			
Number plates			

Item	In place Yes/No	Condition (✓ or ✕)	Reference/Comment
Document holder in cab			
Dangerous goods diamond			
Dangerous goods signage			
No smoking, etc, signage			
Tank and pipelines free of leaks			
General condition			
Engine starting			

Inspection outcome

Authorisation for issue of a Safe Loading Pass for this vehicle is	**APPROVED**	**NOT APPROVED**

This vehicle may be presented for re-inspection if the following defects have been rectified:

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

Signature of inspector _____ **Date** _____

Annexure 7 BL/SLP – Safe Loading Pass

Suggested layout and format for a Bulk Road Tanker Safe Loading Pass

Page size: 11 mm high x 80 mm wide

Front laminated for security and wear protection.

Front

SLP no _____

Safe Loading Pass

"Certificate of fitness" of a Bulk Road Tanker to load Bitumen at a Bitumen bulk loading facility.

Vehicle registration number:

Vehicle type:

Operator:

Issuing company:

_____
Name of authorised issuer

_____
Signature of issuer

Date issued: _____

Expiry date: _____

Issued in accordance with the requirements of the SABITA Code of Practice – Loading of Bitumen at Refineries.

Back

Restrictions and endorsements

This passport is issued subject to the following operating restrictions:

_____
_____
_____
_____
_____

Endorsements:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Annexure 8 BL/BLIP – Bitumen Loading Incident Report

Bulk Road Tanker Loading Incident Report

Incident number

Loading facility | Date | Time | Reported by

Driver and vehicle detail:

Driver name | OP no | Employer Company

Vehicle SLP no | Date SLP issued

Incident detail:

Location | Bay | Meter no | Product loaded

Preset volume | Volume loaded | Spillage (Y/N) | Spillage quantity

Brief description of incident:

Immediate action taken:

Notification of incident sent to:

Preliminary investigation done by:

....

....

Probable immediate cause of incident:

....

Signature of Load Controller/Shift Supervisor | Date | Time | Signature of driver

Section 6

A GUIDE TO THE SAFE HANDLING OF SOLVENTS IN A BITUMEN/ASPHALT MATERIALS LABORATORY

ACKNOWLEDGEMENT AND DISCLAIMER

1. This publication is an extract of the original Contract Report: CSIR/BE/IE/ER/2009/ 0030/C April 2009, (authors J O'Connell and G Mturi), prepared for SABITA by the CSIR under Project 59E2084: A Guide to the Safe Use of Solvents in a Bitumen / Asphalt Materials Laboratory.
2. The original full CSIR report is available on the SABITA website. The content published in this document has been revised and edited insofar as to replace reference to foreign MSDS sheets and Legislation with links to local (RSA) information as applicable.

   Appendix D of the original report has been omitted from the extract mainly due to extensive revision, and imminent promulgation, of local legislation (OHS Act and Regulations) that will render this publication out-of-date (soon) if published as is.
3. This document is prepared for the sole purpose of making the information contained in this extract available to SABITA members as a guide to assist with making informed decisions in connection with the use of solvents in Asphalt Laboratories as applicable.
4. Whilst every effort has been made to ensure the accuracy of the information contained in this publication, neither the CSIR or SABITA, nor any of its members past present or future, warrants its accuracy or will, regardless of its or their negligence, assume liability for any foreseeable or unforeseeable use made thereof, which liability is hereby excluded. Consequently, such use is at the recipient's own risk on the basis that any use by the recipient constitutes agreement to the terms of this disclaimer. The recipient is obliged to inform any subsequent recipient of such terms.

GENERAL INTRODUCTION

There are many disadvantages associated with the use of solvents in a bituminous laboratory. Mainly, they can be categorized as follows:

Health and Safety Hazards – Solvents are potentially harmful to laboratory operators and represent significant health risks when the solvent liquid or vapours are absorbed through inhalation or through exposure to the skin. Most solvents also present a significant explosion or fire risk.

Environmental Hazards – Solvents in general have a high carbon footprint, ie, their manufacture and disposal may be energy intensive, resulting in a direct or indirect contribution to the carbon dioxide concentration in the atmosphere. In addition some chlorinated solvents, such as the commonly used trichloroethylene (TCE), have been shown to be linked to damage of the ozone layer, and their use has become increasingly restricted under the Montreal Protocol.

Cost Implications – The costs of solvents have increased significantly in the past number of years, and the costs are generally related to the cost of crude oil. However, other factors such as supply and demand, stricter environmental and safety regulations, and more costly manufacturing processes (to reduce carbon emissions and process pollutants) also play important roles. Moreover, not only has the cost of procurement increased significantly, but the cost of disposal and/or recycling has also increased.

Generally, the use of solvents in a bituminous / asphalt laboratory is limited to reagents for specific test methods and to cleaning agents for glassware and equipment. However, samples under test may also contain solvents such as paraffin (eg cut-back bitumen).

The specific test methods where solvents are used as reagents are:

- ❒ The determination of the binder content of a hot mix asphalt sample
- ❒ The recovery of the binder of a hot mix asphalt sample
- ❒ The determination of the solubility of bitumen
- ❒ The xylene/heptane spot test
- ❒ The use of high performance liquid chromatography (HPLC), gas chromatography (GC) or thin layer chromatography (TLC) to characterize the chemical composition of bitumen
- ❒ The Dean and Starke test for the determination of binder content of bitumen emulsions or water content of bituminous mixtures
- ❒ The determination of the softening point of bitumen where the softening point is expected to exceed 85ºC.

Best practice for any bituminous laboratory would be to eliminate the use of solvents altogether for all test methods, as well as for cleaning purposes. Advances in laboratory equipment over the last decade have made this a viable option for some test methods such as the determination of binder content, as well as for certain cleaning requirements.

However, it is not always possible to eliminate the use of solvents altogether. Under these circumstances, the following approach is recommended:

- ❒ The substitution of more hazardous solvents with less hazardous solvents – A number of test method developments over the last decade have allowed for the validation of existing test methods by replacing unsafe solvents such as tricholorethylene (TCE) with “safer” solvent combinations such as toluene/ethanol (85/15) or blends of n-propylbromide (1-bormopropane).

The word “safer” is placed in quotation marks as it is important for any operator in a laboratory to understand that no solvent is completely safe. Even for ‘safe’ solvents, there will always be some laboratory operators who would be sensitized to such solvents, whether through a medical or genetic predisposition.

- ❒ The substitution of more hazardous solvents with one of the new generation “non-toxic”, environmentally friendly solvents - These new generation solvents, based on blends of naturally occurring compounds (eg limonene blends from oils from lemon peels) are easier to dispose of and are generally biodegradable.

Where it is not practical to replace a hazardous solvent, it is important, depending on the toxicity of the solvent, as well as legislative requirements, that the required measures to minimize risk

exposure for a laboratory operator be undertaken. Such risk management (even for less toxic solvents) would entail:

- A set of general laboratory safety rules to minimize the exposure of a laboratory operator to any solvent as well as minimize the risk of fire and explosion. These general laboratory rules are discussed in detail in Appendix A. These general safety rules include details regarding personal protective equipment (PPE), safety training, laboratory signage, maintenance and validation of safety equipment such as fire extinguishers, fume cupboards and extractor fans, etc. The requirements for fume cupboards and air flow through the laboratory for the various toxic solvents are also listed. Specific storage procedures and recommendations are listed separately in Appendix B
- Management and interpretation of Material and Safety Data Sheets (MSDS). The MSDS for all possible solvents to be found in bituminous / asphalt laboratories in Southern Africa are listed in Appendix C. The interpretation of the various properties and their relation to toxicity and fire/explosion risk are discussed in detail. Tables ranking the various solvents with regard to risk are also listed in Appendix C.
- Compliance with the legislative requirements of South Africa in terms of the Occupation Health and Safety Act of 1993 (with Amendments), the General Safety Regulations of 1986 as per Government Gazette Notice R1031, as well as the Hazardous Chemical Substances Regulations of 1995 as per Government Gazette Notice R1179. The requirements for monitoring of laboratory personnel in terms of exposure to those toxic solvents defined in the legislation as well the monitoring of the health of those laboratory personnel exposed to such defined toxic solvents are also discussed in these documents.

1. SOLVENT CLEANING

Typical solvents used for cleaning in South Africa include:

- Paraffin
- Diesel
- Toluene
- Xylene
- Hexane

These solvents vary in their toxicity and risk of fire/explosion, and if a laboratory should use one of them they should adopt the necessary precautionary procedures as outlined later in this document.

Alternative ‘safety solvents’ have been adopted by many laboratories internationally for cleaning purposes. These include:

- D-limonene
- Florasolvs Solvents
- N-propyl bromide solvents (nPB’s)
- Oil-Flo
- Bind-off
- X-it

2. GENERAL APPROACH TO THE SAFE HANDLING OF SOLVENTS

As mentioned in the introduction, the general principles in our approach to solvents in laboratories should be:

- **Eliminate** – a solvent if it is practical to do so (eg ignition oven)
- **Replace** – dangerous/environmentally unfriendly solvents with safer/ more environmentally friendly solvents. Solvents can be evaluated by means of their material and safety data sheets (MSDS). A laboratory operator may not handle a solvent in a laboratory without the operator having familiarized him/herself with the MSDS for that solvent.
- **Safe Handling** – Where it is not practical to replace a hazardous solvent, it is important, depending on the toxicity of the solvent, as well as legislative requirements, that the measures required to minimize exposure to risk be undertaken. Such risk management (even for less toxic solvents) would entail:
  - Ensure the general laboratory safety rules are obeyed.
  - Ensure that the specified storage procedures are followed
  - Before working with a solvent, familiarize yourself with its MSDS with regards to its fire/explosion risk, health risks and procedures to be followed in case of spillage.
  - Ensure compliance with the legislative requirements of South Africa in terms of the Occupation Health and Safety Act of 1993 (with Amendments), the General Safety Regulations of 1986 as per Government Gazette Notice R1031, as well as the Hazardous Chemical Substances Regulations of 1995 as per Government Gazette Notice R1179.

Overall, when working with solvents in a bituminous / asphalt laboratory, a balance between the safety and environmental requirements, technical accuracy and correctness, and cost effectiveness needs to be attained.

3. GENERAL LABORATORY SAFETY RULES

3.1 Introduction

It was originally the intention to limit the scope of this section to the use of solvents only. It was decided to include all aspects of safety in a laboratory, as a limited edition might leave the rules open to misinterpretation, and expose the authors to such liability that might arise from such misinterpretation. Many of the guidelines / rules set out in this section are further circumscribed in the relevant legislative requirements.

The first step in establishing laboratory safety rules is conducting a risk assessment. Thereafter the rules are established based on the risks identified from the hazards present in the laboratory. The risk assessment should cover the following areas:

- ❒ Hazard Communication
- ❒ Chemical Storage
- ❒ Personal Protective Equipment (PPE)
- ❒ Handling and Use of Chemicals
- ❒ Fire and Gas Safety
- ❒ Hazardous Waste Management
- ❒ Ventilation and Fume Hoods
- ❒ Physical Hazards, Ergonomics, safe Conduct and Housekeeping
- ❒ Equipment Safety
- ❒ Emergency Processes

3.2 Hazard communication

It is important that all laboratory workers and visitors have access to and are exposed to all information on hazardous materials. This information is provided by means of product labels, material safety data sheets (MSDS), warning signs as well as training by appropriate professionals to be able to interpret hazard warning information.

SHE / SHEQ policy documents must contain an approved list of acceptable laboratory abbreviations. This permits laboratories to use abbreviations on labels etc. However, a list of abbreviations must be posted in the laboratory, preferably in a location close to where the products are stored; and a list must be included with the MSDS file. Hazard communication occurs via:

- ❒ **Labelling** - Labels identify as well as alerts people to the dangers of the product and basic safety precautions when handling the product. A label may be a mark, sign, stamp, device, sticker, ticket, tag, or wrapper and must be attached to, imprinted, stencilled or embossed on the container of the controlled product. There are 2 types of labels i.e. supplier labels and workplace labels.

Supplier's Labels:

Suppliers are responsible for making sure their products are clearly labelled. A supplier label generally contains the following information:

- ✍ Product identifier (name of product)
- ✍ Supplier identifier (name of company that sold it)
- ✍ Impurities, other components
- ✍ Flash point (is applicable)
- ✍ Storage colour code
- ✍ Hazard warning/rating/class
- ✍ Risk descriptor (danger, warning, caution, etc)
- ✍ Risk descriptive statement
- ✍ Handling advice (how to work with the product safely)
- ✍ First aid measures (what to do in an emergency)
- ✍ Reference to the MSDS

Supplier labels may contain additional information such as:

- ✍ Identification numbers (i.e. CAS number, UN number and barcodes)
- ✍ Recommended personal protective equipment
- ✍ Recommended fire extinguisher class

These supplier labels must be provided in the official language of the users.

Workplace Labels:
Appropriate labels must be present when:
- ✍ Controlled products are produced, manufactured or prepared (e.g., stock solutions) in the laboratory;
- ✍ The controlled product is transferred from the original container into another container; and
- ✍ The original supplier label becomes illegible or damaged or when it is removed;

The authors also recommend that a workplace label contain the following information:
- ✍ Product identifier (product name) – including the full name of the product/solution as it appears on the MSDS as well as its purity and concentration
- ✍ Information for the safe handling of the product and reference to the MSDS
- ✍ Date of transfer / manufacture and expiry date

Laboratory Sample Labels:
Laboratory samples are samples intended solely to be tested in a laboratory. These would include recovered binders and separated binder components.
The requirements for laboratory samples that are intended to be used in a laboratory immediately and solely by that person who prepared them include:
- ✍ The samples must be clearly identified;
- ✍ A description of sample's contents must be readily available (e.g. noted in a lab book or similar electronic system); and
- ✍ Material Safety Data Sheets for the sample must be readily available.

Laboratory samples that must be transported outside of a laboratory (e.g. sent elsewhere for analysis), including within the institution must have a label affixed to it that contains the following information:
- ✍ Product identifier (product name)
- ✍ Owner's name (name of Principal Investigator who prepared the sample)
- ✍ Lab number and building
- ✍ Emergency telephone number

When samples are greater than 10 kg, the label affixed to the container must meet the requirements of a supplier label. Laboratory samples should not be sent via internal mail.

- ❒ **Material Safety Data Sheets** - See Sub-section 5 (The Management and Interpretation of Material and Safety Data Sheets - for binder and asphalt laboratories)

- ❒ **Education and Training** - Training and education provides more detailed instruction on the specific procedures necessary to carry out work safely. Training can be divided into two parts: General Training and Job-specific Training.

General Training
This is basic training that an organization is responsible for conducting so that all personnel whose work function may result in safety, health or environmental incidents undergo appropriate training. This training should provide instruction on the classification of products; include risks and precautions, (Hazard register) and the content, purpose and interpretation of information found on labels and in MSDS.

Job-specific training
This refers to training in the procedures and test methods employed by a particular laboratory, and would include training for the safe handling and storage of products specific to that laboratory (including spill and leak training, waste disposal and basic first aid instructions). Job-specific training is usually the responsibility of the Laboratory Supervisor. Training requirements shall be established, taking the following into account:
- ❒ New employees during their induction period in the organization
- ❒ New employees during their job-specific training
- ❒ Existing employees when there is a change in their duties
- ❒ When new equipment or materials are introduced (Change management procedure)
- ❒ When emergency procedures are revised
- ❒ When a drill indicates a need for improvement

3.3 Chemical Storage

See Sub-section 4 (Recommendation for Solvent Storage in a binder or asphalt laboratories)

3.4 Personal Protective Equipment (PPE)

A wide variety of personal protective gear is available which, with proper use and care, will minimize or eliminate exposure to hazardous materials. Every laboratory worker should be familiar with the location, types, and uses of the protective gear available for the job.

The laboratory supervisor should have sufficient quantities of equipment to protect everyone who will work with hazardous materials. All laboratory workers should at all times wear the appropriate protective equipments such as eye and face protection, protective clothing, hand protection, foot protection and respirators where circumstances require their use.

It should be noted that PPE should only be used as a control measure when other measures are inappropriate or are inadequate by themselves.

However, there is growing evidence that the levels of protection of PPE indicated by laboratory-based tests may not be achieved in real use situations. Additionally, studies of workplace protection suggest that the spread of contaminants inside protective clothing, including gloves, is commonplace and significant.

Eye and face protection

Eye and/or facial protection should be required for all personnel (staff and visitors) at:

- ❒ All areas where hazardous materials, or substances of an unknown nature, are stored, used or handled,
- ❒ All areas where the possibility of splash, flying objects, moving particles and/or rupture exist,
- ❒ All areas where there are other eye hazards (e.g. UV or laser light).

It is recommended that:

- ✍ Goggles/safety glasses and face shields should be worn when handling, pouring or transferring any chemical in order to avoid eye damage.
- ✍ Eye wash bottles and safety showers be installed where corrosive and toxic chemicals are being handled and there is a risk of exposure.
- ✍ Contact lenses should be discouraged strongly since gases and vapours can be concentrated under the lens and cause permanent eye damage. In the event of a splash, the involuntary eyelid spasm makes removal of the lens nearly impossible and the eye could not be irrigated satisfactorily

Protective eyewear for employees who wear prescription eyeglasses must be one of the following:

- ✍ Eyeglasses with protective lenses that also provide optical correction
- ✍ Goggles to be worn over glasses
- ✍ A face shield to fit over eyeglasses

Instructions for selection and use of protective eyewear are as follows:

- ✍ Light-to-moderate work: certified safety glasses with side shields.
- ✍ Work with significant risk of splash of chemicals, or projectiles: goggles.
- ✍ Work with significant risk of splash on face, or possible explosion: full face shield, plus goggles.
- ✍ If safety glasses with correction lenses are needed, first consult with your optometrist or ophthalmologist.

3.5 Protective Clothing

All laboratory workers should wear fully buttoned laboratory coats or appropriate protective clothing, such as aprons and coveralls, at all experimental areas where hazardous materials are handled.

Instructions for selection and use of protective laboratory clothing are as follows:

- ✍ Select knee-length lab coats with button or snap closures
- ✍ Wear a solid-front lab coat or gown with back closures and knitted cuffs when working with highly toxic or infectious agents
- ✍ Wear protective aprons for special procedures such as transferring large volumes of corrosive material
- ✍ Remove protective clothing when leaving the laboratory

✍ Remove protective clothing in the event of visible or suspected contamination

Laboratory coats should be able to absorb even large spills and if removed promptly may not contaminate the skin. In some cases, disposable synthetic materials (Static Electricity?) are used for protective clothing where maximum impermeability is desired.

3.6 Foot Protection

Open-toed shoes, sandals, or other shoes that do not fully enclose the foot pose a significant potential for foot injuries in the laboratory. Small pieces of glass from broken pipettes or test tubes can be trapped easily between the foot and open shoe causing serious lacerations. A full shoe can protect the foot from spilled chemicals for enough time to get to a sink or safety shower. An open shoe affords no protection. Special rubber boots or plastic shoes may be needed where large quantities of solvents might penetrate normal foot gear (e.g. during spill clean-up operations). However, where specific laboratory safety rules call for the use of safety shoes, these must be worn in accordance with those safety rules.

3.7 Hand protection

In the laboratory, gloves are used for protecting hands from radiation, chemical products, hazardous material and physical hazards such as abrasion, tearing, puncture and exposure to temperature extremes.

Latex gloves and skin reactions

Natural latex is derived from the sap of the rubber tree and contains rubber polymers, carbohydrates, lipids, phospholipids and proteins. During the manufacturing process additional chemical agents are added to impart elasticity, flexibility and durability to the latex. Because of these properties, and because of their high tactile strength and low cost, latex gloves are used for many laboratory procedures. Unfortunately, for some people, wearing latex gloves can cause skin reactions; these can be either irritant or allergic in nature, and can be caused by:

- ❒ Chronic irritation from sweating of hands inside gloves or from gloves rubbing against the skin
- ❒ Sensitization to the chemical additives used in the manufacturing process
- ❒ Reaction to naturally-occurring latex proteins
- ❒ Frequent hand-washing, as well as residues from scrubs, soaps, cleaning agents and disinfectants may further irritate the skin.
- ❒ Using one of the following alternatives may reduce the risk of skin problems associated with the use of latex rubber gloves:
- ❒ Non-latex gloves
- ❒ "hypo-allergenic", non-powdered or low-protein latex gloves
- ❒ Polyethylene, pvc or cloth liners under latex gloves
- ❒ Non-latex gloves under latex gloves

Occurrences of skin problems (e.g., rash, itching, peeling, red, blistering skin or dry flaking skin with cracks and sores) that seem to be associated with the wearing of latex gloves should be reported to a physician when symptoms first appear.

Glove selection guidelines

Base selection of glove material on:

- ❒ Identification of the work procedures requiring hand protection
- ❒ Flexibility and touch sensitivity required; a need for high tactile sensitivity, for example, would restrict glove thickness, and some protocols may require the use of gloves with non-slip or textured surfaces
- ❒ Type and length of contact (e.g. Occasional or splash vs. Prolonged or immersion contact)
- ❒ Whether disposable or reusable gloves are more appropriate

Table - Recommended glove materials for a variety of laboratory hazards

Hazard	Degree of Hazard	Recommended Material
Abrasion	Severe	Reinforced heavy rubber, staple-reinforced leather
	Less severe	Rubber, plastic, leather, polyester, nylon, cotton
Sharp edges	Severe	Metal mesh, staple-reinforced heavy leather, aramid-steel
	Less severe	Leather, terry cloth (aramid-steel)
	Mild with delicate work	Lightweight leather, polyester, nylon, cotton

Chemicals and liquids	Varies depending on the concentration, contact time, etc. Consult MSDS, manufacturer or permeation chart	Choice depends on chemical. Examples: natural, nitrile or butyl rubber, neoprene, PTFE (polytetrafluoroethylene), polyvinyl chloride, polyvinyl alcohol
Cold		Leather, insulated plastic or rubber, wool, cotton
Heat	Over 350ºC	Asbestos types
	Up to 350ºC	Neoprene-coated asbestos, heat-resistant leather with linings, Nomex
	Up to 200ºC	Heat-resistant leather, terry cloth (aramid fibre)
	Up to 100ºC	Chrome-tanned leather, terry cloth
General duty		Cotton, terry cloth, leather
Product contamination		Thin-film plastic; lightweight leather, cotton, polyester, nylon
Radiation	Low to moderate radiotoxicity	Any disposable rubber or plastic glove

**Gloves not listed here may also be suitable; refer to the MSDS, glove manufacturer or permeation chart.*

No single glove material is resistant to all chemicals, nor will most gloves remain resistant to a specific chemical for longer than a few hours. Determine which gloves will provide an acceptable degree of resistance by consulting the MSDS for the product, contacting glove manufacturers or by referring to a compatibility chart or table for permeation data. These resources may use the following terms:

- ❒ "permeation rate" refers to how quickly the chemical seeps through the intact material: the higher the permeation rate the faster the chemical will permeate the material;
- ❒ "breakthrough time" refers to how long it takes the chemical to seep through to the other side of the material, and
- ❒ "degradation" is a measure of the physical deterioration (for example, glove material may actually dissolve or become harder, softer or weaker) following contact with the chemical

Selection, use and care of protective gloves

Guidelines for glove use include the following:

- ✍ Choose a glove that provides adequate protection from the specific hazard(s)
- ✍ Be aware that some glove materials may cause adverse skin reactions in some individuals and investigate alternatives
- ✍ Inspect gloves for leakage before using; test rubber and synthetic gloves by inflating them
- ✍ Make sure that the gloves fit properly
- ✍ Ensure that the gloves are long enough to cover the skin between the top of the glove and the sleeve of the lab coat
- ✍ Discard worn or torn gloves
- ✍ Discard disposable gloves that are, or may have become, contaminated
- ✍ Avoid contaminating "clean" equipment: remove gloves and wash hands before carrying out tasks such as using the telephone
- ✍ Always wash your hands after removing gloves, even if they appear not to be contaminated
- ✍ Do not reuse disposable gloves
- ✍ Follow the manufacturer's instructions for cleaning and maintenance of reusable gloves
- ✍ Before using gloves, learn how to remove them without touching the contaminated outer surface with your hands

3.8 Respirators

Respirators should be used only in emergency situations (e.g. hazardous spills or leaks) or when other measures, such as ventilation, cannot adequately control exposures.

There are two classes of respirators: air-purifying and supplied-air. The latter supply clean air from a compressed air tank or through an air line outside the work area, and are used in oxygen-deficient atmospheres or when gases or vapours with poor warning properties are present in dangerous concentrations.

Air-purifying respirators are suitable for many laboratory applications and remove particulates (dusts, mists, metal fumes, etc.) or gases and vapours from the surrounding air.

Selection, use and care of respirators

Follow proper procedures for selecting and using respiratory protective equipment. Correct use of a respirator is as vital as choosing the right respirator. An effective program for respiratory protection should include the following:

- Written standard operating procedures and training
- Selecting a respirator that is suitable for the application. Consult the msds or the environmental safety office before purchasing and using a respirator
- Assigning respirators to individuals for their exclusive use, whenever possible
- Fit-testing: evaluation of facial fit for all users of respirators; beards, long sideburns, glasses or the wrong size of respirator may prevent an effective seal between the wearer's face and the respirator
- Protocols for using, cleaning and sanitary storage of respirators
- Regular inspection of the respirator, and replacement of defective parts
- Medical surveillance, before an individual is assigned to work in an area where respirators are required, to verify the person's ability to function under increased breathing resistance.

It is essential to assess the health status of the wearer and their medical status re-viewed periodically. It has been determined that persons with certain medical disorders and conditions may be at risk when wearing a respiratory protective device. The following clinical conditions are among those which could compromise an individual's ability to wear a respirator without risk:

- Chronic obstructive and restrictive lung disease: chronic bronchitis, emphysema, pneumoconiosis, fibro thorax, asthma, etc.
- Ischemic heart disease: coronary insufficiency and myocardial infarction.
- Benign and accelerated hypertension.
- Hemorrhagic disorders: vascular haemophilia, hypersplenism, thrombocytopenia, purpura, etc.
- Thyroid disorders or cystic fibrosis.
- Epilepsy: grand mal, focal, etc.
- Diabetes mellitus
- Cerebrovascular accidents
- Facial abnormalities
- Kidney diseases
- Conductive and sensorineural hearing loss
- Serious defects in visual acuity
- Ruptured eardrum

The importance of claustrophobia, anxiety, and other psychological factors during the wearing of a respirator should not be overlooked in a medical assessment. Without such screening, persons psychologically unsuited to wearing respirators may be placed in situations in which they become a danger to themselves and others. Therefore, prospective respirator users must show evidence that the wearing of respiratory protective devices will not produce undue physical or psychological stress or risk.

3.9 Handling and Use of Chemicals

Laboratory personnel work in a potentially extremely hazardous and unforgiving environment. The substances with which they work may be toxic, flammable, explosive or carcinogenic, to mention a few unpleasant possibilities. It is therefore important that all personnel in the laboratory learn the potential hazard of the chemicals they are handling and using everyday.

Toxic chemicals and the four routes of entry

Chemicals can gain entry into the body by:

- Inhalation of gases, vapours and particulate material (e.g. mists, dusts, smoke, fumes)
- Absorption through skin of liquids, solids, gases and vapours
- Ingestion of chemicals directly or indirectly via contaminated foods and beverages and contact between mouth and contaminated hands (nail-biting, smoking)
- Injection of chemicals through needles and other contaminated laboratory sharps

Flammable chemicals

Flammable and combustible liquids, solids or gases will ignite when exposed to heat, sparks or flame. Flammable materials burn readily at room temperature, while combustible materials must be heated before they will burn. Flammable liquids or their vapours are the most common fire hazards in laboratories.

Oxidizing Chemicals

Oxidizers provide oxidizing elements such as oxygen or chlorine, and are capable of igniting flammable and combustible material even in an oxygen-deficient atmosphere. Oxidizing chemicals can increase the speed and intensity of a fire by adding to the oxygen supply, causing materials that would normally not burn to ignite and burn rapidly. Oxidizers can also:

- ❒ React with other chemicals, resulting in release of toxic gases
- ❒ Decompose and liberate toxic gases when heated
- ❒ Burn or irritate skin, eyes, breathing passages and other tissues

Precautions to follow when using and storing oxidizers in the laboratory include the following:

- ✍ Keep away from flammable and combustible materials
- ✍ Keep containers tightly closed unless otherwise indicated by the supplier
- ✍ Mix and dilute according to the supplier's instructions
- ✍ To prevent release of corrosive dusts, purchase in liquid instead of dry form
- ✍ Reduce reactivity of solutions by diluting with water
- ✍ Wear appropriate skin and eye protection
- ✍ Ensure that oxidizers are compatible with other oxidizers in the same storage area

Reactive Chemicals

- ❒ May be sensitive to jarring, compression, heat or light
- ❒ May react dangerously with water or air
- ❒ May burn, explode or yield flammable or toxic gases when mixed with incompatible materials
- ❒ Can vigorously decompose, polymerize or condense
- ❒ Can also be toxic, corrosive, oxidizing or flammable
- ❒ Some chemicals may not be dangerous when purchased but may develop hazardous properties over time (e.g. diethyl ether and solutions of picric acid).

Follow these precautions when working with dangerously reactive chemicals:

- ✍ Understand the hazards associated with these chemicals and use them under conditions which keep them stable
- ✍ Store and handle away from incompatible chemicals
- ✍ Keep water-reactive chemicals away from potential contact with water, such as plumbing, fire sprinkler heads and water baths
- ✍ Handle in a chemical fume hood
- ✍ Wear the appropriate skin and eye protection
- ✍ Work with small quantities
- ✍ Use up or dispose of these chemicals before they attain their expiry date

Corrosive chemicals

Corrosives are materials, such as acids and bases (caustics, alkalis) which can damage body tissues as a result of splashing, inhalation or ingestion. Also:

- ❒ They may damage metals, releasing flammable hydrogen gas
- ❒ They may damage some plastics

- ❒ Some corrosives, such as sulphuric, nitric and perchloric acids, are also oxidizers; thus they are incompatible with flammable or combustible material
- ❒ They may release toxic or explosive products when reacted with other chemicals
- ❒ They may liberate heat when mixed with water

Precautions for handling corrosive materials include:

- ✍ Wear appropriate skin and eye protection
- ✍ Use in the weakest concentration possible
- ✍ Handle in a chemical fume hood
- ✍ Use secondary containers when transporting and storing corrosives
- ✍ Always dilute by adding acids to water
- ✍ Dilute and mix slowly
- ✍ Store acids separately from gases

Chemical spill response - Spill response contingencies

Laboratory heads are responsible for predetermining procedures for response to the types of spill situations that may be anticipated for their operations. Individuals requiring assistance in preparing spill response plans should contact their Environmental Health and Safety Dept.

Development of spill response plans - Communications

All laboratories housing hazardous materials are required to provide means of reaching contact people who may be summoned in the event of emergencies involving their laboratory, especially for after-hours situations. This may involve posting the relevant telephone number(s) and/or providing them to the Security Services, who operate the emergency telephone number.

Laboratory Managers are also required to provide to the Security Services telephone numbers where they, or alternate contact persons, may be reached during after-hours crises.

General guidelines

The following factors are to be considered when developing spill response procedures:

- ❒ Categories of chemicals (e.g. oxidizers, flammable solvents) and their chemical, physical and toxicological properties.
- ❒ The quantities that may be released.
- ❒ Possible locations of release (e.g. laboratory, corridor).
- ❒ Personal protective equipment needed.
- ❒ Types and quantities of neutralizing or absorbing material needed.

These guidelines should be followed when initially responding to a spill situation:

- ✍ Determine appropriate clean up method by referring to the Material Safety Data Sheet (MSDS). If you are unsure how to proceed, or if you do not have the necessary protective equipment, do not attempt to clean up the spill.
- ✍ If the spill is minor and of known limited danger, clean up immediately.
- ✍ If the spill is of unknown composition, or potentially dangerous (explosive, toxic vapours), alert everyone present and evacuate the room.
- ✍ If the spill cannot be safely handled using the equipment and personnel present, call the emergency telephone number to request assistance.

Guidelines for specific types of spills

This section describes how to clean up some of the chemical spills that may occur in the laboratory. Refer to sub-section on Waste Management for details on how to dispose of the absorbed chemical.

Flammable and toxic liquids

- ❒ If you can do so without putting yourself at risk, immediately shut off all potential ignition sources
- ❒ If fire occurs, alert everyone present and extinguish all flames. If the fire cannot be controlled immediately pull the nearest fire alarm.
- ❒ If no flames are evident, pour adsorbent around the perimeter of the spill and then cover the rest of the material. Wear an appropriate respirator if toxic vapours are involved.
- ❒ Wear gloves resistant to the chemical being handled. Using a plastic utensil (to avoid creating sparks), scoop up the absorbed spill, place it in a plastic bag, seal it, and place in a labelled container.

Corrosive liquids

- ❒ Alert everyone present. If vapours are being released, clear the area.
- ❒ Do not attempt to wipe up a corrosive liquid unless it is very dilute.
- ❒ Gloves, boots, apron and eye protection must be used when neutralizing an extensive corrosive spill. Respiratory protection is required if the liquid releases corrosive vapour or gas.
- ❒ Pour the required neutralizing or adsorbing material around the perimeter of the spill, and then carefully add water and more neutralizing material to the contained area. Carefully agitate to promote neutralization.
- ❒ Use pH paper to verify that all contaminated areas are neutralized and safe to wipe up.
- ❒ If an adsorbent (e.g. spill control pillows) is used instead of a neutralizer, scoop up the absorbed spill, place it in a plastic bag, seal it, and then place in a labelled box. If neutralized material contains no toxic heavy metals (e.g. chromium), flush down the drain with plenty of water.

Corrosive solids

Small spills can be cleaned up mechanically with a dustpan and brush. Larger spills should be cleaned up using a HEPA (High-Efficiency Particulate Air) filter vacuum. For spills containing fine dusts, an air-purifying respirator with dust filters is recommended, as are gloves, protective goggles, and a lab coat.

Toxic solids

Avoid disturbing such solids (e.g. asbestos) which may release toxic dusts. Wet the material thoroughly, then place it in a plastic bag and label it appropriately. If wet removal is not possible, a vacuum equipped with a HEPA (High Efficiency Particulate Air) filter is required.

Gases

In the event of the release of a corrosive gas (e.g. chlorine) or gases that are absorbed through the skin (e.g. hydrogen cyanide), a complete chemical resistant suit and a self-contained breathing apparatus are required. There is no practical means of absorbing or neutralizing a gas - the leak must be corrected at the source.

Mercury

- ❒ If a small amount of mercury is spilled (e.g. broken thermometer), use an aspirator bulb or a mercury sponge to pick up droplets, place the mercury in a container, cover with water, seal it, and label the bottle appropriately.
- ❒ To clean up the residual micro-droplets that may have worked into cracks and other hard-to-clean areas, sprinkle sulphur powder or other commercially available product for mercury decontamination. Leave the material for several hours and sweep up solid into a plastic bag, seal it and label it appropriately.
- ❒ Contact the appropriate organization for monitoring of mercury air concentrations.
- ❒ If a large spill of mercury is involved, the area should be closed off, and a mercury respirator worn during the clean-up. A mercury vacuum is available from the appropriate organization for large mercury spills.

Special categories

For further information on responses to other categories consult Sub-section 5: The Management and Interpretation of material safety data sheets.

3.10 Fire and Gas Safety

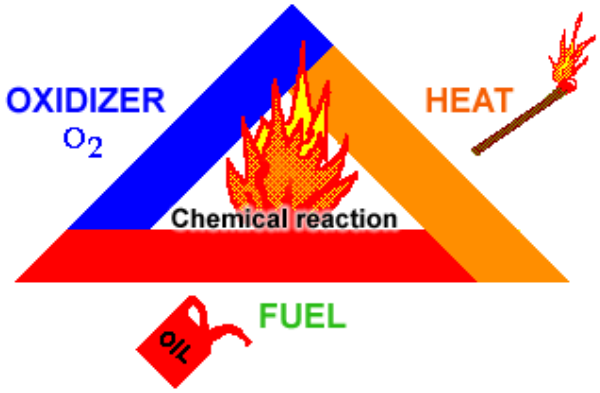
Fire Safety

Laboratory fires can be caused by Bunsen burners, runaway chemical reactions, electrical heating units, failure of unattended or defective equipment, or overloaded electrical circuits.

- ❒ Familiarize yourself with the operation of the fire extinguishers and the location of pull stations, emergency exits and evacuation routes where you work
- ❒ In the event that the general alarm is sounded use the evacuation routes established for your area and follow the instructions of the Evacuation Marshalls
- ❒ Once outside of the building, move away from the doors to enable others to exit.

The fire triangle

Fire cannot occur without an ignition source, fuel and an oxidizing atmosphere (usually air), the three elements that comprise what is called the "fire triangle":



Fire will not be initiated if any one of these elements is absent, and will not be sustained if one of these elements is removed. This concept is useful in understanding prevention and control of fires. For example, the coexistence of flammable vapours and ignition sources should be avoided, but when flammable vapours cannot be controlled elimination of ignition sources is essential.

Classes of Fire

The National Fire Protection Association has defined four classes of fire, according to the type of fuel involved. These are:

- ❒ Class A fires involve combustibles such as paper, wood, cloth, rubber and many plastics.
- ❒ Class B fires entail burning of liquid fuels like oil-based paints, greases, solvents, oil and gasoline.
- ❒ Class C fires are of electrical origin (fuse boxes, electric motors, wiring).
- ❒ Class D fires encompass combustible metals such as magnesium, sodium, potassium and phosphorus.

Fire extinguishers

Fire extinguishers are rated as A, B, C or D (or combinations of A, B, C and D) for use against the different classes of fires. Familiarize yourself with the fire class ratings of the extinguishers in your work area so that you will know what types of fire you can attempt to extinguish with them.

Learn how to use the extinguisher in your lab, as there will be no time to read instructions during an emergency. Attempt to fight small fires only, and only if there is an escape route behind you. Remember to have the extinguisher recharged after every use. If you do fight a fire, remember the acronym "PASS" when using the extinguisher:

P: Pull and twist the locking pin to break the seal.

A: Aim low, and point the nozzle at the base of the fire.

S: Squeeze the handle to release the extinguishing agent.

S: Sweep from side to side until the fire is out.

Be prepared to repeat the process if the fire breaks out again!

Preventing fires

Use the following precautions when working with or using flammable chemicals in a laboratory; keep in mind that these precautions also apply to flammable chemical waste.

- ❒ Minimize the quantities of flammable liquids kept in the laboratory.
- ❒ Do not exceed the maximum container sizes specified by your Local Authority By-laws
- ❒ Except for the quantities needed for the work at hand, keep all flammable liquids in UL-(Underwriter's Laboratories) approved flammable liquid storage cabinets. Keep cabinet doors closed and latched at all times. Do not store other materials in these cabinets.
- ❒ Use and store flammable liquids and gases only in well-ventilated areas. Use a fume hood when working with products that release flammable vapours.
- ❒ Keep flammable solvent containers, including those for collecting waste, well capped. Place open reservoirs or collection vessels for organic procedures like HPLC inside vented chambers.
- ❒ Store flammable chemicals that require refrigeration in "explosion-safe" (non-sparking) laboratory refrigerators.
- ❒ Keep flammable chemicals away from ignition sources, such as heat, sparks, flames and direct sunlight. Avoid welding or soldering in the vicinity of flammables.

- ❒ Bond and ground large metal containers of flammable liquids in storage. To avoid the build-up of static charges, bond containers to each other when dispensing.
- ❒ Use portable safety cans for storing, dispensing and transporting flammable liquids.
- ❒ Clean spills of flammable liquids promptly.

Evacuations

In the event that the general alarm is sounded, follow the evacuation routes established for your area; do not use the elevators. Follow the instructions of the Evacuation Marshalls. Once outside the building, move away from the doors to allow others to exit.

Gas Safety - Hazards of compressed gases

Compressed gases are hazardous due to the high pressure inside cylinders. Knocking over an unsecured, uncapped cylinder of compressed gas can break the cylinder valve; the resulting rapid escape of high pressure gas can turn a cylinder into an uncontrolled rocket or pinwheel, causing serious injury and damage.

Poorly controlled release of compressed gas in the laboratory can burst reaction vessels, cause leaks in equipment and hoses or result in runaway chemical reactions.

Compressed gases may also have flammable, oxidizing, dangerously reactive, corrosive or toxic properties. Inert gases such as nitrogen, argon, helium and neon can displace air, reducing oxygen levels in poorly ventilated areas and causing asphyxiation.

Safe handling, storage and transport of compressed gas cylinders

- ❒ All gas cylinders, full or empty, should be securely supported using suitable racks, straps, chains or stands to prevent tipping or damage to the neck, valve and regulator.
- ❒ Compressed gas cylinders containing toxic gases shall be used only in an operating chemical fume hood.
- ❒ When cylinders are not in use or are being transported, remove the regulator and attach the protective cap.
- ❒ An appropriate cylinder cart should be used for transporting cylinders. Chain or strap the cylinder to the cart.
- ❒ Verify that the regulator is appropriate for the gas being used and the pressure being delivered. Do not rely upon the pressure gauge to indicate the maximum pressure ratings; check the regulator's specifications.
- ❒ Do not use adaptors or Teflon tape to attach regulators to gas cylinders.
- ❒ Never bleed a cylinder completely empty; leave a residual pressure.
- ❒ Do not lubricate the high-pressure side of an oxygen regulator.
- ❒ Do not expose cylinders to temperature extremes.
- ❒ Store incompatible classes of gases separately.
- ❒ Compressed gas cylinders shall not be stored in unventilated locations such as cupboards or lockers – shall be stored in a location where they will not be tampered with by unauthorized persons, dry location that are well-protected and well-ventilated (at least 20 feet from highly combustible materials).
- ❒ Cylinders shall not be dropped or struck or allowed to hit each other violently.
- ❒ Cylinder valves not equipped with fixed hand wheels shall have keys or handles on valve spindles or stems while cylinders are in service. If multiple cylinders are connected to a manifold, only one key or handle is required.
- ❒ Leaking regulators, cylinder valves, hose, piping systems, apparatus or fittings shall not be used. Do not attempt to repair or fix cylinder valves.
- ❒ Cylinders shall not be used as rollers or supports, whether full or empty.
- ❒ Cylinders must not be placed where they might form part of an electrical circuit.
- ❒ Never use a cylinder's contents for purposes other than those intended by the supplier.
- ❒ Never allow acetylene to come in contact with unalloyed copper, except in a blowpipe or torch.
- ❒ When flammable lines or other parts of equipment are being purged of air or gas, open lights or other ignition sources will not be allowed near uncapped openings.
- ❒ All compressed gas cylinders will be legibly marked with their contents.
- ❒ Cylinders shall not be stored on their side, unless approved for that use.

3.11 Hazardous Waste Management

All laboratory operations with chemicals result in the production of chemical wastes. These wastes may pose potential harm, both short and long term, to human health or to the environment, unless the disposal is properly handled. There are now regulations and guidelines governing all areas of waste management from creation, transportation to disposing of hazardous waste. The following guidelines are specifically given for laboratories to be able to manage hazardous waste.

Waste minimization

In order to minimize the amount of hazardous waste presented for disposal, it is important to follow these guidelines:

- Avoid overstocking: one of the main sources of laboratory waste is surplus stock - the result of over buying. Recent pricing arrangements with suppliers have greatly reduced the benefits of purchasing chemicals in large volumes. Also, there is little need to store large quantities of chemicals, as orders are generally shipped the day after an order is received.
- Do not accept donations of materials that you don't plan to use. Many companies have traditionally unloaded unwanted reagents by donating them to laboratories, which eventually transfers the cost of disposal to the University.
- Substitute non-hazardous experimental materials for hazardous ones. For example, use aqueous-based, biodegradable scintillation fluids whenever possible.
- If laboratory personnel employ good waste separation practises, the quantity of waste (solid and liquid chemicals, contaminated protective clothing, pipettes, etc) can be kept to a minimum.

Hazardous waste disposal guidelines

- Label all waste materials completely and legibly, using labels available from an appropriate organization. Inadequately labelled containers will not be accepted.
- Package waste materials in approved containers.
- Overfilled and/or leaking containers cannot be accepted for disposal.
- Never discharge wastes into the sewer unless you have verified that hazardous wastes regulations permit you to do so. For information, contact an appropriate organization.

Waste preparation procedures

- Organic solvents and oils
  - Collect in the containers provided by an appropriate organization
  - Indicate the composition of the contents as accurately as possible on the attached label.
- Miscellaneous chemicals and cylinders
  - Complete a lab chemical inventory form and send to an appropriate organization
  - Await instructions.
- Chemicals of unknown composition
  - Unknown chemicals cannot be accepted. Analyze or contact an appropriate organization to arrange for analysis (at the expense of the waste generator).
- Peroxide-forming (e.g. ether) and explosive (e.g. dry picric acid) chemicals
  - Do not mix with solvents or other waste.
  - If the material is older than one year, do not attempt to open or move the container. Contact an appropriate organization for advice.
- Corrosives (acids and bases)
  - Collect acids (pH<7) and bases (pH>7) separately in the plastic containers provided by an appropriate organization. Do not mix acids with bases.
  - Indicate the composition of the contents, as accurately as possible, on the attached label.
- Broken glassware (uncontaminated)
  - Designate a cardboard box for broken glass; label it "BROKEN GLASS", and place glass inside. When the box is full, seal it with tape and place it next to the garbage receptacle for pickup by the cleaning staff.
- Empty chemical reagent bottles
  - Remove the cap from the empty bottle and allow volatile materials to evapourate into the fume hood.
  - Rinse the bottle three times with tap water and let dry.
  - Remove or obliterate the label.
  - Place the uncapped bottle next to the garbage receptacle.

3.12 Ventilation and Fume Hoods

General ventilation, also called dilution ventilation, involves dilution of inside air with fresh outside air, and is used to:

- ❒ Maintain comfortable temperature, humidity and air movement for room occupants
- ❒ Dilute indoor air contaminants
- ❒ Replace air as it is exhausted to the outside via local ventilation devices such as fume hoods
- ❒ Provide a controlled environment for specialized areas

General ventilation systems comprise an air supply and an air exhaust. The air may be supplied via a central HVAC (Heating, Ventilation and Air Conditioning) system or, especially in older buildings, via openable windows. Laboratory air may be exhausted through either local exhaust devices or air returns connected to the HVAC system.

Local exhaust ventilation (LEV) systems capture and discharge air contaminants or heat from points of release. Common local exhaust ventilation devices found in laboratories include:

- ❒ Chemical fume hoods
- ❒ Canopy hoods
- ❒ Slotted hoods
- ❒ Biological safety cabinets
- ❒ Direct connections

Chemical hoods, canopy hoods and direct connections exhaust devices can be used for binder and asphalt laboratories.

Chemical fume hoods

Chemical fume hoods are enclosed units with a sliding sash for opening or closing the hood. They are able to capture and exhaust even heavy vapours, and are preferred for all laboratory procedures that require manual handling of hazardous chemical material. Refer to sub-section on safe use of chemical fume hoods below for information on the safe use of chemical fume hoods.

Canopy hoods

Canopy hoods are designed to capture heat from processes or equipment, such as atomic absorption spectrophotometers or autoclaves; a canopy or bonnet is suspended over a process and connected to an exhaust vent. The following limitations make canopy hoods poor substitutes for chemical fume hoods, because they:

- ❒ Draw contaminated air through the user's breathing zone
- ❒ Do not capture heavy vapours
- ❒ Provide less containment than chemical fume hoods, and are more affected by air turbulence
- ❒ Do not provide adequate suction more than a few inches away from the hood opening

Direct connections

Direct connections provide direct exhausting of contaminants to the outdoors and are used for venting:

- ❒ Flammable liquid storage cabinets
- ❒ Other toxic chemical storage cabinets
- ❒ Solvent and waste reservoirs, such as for hplc solvent systems
- ❒ Reaction vessels, sample analyzers, ovens, dryers and vacuum pump outlets

Ventilation balancing and containment

By regulation, more air is exhausted from a laboratory than is supplied to it, resulting in a net negative pressure (vacuum) in the laboratory. Negative pressure draws air into the laboratory from surrounding areas, and serves to prevent airborne hazardous chemicals from spreading outside the laboratory in the event of an accidental release inside the laboratory.

Balancing of laboratory ventilation must take into consideration the amount of air exhausted by local ventilation devices such as fume hoods. Modern laboratories do not have operable windows, as opening of windows tends to pressurize a room, pushing air from the laboratory into adjacent non-laboratory areas.

Safe use of chemical fume hoods

Fume hoods properly used and maintained will render substantial protection, provided the user is aware of its capabilities and limitations. The recommended performance standard for fume hoods is the delivery of a minimum face velocity of 100 linear feet per minute (0.5 m/s) at half sash

height. An approved inspection authority should be used to determine and confirm that appropriate performance standards are met. To ensure your fume hood provides the highest degree of protection observe the following guidelines:

- Only materials being used in an ongoing experiment should be kept in the fume hood. Cluttering the hood will create air flow disturbances.
- When it is necessary to keep a large apparatus inside a hood, it should be placed upon blocks or legs to allow air to flow underneath.
- Operate the hood with the sash as low as practical. Reducing the open face will increase the face velocity.
- Work as far into the hood as possible. At least six inches is recommended.
- Do not lean into the hood. This disturbs the air flow, and also places your head into the contaminated air inside the hood.
- Do not make quick motions into or out of the hood, or create cross drafts by walking rapidly past the hood. Opening doors or windows can sometimes cause strong air currents which will disturb the air flow into the hood.
- Heating devices should be placed at the rear of the hood.
- Do not use a hood for any function it was not specifically designed.
- Keep hood door closed when not attended.
- Remember that sinks inside fume hoods are not designed for disposing of chemical wastes.

Local Exhaust Ventilation design operation and maintenance standards

Reference to local regulatory standards in connection with ventilation can be found in the following OHS Act regulations:

- Environmental Regulations for Workplaces, 1987: Regulation 5 (1) Ventilation (General ventilation requirements for all work places)
- Hazardous Chemical Substances Regulations, 1995: Regulation 10 (1) Control of exposure to HCS (Reference to engineering control measures where exposure to HCS is above Occupational Exposure Limits)

However, the above regulations are not sufficient in so far as providing guidance and specific design, operation and maintenance standards for the control of airborne contaminants in the workplace.

In the absence of suitable local (RSA) standards SABITA therefore recommends that, for the purpose of following and illustrating good practice in this regard, the following guide is adopted as the standard for demonstrating legal compliance and implementing "***best available techniques"*** as required by the SABITA HSE Charter:

- ***Controlling airborne contaminants at work- A guide to local exhaust ventilation***

This guide is available on the UK Health and Safety Executive website and is made available as a free download under the terms of the ***Click-Use PSI Licence number: C2010002170 (Southern African Bitumen Association), end date 22 August 2015***, at the following link: http://books.hse.gov.uk/hse/public/saleproduct.jsf?catalogueCode=9780717662982

3.13 Physical Hazards, Ergonomics, Safe Conduct and Housekeeping

There are other hazards present in the laboratory environment that may or may not be linked to hazardous chemicals but worth bearing in mind for the general safety of all lab staff.

Electrical safety

- Purchase and use only approved electrical equipment.
- All electrical outlets should carry a grounding connection requiring a three-pronged plug.
- Never remove the ground pin of a three-pronged plug.
- Remove cords by grasping the plug, not the cord.
- All electrical equipment should be wired with a grounding plug.
- All wiring should be done by, or under the approval of, a certified electrician.
- Electrical equipment that has been wetted should be disconnected at the main switch or breaker before being handled. Familiarize yourself with the location of such devices.
- Know how to cut off the electrical supply to the laboratory in the event of an emergency.
- Maintain free access to panels; breaker panels should be clearly labelled as to which equipment they control.
- Ensure that all wires are dry before plugging into circuits.
- Electrical equipment with frayed wires should be repaired before being put into operation.
- Tag and disconnect defective equipment.

- ✍ Be sure that all electrical potential has been discharged before commencing repair work on any equipment containing high voltage power supplies or capacitors.
- ✍ Minimize the use of extension cords and avoid placing them across areas of pedestrian traffic.
- ✍ Use only CO2, or dry chemical fire extinguishers for electrical fires.

High pressure and vacuum work

Pressure differences between equipment and the atmosphere result in many lab accidents. Glass vessels under vacuum or pressure can implode or explode, resulting in cuts from projectiles and splashes to the skin and eyes. Glass can rupture even under small pressure differences. Rapid temperature changes can lead to pressure differences, as can carrying out chemical reactions inside sealed containers.

The hazards associated with pressure work can be reduced by:

- ✍ Checking for flaws such as cracks, scratches and etching marks before using vacuum apparatus
- ✍ Using vessels specifically designed for vacuum work. Thin-walled or round-bottomed flasks larger than 1 l should never be evacuated
- ✍ Assembling vacuum apparatus so as to avoid strain. Heavy apparatus should be supported from below as well as by the neck
- ✍ Taping glass vacuum apparatus to minimize projectiles due to implosion
- ✍ Using adequate shielding when conducting pressure and vacuum operations
- ✍ Allowing pressure to return to atmospheric before opening vacuum desiccators or after removal of a sample container from cryogenics
- ✍ Wearing eye and face protection when handling vacuum or pressure apparatus

Repetitive work and ergonomics

Ergonomics is concerned with how the workplace "fits" the worker. Performing certain work tasks without regard for ergonomic principles can result in:

- ❒ Fatigue
- ❒ Repetitive motion injuries
- ❒ Strains, aches and injuries from biomechanical stresses
- ❒ Eyestrain from video display terminals (vdts)
- ❒ Decreased morale

Factors that can increase the risk of musculoskeletal injury are:

- ❒ Awkward positions or movements
- ❒ Repetitive movements
- ❒ Application of force

In a laboratory setting, look for the following when addressing ergonomic concerns:

- ✍ Laboratory bench and workbench heights are suitable for all personnel
- ✍ Laboratory chairs are on wheels or castors, are sturdy (5-legged), and are adjustable (seat height, angle, backrest height)
- ✍ VDTs are positioned at or slightly below eye level, and are positioned so as to avoid glare from lights or windows
- ✍ Computer keyboards and pointing devices are positioned so that wrists are kept in a neutral position and forearms are horizontal
- ✍ Colour, lettering size and contrast of equipment display monitors are optimized so as not to cause eye strain
- ✍ Work station design does not necessitate excessive bending, reaching, stretching or twisting
- ✍ Vibration-producing equipment, such as vortex mixers and pump-type pipettes are not used for extended periods of time
- ✍ Buttons and knobs on equipment are accessible and of a good size
- ✍ Heavy items are not carried or handled
- ✍ Laboratory workers are using proper techniques when lifting or moving materials
- ✍ Indoor air quality parameters, such as temperature, humidity and air supply are comfortable
- ✍ Floors are slip-resistant
- ✍ Noise levels are not excessive

Glassware safety

- ❒ Use a dustpan and brush, not your hands, to pick up broken glass.
- ❒ Discard broken glass in a rigid container separate from regular garbage and label it appropriately (see sub-section on Waste Preparation Procedures under Hazardous Waste Management).
- ❒ Protect glass that is subject to high pressure or vacuum. Wrapping glass vessels with cloth tape will minimize the possibility of projectiles.
- ❒ Glass is weakened by everyday stresses such as heating and bumping. Handle used glassware with extra care.
- ❒ Discard or repair all damaged glassware, as chipped, cracked or star-cracked vessels cannot handle the normal stresses.

When handling glass rods or tubes:

- ✍ Fire polish the ends,
- ✍ Lubricate with water or glycerine when inserting through stopper,
- ✍ Ensure stopper holes are properly sized, and not too small,
- ✍ Insert carefully, with a slight twisting motion, keeping hands close together, and
- ✍ Use gloves or a cloth towel to protect your hands

Safe Laboratory Conduct & Housekeeping

To minimize the potential for eating/drinking hazardous materials, the following procedures are recommended in all laboratories:

- ✍ No eating, drinking, smoking, gum chewing, or application of cosmetics in areas where chemicals are stored or used.
- ✍ Wash hands and face after working with or around chemicals and before eating, drinking, smoking, using the restroom, applying cosmetics, or leaving the facility.
- ✍ Do not store, handle, or prepare food or beverages in refrigerators, glassware, utensils, microwaves, ovens, cabinets, sinks, countertops, tables, or other locations which are also used for laboratory operations.
- ✍ Food and drink is permitted only in designated eating, preparation, and food storage locations within the lab.
- ✍ Do not enter designated eating, preparation and food storage areas wearing contaminated clothing or with contaminated laboratory tools or equipment. If in doubt, remove or clean equipment and clothing before bringing it into these areas.
- ✍ Do not leave cigarettes lying in a laboratory or near fumes which can be absorbed by the cigarettes.
- ✍ To minimize the hazard of residual chemicals, always cleanup your work area after completing test procedures or laboratory work. Wipe up any spills or waste material and dispose of properly.
- ✍ Clean tools and containers that may be contaminated before putting them away. Clean any protective equipment that may have been contaminated and store properly.
- ✍ After protective equipment has been removed, check personal clothing for contamination. Remove or neutralize contamination or contaminated clothing before leaving the laboratory or going home. Always wash face and hands before leaving.
- ✍ Avoid practical jokes or other behavior that might confuse, startle or distract another worker. Never use laboratory chemicals, materials, or equipment for practical jokes or horseplay.
- ✍ Do not use mouth suction for pipettes or starting a siphon.

To minimize the hazards of entanglement or chemical contamination the following personal apparel rules are recommended:

- ✍ Confine long hair, necklaces, neckties, and other loose clothing that could get caught in moving equipment or be contaminated with chemicals.
- ✍ Remove jewelry, rings, earrings, watches, and other personal items that will interfere with the use of protective equipment or could get caught in equipment.
- ✍ Appropriate shoes will be worn at all times in the chemical and material handling and storage areas of the laboratory. Sandals, flip- flops, or open toed shoes are not allowed.

Personal Housekeeping:

- ✍ Keep the work area clean and uncluttered.
- ✍ Keep chemicals and equipment properly labeled and stored.
- ✍ Cleanup the area on completion of an operation or at the end of the day.

Equipment Safety

Whenever lab equipment is purchased, preference should be given to equipment that limits contact between the operator and hazardous material, and mechanical and electrical energy is corrosion-resistant, easy to decontaminate and impermeable to liquids has no sharp edges or burrs.

Every effort should be made to prevent equipment from becoming contaminated. To reduce the likelihood of equipment malfunction that could result in leakage or spill:

- Review the manufacturer's documentation. Keep for future reference.
- Use and service equipment according to the manufacturer's instructions.
- Ensure that anyone who uses a specific instrument or piece of equipment is properly trained in setup, use and cleaning of the item.

The following sections outline some of the precautions and procedures to be observed with some commonly used laboratory equipment.

Centrifuges

Improperly used or maintained centrifuges can present significant hazards to users. Failed mechanical parts can result in release of flying objects and hazardous chemicals. The high speed spins generated by centrifuges can create large amounts of aerosol if a spill, leak or tube breakage occurs. To avoid contaminating your centrifuge:

- Check glass and plastic centrifuge tubes for stress lines, hairline cracks and chipped rims before use. Use unbreakable tubes whenever possible.
- Avoid filling tubes to the rim.
- Use caps or stoppers on centrifuge tubes. Avoid using lightweight materials such as aluminium foil as caps.
- Use sealed centrifuge buckets (safety cups) or rotors that can be loaded and unloaded in a biological safety cabinet. Decontaminate the outside of the cups or buckets before and after centrifugation. Inspect o-rings regularly and replace if cracked or dry.
- Ensure that the centrifuge is properly balanced.
- Do not open the lid during or immediately after operation, attempt to stop a spinning rotor by hand or with an object, or interfere with the interlock safety device.
- Decant supernatants carefully and avoid vigorous shaking when re-suspending.

When using high-speed or ultra centrifuges, additional practices should include:

- Connect the vacuum pump exhaust to a trap.
- Record each run in a logbook: keep a record of speed and run time for each rotor.
- Never exceed the specified speed limitations of the rotor.

Heating baths, water baths

Heating baths keep immersed materials immersed at a constant temperature. They may be filled with a variety of materials, depending on the bath temperature required; they may contain water, mineral oil, glycerine, paraffin or silicone oils, with bath temperatures ranging up to 300oC. The following precautions are appropriate for heating baths:

- Set up on a stable surface, away from flammable and combustible materials including wood and paper
- Relocate only after the liquid inside has cooled
- Ensure baths are equipped with redundant heat controls or automatic cut-offs that will turn off the power if the temperature exceeds a preset limit
- Use with the thermostat set well below the flash point of the heating liquid in use
- Equip with a thermometer to allow a visual check of the bath temperature.

The most common heating bath used in laboratories is the water bath. When using a water bath:

- Clean regularly; a disinfectant, such as a phenolic detergent, can be added to the water
- Avoid using sodium azide to prevent growth of microorganisms; sodium azide forms explosive compounds with some metals
- Raise the temperature to 90oc or higher for 30 minutes once a week for decontamination purposes
- Unplug the unit before filling or emptying, and have the continuity-to-ground checked regularly

Shakers, blenders and sonicators

When used with infectious agents, mixing equipment such as shakers, blenders, sonicators, grinders and homogenizers can release significant amounts of hazardous aerosols, and should be operated inside a biological safety cabinet whenever possible. Equipment such as blenders and stirrers can also produce large amounts of flammable vapours. The hazards associated with this type of equipment can be minimized by:

- Selecting and purchasing equipment with safety features that minimize leaking
- Selecting and purchasing mixing apparatus with non-sparking motors.
- Checking integrity of gaskets, caps and bottles before using. Discard damaged items.
- Allowing aerosols to settle for at least one minute before opening containers
- When using a sonicator, immersing the tip deeply enough into the solution to avoid creation of aerosols
- Decontaminating exposed surfaces after use

Ovens and hot plates

Laboratory ovens are useful for baking or curing material, off-gassing, dehydrating samples and drying glassware.

- Select and purchase an oven whose design prevents contact between flammable vapours and heating elements or spark-producing components
- Discontinue use of any oven whose backup thermostat, pilot light or temperature controller has failed
- Avoid heating toxic materials in an oven unless it is vented outdoors (via a canopy hood, for example)
- Never use laboratory ovens for preparation of food for human consumption
- Glassware that has been rinsed with an organic solvent should be rinsed with distilled water before it is placed in a drying oven

Analytical equipment

The following instructions for safe use of analytical equipment are general guidelines; consult the user's manual for more detailed information on the specific hazards:

- Ensure that installation, modification and repairs of analytical equipment are carried out by authorized service personnel.
- Read and understand the manufacturer's instructions before using this equipment.
- Make sure that preventive maintenance procedures are performed as required.
- Do not attempt to defeat safety interlocks.
- Wear safety glasses and lab coats (and other appropriate personal protective equipment as specified) for all procedures.

Gas chromatographs (GC)

Gas chromatography requires handling compressed gases (nitrogen, hydrogen, argon, helium), and flammable and toxic chemicals. Consult product MSDSs before using such hazardous products. Specific precautions for working with gas chromatographs include:

- Perform periodic visual inspections and pressure leak tests of the sampling system plumbing, fittings and valves.
- Follow the manufacturer's instructions when installing columns. Glass or fused capillary columns are fragile: handle them with care and wear safety glasses to protect eyes from flying particles while handling, cutting or installing capillary columns.
- Turn off and allow heated areas such as the oven, inlet and detector, as well as connected hardware, to cool down before touching them.
- To avoid electrical shock, turn off the instrument and disconnect the power cord at its receptacle whenever the access panel is removed.
- Turn off the hydrogen gas supply at its source when changing columns or servicing the instrument.
- When using hydrogen as fuel (flame ionization FID and nitrogen-phosphorus detectors NPD), ensure that a column or cap is connected to the inlet fitting whenever hydrogen is supplied to the instrument to avoid build-up of explosive hydrogen gas in the oven.
- Measure hydrogen gas and air separately when determining gas flow rates.
- Perform a radioactive leak test (wipe test) on electron capture detectors (ECDs) at least every 6 months for sources of 50MBq (1.35 mCi) or greater.
- Ensure that the exhaust from (ECDs) is vented to the outside.

- When performing split sampling, connect the split vent to an exhaust ventilation system or appropriate chemical trap if toxic materials are analyzed or hydrogen is used as the carrier gas.
- Use only helium or nitrogen gas, never hydrogen, to condition a chemical trap.

High-pressure liquid chromatography (HPLC) equipment

HPLC procedures may require handling of compressed gas (helium) and flammable and toxic chemicals. Familiarize yourself with the hazardous properties of these products, as well as recommended precautionary measures, by referring to MSDSs.

- Inspect the drain system regularly; empty the waste container frequently when using organic solvents.
- Ensure that waste collection vessels are vented.
- Never use solvents with auto-ignition temperatures below 110°C.
- Be sure to use a heavy walled flask if you plan to use vacuum to degas the solvent.
- Never clean a flow-cell by forcing solvents through a syringe: syringes under pressure can leak or rupture, resulting in sudden release of syringe contents.
- High voltage and internal moving parts are present in the pump. Switch off the electrical power and disconnect the line cord when performing routine maintenance of the pump.
- Shut down and allow the system to return to atmospheric pressure before carrying out maintenance procedures.

Emergency Processes

Every laboratory will experience an accident, minor or major, involving hazardous agents or conditions at some time during its operation. During these incidents, laboratory personnel may be placed at high risk.

Many laboratories may be ill-prepared to meet and control these emergencies because they have not integrated safety as an essential part of each laboratory operation. This involves creating emergency contingency plans based on the potential emergencies identified and periodically undergoing training in preparation for possible emergencies.

This section outlines guidelines given for various emergencies that could happen in a laboratory. It is also recommended there be a laboratory representative for each of the emergencies outlined below, who will be properly trained to handle/co-ordinate on behalf of the lab.

❒ **First aid**

Know how to handle emergency situations before they occur:

- Become familiar with the properties of the hazardous products used in your area.
- Familiarize yourself with the contents of the first aid kit and learn how to use them. Keep instructions readily available and easy to understand.
- Locate and know how to test and operate emergency equipment, such as showers and eyewashes, in your area.
- Learn first aid: Contact an appropriate organization for first aid training.

The emergency first aid procedures described below should be followed by a consultation with a physician for medical treatment.

Burns

In the laboratory, thermal burns may be caused by intense heat, flames, molten metal, steam, etc. Corrosive liquids or solids such as bases and acids can cause chemical burns; first aid treatment for chemical burns is described in sub-section: *Chemical splashes to the skin or eyes, below.* In electrical burns, electrical current passing through the body generates heat.

Burns to the skin

First aid treatment of skin burns encompasses the following:

- If the burn is electrical in origin, ascertain that the victim is not in contact with the power supply before touching him/her. If the victim remains in contact with a power source, unplug the device or shut off the main power switch at the electrical distribution panel.
- Dial the emergency number if the burn is serious. Seek immediate medical treatment for all electrical burns, even if they don't appear to be serious.
- Remove jewellery, including watches, from the burned area.
- Expose the burnt area, but avoid removing clothes that are stuck to the skin.
- If possible, immerse burnt surfaces in cold water for at least 10 minutes, or apply cold wet packs.

- Avoid applying lotions, ointments or disinfectants to a burn. First and second degree burns can be washed with soap and water after the cool down period.
- Cover first and second degree burns with a moist bandage; apply dry compresses to third degree burns and to entry and exit wounds of electrical burns.
- Do not burst blisters, as they form a natural barrier against infection.

Burns to the eyes

Burns to the eyes may be caused by chemical substances, heat (hot liquids, steam, open flames, molten metal, etc.), or radiation from welding procedures, laboratory lamps and lasers. Burns caused by ultraviolet, visible or near-infrared radiation may not produce symptoms until 6-8 hours after exposure. *First aid procedures for chemical burns to the eyes are described in sub-section Chemical splashes to the skin or eyes, below.* General first aid procedures for thermal and radiation burns to the eyes are as follows:

- Prevent the victim from rubbing or touching the eyes.
- For heat burns, flush the eyes with cool water until the pain subsides.
- Cover the eyes with dry sterile gauze pads; apply a wet compress to the eyes if it is too painful to close them.
- Send the victim for medical care. If the burn is the result of exposure to a laser beam, advise emergency medical personnel of the characteristics of the laser and the distance between the victim and the laser.

Cuts

First aid treatment for minor scrapes, scratches, cuts, lacerations or puncture wounds include the following:

wash the wound and surrounding area with mild soap and running water

- Remove any dirt around the wound
- Cover with an adhesive dressing or gauze square taped on all sides with adhesive tape
- Wounds caused by dirty, soiled or grimy objects should be examined by a physician, who will determine whether a tetanus immunization is needed
- If the wound was caused by an object that has contacted human blood or body fluids, the victim must be seen by a physician immediately, as immunization or post-exposure prophylaxis may be required.

If a wound is bleeding profusely, the first aider should attempt to stop the bleeding as quickly as possible:

- Elevate the injured area above the level of the heart, if possible, in order to reduce the blood pressure to the area of the wound.
- Apply direct pressure to the wound unless an object is protruding from it (in this situation, apply pressure around the injury). Direct pressure can be applied with the fingers of the hand, the palm of the hand or with a pressure dressing.
- If bleeding cannot be controlled with direct pressure, apply pressure to the arteries supplying the injured area. This involves compressing the artery between the wound and the heart, against a bone.
- Do not remove a dressing that has become soaked with blood, as this may interrupt the clotting process; apply an additional dressing on top of the first.
- Avoid over-tightening of the dressing; i.e. do not cut off the blood circulation to limbs.
- As a tourniquet completely stops the flow of blood to beyond the point of application, it should be applied only as a last resort, as in the case of a severed limb.

Chemical splashes to the skin or eyes

For splashes to the skin:

If the splash affects a large area of skin, go to the nearest shower and rinse thoroughly for at least 20 minutes; remove contaminated clothing while in the shower. For splashes involving a small skin area, proceed to the nearest drench hose, remove contaminated clothing and jewellery and rinse for 15 minutes.

For splashes to the eyes:

- Go to the nearest eyewash and rinse for at least 20 minutes.
- If you are wearing contact lenses, remove them as quickly as possible, while continuing to flush.
- Hold your eyelids open with your fingers.
- Roll your eyeballs, so that water can flow over the entire surface of the eye.
- Lift your eyelids frequently to ensure complete flushing.

- Cover the injured eye with dry sterile gauze pads while waiting for medical attention.

Poisoning

As described in Section on the Handling and use of chemicals, toxic substances can enter and poison the body by inhalation, absorption through the skin, ingestion or injection. When assisting a victim of poisoning:

- Call for an ambulance for serious poisoning
- Ensure that the area is safe to enter before attempting to aid the victim
- Move the victim away from the contaminated area and provide first aid as required
- Do not induce vomiting unless advised to do so by a reliable authority
- Provide emergency medical personnel with the MSDS for the poisonous product. If the victim was overcome by an unknown poison and has vomited, provide the ambulance technicians with a sample of the vomit.
- Always ensure that the victim receives medical attention, even if the exposure seems minor.

Fires

Local response to emergencies shall be in accordance with the facility Emergency Response Plans. As general guidance the following should be observed:

- All staff should familiarize themselves with the locations of the fire alarms and evacuation routes in the areas that they occupy.
- The immediate response depends on the size of the fire.
- Laboratory personnel should attempt to extinguish a fire only if it is clearly safe to do so.
- Alert the local authority Fire Department from a safe location if it is clear that fighting the fire is beyond own capabilities.
- Evacuate the premises in a swift, orderly fashion using the stairways and/or fire escapes, but NOT the elevators, and following the instructions of Evacuation Marshalls.
- Inform the Facility Emergency Controller of the location, magnitude and nature (e.g. electrical) of the fire, the open evacuation routes, individuals requiring assistance, and other pertinent details.
- Once outside the building, move away from the doors to enable others to exit.

Clothing fires

If your clothing should catch fire, it is important not to run, as this would provide additional air to support the flames. Remember the "Stop, Drop and Roll" rule:

- Stop where you are
- Drop to the floor, and
- Roll to smother the flames

As soon as the flames are extinguished, go to the nearest emergency shower to cool burned areas with copious amounts of water. If someone else is on fire:

- Immediately immobilize the victim and force him/her to roll on the ground to extinguish the flames.
- Assist in smothering the flames, using whatever is immediately available, such as a fireproof blanket or clothing.
- Give appropriate first aid (refer to sub-section on first aid above).

Hazardous chemical spills

In the event of a spill of a hazardous (volatile, toxic, corrosive, reactive or flammable) chemical, the following procedures should be followed:

- If there is fire, activate the alarm. If you are unable to control or extinguish a fire, follow the fire evacuation procedures, as described in section Fire and Gas Safety (sub-section Evacuations).
- If you are to stop the spillage from continuing, make sure it is safe to do so and make sure you are wearing the appropriate PPE

If the spill is in a laboratory or chemical storeroom:

- Evacuate all personnel from the room
- Be sure the hood/local exhaust is turned on
- If flammable liquids are spilled, disconnect the electricity to sources of ignition if possible
- Call for additional assistance if you cannot manage the clean-up yourself.

If the spill is in a corridor or other public passageway:

- Evacuate all people from the area and close off the area to keep others out.

- Call the emergency telephone number to have the air system in the area shut down (to prevent contamination of other areas) and to request additional assistance.

Natural gas leaks

If you are using gas, and detect a natural gas smell:

- Check that all gas valves have been turned off.
- Call the local emergency number if the odour persists.
- Alert the local authority emergency response brigade if proven that there is a confirmed gas leak. (Evacuation/Isolate electrical appliances?)

Practice Drills

All emergency drills should be tested periodically. The objectives of a drill shall include evaluation of the following:

- Practicality of the plan (structure and organization)
- Adequacy of communications and interactions among parties
- Emergency equipment effectiveness
- Adequacy of first aid and rescue procedure
- Adequacy of emergency personnel response and training
- Public relations skills
- Evacuation and personnel count procedures

The complexity of the drill may be increased as the response team gains efficiency.

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4. Recommendations for Solvent Storage

Introduction

Operations involving the handling of solvents or chemicals in general, whether they are small quantities of pure or concentrated substances or large quantities of more dilute materials, provide the setting for accidental release into the environment. Laboratory storage practices may enhance or diminish overall laboratory safety. There are many factors to be considered during storage of chemicals such as the amount, location and organization of the stored chemicals as well as packaging and labelling. However there are general guidelines when it comes to laboratory storage.

General Storage Guidelines

- Do not block access to emergency safety equipment such as fire extinguishers, eye wash bottles, showers, first aid kits or utility controls such as breaker boxes or gas shut-off valves
- Avoid blocking exits or normal paths of travel: keep hallways, walkways and stairs clear of chemicals, boxes, equipment and shelf projections
- Ensure that the weight of stored material does not exceed the load-bearing capacity of shelves or cabinets
- Ensure that wall-mounted shelving has heavy-duty brackets and supports and is attached to studs or solid blocking. Regularly inspect clamps, supports, shelf brackets and other shelving hardware
- Arrange items so that they do not overhang or project beyond the edges of shelves or counter tops
- Do not stack materials so high that stability is compromised
- Leave a minimum of 18 inches (45.7 cm) of clearance between sprinkler heads and the top of storage
- Use a safety step or stepladder to access higher items; never stand on a stool or a chair
- Store frequently used items between knee and shoulder height
- Store heavy objects on lower shelves
- Store hazardous chemicals in an area that is accessible only to authorized laboratory workers
- Minimize quantities and container sizes kept in the lab – commensurate with their usage and shelf-life
- Do not store chemicals in aisles, under sinks or on floors, desks or bench tops
- Store chemicals away from sources of heat (e.g. ovens or steam pipes) and direct sunlight – substances which are temperature sensitive may require storage in a controlled temperature environment with contingency plans in the event of power-failure
- Never stack bottles on top of each other
- Do not store chemicals above eye level/shoulder height
- Store larger containers on lower shelves
- Store liquids inside chemically-resistant secondary containers (such as trays or tubs) that are large enough to hold spills – ensure chemical containers and their seals or stoppers are appropriate for the type and quantity of chemical stored (as far as is practicable, chemicals should be stored in the containers in which they are supplied)
- Containers that have held hazardous chemicals shall be treated as full, unless the receptacle or package has been rendered free from hazardous chemicals
- Store chemicals inside closable cabinets or on sturdy shelving that has 12.7 mm-19 mm (½ - ¾ inch) edge guards to prevent containers from falling
- Ensure that chemicals cannot fall off the rear of shelves
- Store chemicals based on compatibility and not in alphabetical order (refer to Table 1, 2 and 3 below). If a chemical presents more than one hazard, segregate according to the primary hazard
- Designate specific storage areas for each class of chemical, and return reagents to those locations after each use – the amounts stored in laboratory areas should be kept to a minimum
- Store volatile toxic and odorous chemicals in a way that prevents release of vapours (e.g. inside closed secondary containers, ventilated cabinets, paraffin sealing)
- Store flammables requiring refrigeration in explosion-safe or lab-safe refrigerators

- ✍ All packages in storage shall be labelled to allow unmistakable identification of the contents (see Appendix A)
- ✍ Opening of packages, transferring of contents, dispensing of chemicals or sampling shall not be conducted in or on top of a cabinet or a cupboard for storing chemicals unless it is specifically designed for this purpose and appropriate procedures and equipment are used.
- ✍ Label reactive or unstable chemicals (e.g. ethers) with the date of receipt and the date opened
- ✍ Inspect chemicals weekly for signs of deterioration and for label integrity – leaking or damaged packages shall be removed to a safe area for repacking or disposal, labels shall be reattached or replaced, as necessary, to clearly identify the contents of the package
- ✍ Dispose of unwanted chemicals promptly through the Waste Management Program
- ✍ Procedures shall be established to deal with clean-up and safe disposal of spillages (spill-kit should be readily accessible)
- ✍ Keep inventory records of chemicals, and update annually

Chemical Compatibility

The storage scheme outlined in the sub-section Chemical Segregation may not suffice to prevent mixing of incompatible chemicals. Certain hazardous combinations can occur even between chemicals of the same classifications. Table 1 shows which chemical groups should not be stored together and Table 2 shows common examples of incompatible combinations:

Table 1 – Compatible chemical groups

Number	Chemical Group	Do not store with group numbers
1	Inorganic acids	2-8,10,11,13,14,16-19,21,22,23
2	Organic acids	1,3,4,7,14,16,17-19,22
3	Caustics	1,2,6,7,8,13-18,20,22,23
4	Amines and alkanolamines	1,2,5,7,8,13-18,23
5	Halogenated compounds	1,3,4,11,14,17
6	Alcohols, glycols, glycol ethers	1,7,14,16,20,23
7	Aldehydes	1-4,6,8,15-17,19,20,23
8	Ketones	1,3,4,7,19,20
9	Saturated hydrocarbons	20
10	Aromatic hydrocarbons	1,20
11	Olefins	1,5,20
12	Petroleum oils	20
13	Esters	1,3,4,19,20
14	Monomers, polymerizable esters	1-6,15,16,19-21,23
15	Phenols	3,4,7,14,16,19,20
16	Alkylene oxides	1-4,6,7,14,15,17-19,23
17	Cyanohydrins	1-5,7,16,19,23
18	Nitriles	1-4,16,23
19	Ammonia	1-2,7,813-17,20,23
20	Halogens	3,6-15,19,21,22
21	Ethers	1,14,20
22	Elemental phosphorus	1-3,20
23	Acid anhydrides	1,3,4,6,7,14,16-19

Table 2 – Examples of incompatible combinations of some commonly used chemicals.

CHEMICAL	Keep from contact with:
Acetic Acid	chromic acid, nitric acid, hydroxyl compounds, perchloric acid, peroxides, permanganate
Acetylene	chlorine, bromine, copper, fluorine, silver, mercury
Alkali Metals (e.g. Sodium)	water, chlorinated hydrocarbons, carbon dioxide, halogens
Ammonia, Anhydrous	mercury, chlorine, calcium hypochlorite, iodine, bromine, hydrofluoric acid
Ammonium Nitrate	acids, metal powders, flammable liquids, chlorates, nitrites, sulphur, finely divided combustible materials
Aniline	nitric acid, hydrogen peroxide
Bromine	same as chlorine
Carbon, Activated	calcium hypochlorite, all oxidizing agents
Chlorates	ammonium salts, acids, metal powders, sulphur, finely divided combustible materials
Chromic Acid	acetic acid, naphthalene, camphor, glycerin, turpentine, alcohol, flammable liquids

Chlorine	ammonia, acetylene, butadiene, butane, methane, propane (or other petroleum gases), hydrogen, sodium carbide, turpentine, benzene, finely divided metals
Copper	acetylene, hydrogen peroxide
Flammable Liquids	ammonium nitrate, inorganic acids, hydrogen peroxide, sodium peroxide, halogens
Hydrocarbons	fluorine, chlorine, bromine, chromic acid, sodium peroxide
Hydrofluoric Acid	anhydrous ammonia, ammonium hydroxide
Hydrogen Peroxide	copper, chromium, iron, most metals or their salts, alcohols, acetone, aniline, nitromethane, flammable liquids, oxidizing gases
Hydrogen Sulphide	fuming nitric acid, oxidizing gases
Iodine	acetylene, ammonia (aqueous or anhydrous), hydrogen
Mercury	acetylene, fulminic acid, ammonia
Nitric Acid	acetic acid, aniline, chromic acid, hydrocyanic acid, hydrogen sulphide, flammable liquids, flammable gases
Oxalic Acid	silver, mercury
Perchloric Acid	acetic anhydride, bismuth and its alloys, organic materials
Potassium	carbon tetrachloride, carbon dioxide, water
Potassium Chlorate	sulphuric and other acids
Potassium Permanganate	glycerin, ethylene glycol, benzaldehyde, sulphuric acid
Silver	acetylene, oxalic acid, tartaric acid, ammonia compounds
Sodium Peroxide	alcohol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulphide, glycerin, ethylene glycol, ethyl acetate, methyl acetate, furfural
Sulphuric Acid	potassium chlorate, potassium perchlorate, potassium permanganate (or compounds with similar light metals, such as sodium, lithium, etc.)

- ✍ Read the label carefully before storing a chemical. More detailed storage information is usually provided by the MSDS (Material Safety Data Sheet).
- ✍ Ensure that incompatible chemicals are not stored in close proximity to each other. Separate certain chemicals from each other according to the segregation scheme in Table 3. Note that in some instances chemicals of the same category may be incompatible. The following storage recommendations are given to avoid the possibility of an explosion or the emission of toxic flammable or corrosive gases:
- ✍ Store two incompatible goods at least 3m apart.
- ✍ Store goods that could react violently at least 5m apart

For more detailed information refer to the reactivity section of the Material Safety Data Sheet or a reference manual on reactive chemical hazards.

Table 3 – Suggested Segregation for Chemical Storage

Flammables Store in grounded flammable liquid storage cabinet Separate from oxidizing materials Examples: Acetone Ethanol Glacial acetic acid	**Non-flammable solvents** Store in cabinet Can be stored with flammable liquids Separate from oxidizing materials Examples: Carbon tetrachloride Ethylene glycol Mineral oil
Acids Store in cabinet of non-combustible material Separate oxidizing acids from organic acids Separate from caustics, cyanides, sulfides Examples: Nitric acid Hydrochloric acid Sulphuric acid	**Caustics** Store in dry area Separate from acids Examples: Ammonium hydroxide Sodium hydroxide Potassium hydroxide
Water reactive chemicals Store in cool, dry location Separate from aqueous solutions Protect from fire sprinkler water Examples: Sodium	**Oxidizers** Store in cabinet of non-combustible material Separate from flammable and combustible materials Examples: Sodium hypochlorite Benzoyl peroxide

Potassium Lithium	Potassium permanganate
Non-oxidizing compressed gases Store in well-ventilated area Separate physically from oxidizing compressed gases Examples: Nitrogen Hydrogen Carbon Dioxide	**Oxidizing compressed gases** Separate physically from flammable compressed gases Examples: Oxygen Chlorine Nitrous oxide

Unstable Chemicals

Many chemicals (most notably ethers such as THF, dioxane, diethyl and isopropyl ether) are susceptible to decomposition resulting in explosive products. Ethers, liquid paraffins, and olefins form peroxides on exposure to air and light. Since most of these products have been packaged in an air atmosphere, peroxides can form even if the containers have not been opened.
Discard unopened containers of ethers after one year
Discard containers of ethers within six months of opening
Never handle ethers beyond their expiry dates; contact your local waste disposal coordinator to arrange to have the material stabilized and removed

The following are common examples of compounds prone to peroxide formation:

Cyclohexene	Dioxane
Dicyclopentadiene	Isopropyl ether
Diethyl ether (ether)	Tetrahydrofuran
Dimethyl ether	(THF)

The label and Material Safety Data Sheet (MSDS) will also indicate if a chemical is unstable.

Explosive Chemicals

Many chemicals are susceptible to rapid decomposition or explosion when subjected to forces such as being struck, vibrated, agitated or heated. Some become increasingly shock sensitive with age. Example: Picric acid becomes shock sensitive and explosive if it dries out.

- ✍ Refer to the label and the Material Safety Data Sheet to determine if a chemical is explosive.
- ✍ Write the dates received and opened on all containers of explosive or shock-sensitive chemicals
- ✍ Inspect all such containers every month
- ✍ Keep picric acid solutions wet i.e. 30% or more water
- ✍ Discard opened containers after six months and closed containers after one year, unless the material contains stabilizers
- ✍ Wear appropriate personal protective equipment and perform experiments behind face shield.
- ✍ Work with small quantities.

The following are atomic groupings that are associated with the possibility of explosion:

Acetylide	Fulminate	Nitroso
Amine oxide	N-haloamine	Nitro
Azide	Hypohalite	Ozonide
Chlorate	Hydroperoxide	Perchlorate
Diazo	Nitrate	Peroxide
Diazonium	Nitrite	Picrate

The following are common examples of materials known to be shock-sensitive and explosive:

Ammonium nitrate	Fulminate of mercury
Ammonium perchlorate	Lead azide
Copper acetylide	Nitroglycerine
Dinitrotoluene	Picric acid (when dry)
	Trinitrotoluene

Chemical Storage Cabinets

Flammable chemicals should be stored inside flammable liquid storage cabinets. Only those flammables in use for the day should be outside the cabinet. Guidelines for cabinet use include:

- ✍ Use authority-approved flammable liquid storage cabinets

- Keep cabinet doors of the cabinet closed and latched
- Do not store other materials in these cabinets

Areas containing flammable vapours or combustible dusts should be classified according to hazard zone assessment. Once classified, it is the organization's responsibility to make sure the area is suitably equipped to handle the respective danger. The relevant requirements concerning avoidance of ignition sources are recommended depending on whether these flammables are part of the normal/abnormal operations and whether the ignition source is controlled.

Chemicals kept on shelves or racks shall be subject to the following conditions:

- Shelving and its fixtures shall be compatible with the goods stored, or shall be suitably protected from the goods
- The maximum holding capacity of the shelving systems shall not be exceeded
- Shelves used for chemical storage shall be restrained against lateral movement and shall have lips on them to prevent containers being pushed through to the other side

Chemical storage cabinets are required for the storage of dangerous goods exceeding storage limit quantities. Chemicals kept on cabinets shall comply with the following requirements:

- When storing flammable substances, the contents of the cabinet shall not exceed 100L. If a 250L cabinet is used for the storage, it must be de-rated. This involves removing some of the shelving and placing a sticker over the manufacturer's capacity rating, so that it is clear that 100L is the maximum cabinet capacity.
- All new installations of flammable solvent cabinets must be mechanically ventilated as per regulations. There is no requirement for venting of cabinets containing other classes of dangerous goods
- The capacity of any chemical storage cabinet used in a laboratory to store chemicals that are either flammable solids, spontaneously combustible, dangerous when wet, oxidizing agents and/or organic peroxides is recommended not to exceed 50L.
- Within a radius of 10m, measured from any one cabinet, the cabinet storage capacity aggregated for all cabinets in that radius shall not exceed 250L or 250kg, including no more than 10L or 10kg each of dangerous goods that are either flammable solids, spontaneously combustible, dangerous when wet, oxidizing agents and/or organic peroxides. The radius shall be measured horizontally through intervening walls, unless those walls are able to prevent the spreading of a fire of the magnitude that could be expected to result from the contents of the cabinet(s).

Cabinets shall not be located:

- One above the other;
- Where they can jeopardize emergency escape (minimum 3m);
- Under stairs or in corridors;
- The spill catchment/bund of cabinets must not be used to store chemicals;
- Where possible, store chemicals on spill trays within cupboards or cabinets

Chemical storage rooms must be purpose built and comply with the requirements of regulations.

Flammable Solvent Storage Limits

When a fire or explosion occurs in a laboratory, a major concern is to reduce the amount of fuel available to support the fire. Many solvents commonly used in laboratories are highly flammable, and should even a small quantity become involved in the fire, it would have the capacity of significantly increasing the probability of the fire spreading.

The OHS Act (Occupational Health and Safety Act, General Safety Regulations 4. Use and storage of flammable liquids and; Hazardous Chemical Substances Regulations, 1995 14. Labelling, packaging, transportation and storage) place restrictions on the maximum amounts of flammable liquids allowed to be stored, depending on class, in flammable material storage cabinets within a room and defines the maximum size of individual containers for the various classes of flammables.

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5. The Management and Interpretation of Material and Safety Data Sheets (MSDS)

Introduction

Always review the chemical safety information, including the Material Safety Data Sheet (MSDS) before starting to work with any new or unfamiliar cleaning product or chemical. Material Safety Data Sheets (MSDS) provide information about precautions for protecting against known hazards associated with the material and often include useful information on chemical, physical, and toxicological and ecological properties, along with suggestions for storing, transporting, and disposing of chemicals.

MSD Sheets are a general source of information, and they should be consulted as a first step in assessing the risk associated with using a product or chemical.

However, because there is currently no mandated international standard format for MSD Sheets, their quality varies widely depending upon manufacturer, and the information that they contain may be inappropriate for all applications.

It should be noted, however, there is a national standard for MSDS as outlined in the Hazardous Chemical Substances Regulations, 1995 9A. Handling of hazardous chemical substances.

Exercise caution, and utilize non-MSDS sources of information (such as the internet) as well (see list at end of Glossary of Terms below). Never use a chemical product if there is doubt about how to handle or use it.

You should always consult with your Health, Safety and Environmental (HSE) professionals if you have health, safety or environmental questions. Consult with your supplier when you have application questions.

Definitions of typical technical terms contained within an MSDS (Local and International versions)

Action level - exposure level at which any specified exposure limit take effect.

Acute effect - involves severe symptoms which develop rapidly and may quickly reach a crisis.
Acute exposure - a short-term exposure usually occurring at high concentration.
Acute hazard - a single exposure that may cause harm, but which is unlikely to lead to permanent damage.

Acute health effect - an effect that develops either immediately or a short time after exposure.
Allergic contact dermatitis - type of skin hypersensitivity. Its onset may be delayed by several days to as much as several years, for weaker sensitizers. Once sensitized, fresh exposure to the sensitizing material can trigger itching and dermatitis within a few hours.
Ames test - used to assess whether a chemical might be a carcinogen. It assumes that carcinogens possess mutagenic activity, and uses bacteria and mammalian microsomes to determine whether a chemical is a mutagen. Approximately 85% of known carcinogens are mutagens. The ames test, therefore, is a helpful but not perfect predictor of carcinogenic potential.

Argyria or argyrism - an irreversible bluish-black discoloration of the skin, mucous membranes or internal organs caused by ingestion of, or contact with, various silver compounds.
Auto-ignition temperature (of a chemical) - the lowest temperature at which the material will ignite without an external source of ignition.

Breakthrough time - the time taken in standard tests for permeation of a chemical through a protective barrier (such as a rubber glove) to be detected.
Boiling point - the temperature at which a liquid changes from a liquids to a gas, at normal atmospheric pressure.

Carcinogen - chemical known or believed to cause cancer in humans. The number of known carcinogens is comparatively small, but many more chemicals are suspected to be carcinogenic.
Cas registry number - a unique, identifying number assigned to a chemical by the chemical abstracts service (CAS).

Chemical formula - sometimes called the molecular formula, indicates the elements that make up a chemical.

Chemical name - a proper scientific name for the active ingredient of a product. 0020 may be caused by exposure to gold compounds.

Coefficient of oil/water distribution - the ratio of the solubility of the chemical in an oil to its solubility in water.

Combustible liquid - a liquid which has a flash point above 37.8ºc (100ºf).

Compressed gas - a material which is a gas at normal room temperature (20ºc) and pressure but is packaged as a pressurized gas, dissolved gas or gas liquefied by compression or refrigeration.

Condensation - the process of reducing from one form to another denser form such as steam to water.

Corrosive material - a material that can attack (corrode) metals or cause permanent damage to human tissues such as skin and eyes on contact.
COSHH (control of substances hazardous to health – USA/UK) - COSHH regulations impose a number of obligations on employers; the object of the regulations is to promote safe working with potentially hazardous chemicals. (South Africa has its own version known as the hazardous chemical substances regulations)

Cryogenics - materials which exist at extremely low temperatures, such as liquid nitrogen.
Cutaneous hazard - a chemical which may cause harm to the skin, such as defatting, irritation, skin rashes or dermatitis.

Degradation - term generally used to describe the loss of resilience of material used for protective gloves. Degradation may cause the material to soften, swell, become hard and brittle, or - in severe cases - disintegrate.

Density - the weight of a material in a given volume. It is usually given in grams per millilitre (g/ml).

Dilution ventilation - dilution of contaminated air with uncontaminated air in a general area, room or building for the purposes of health hazard or nuisance control, and/or for heating and cooling.

Dose - amount of the agent that has entered the body through the various routes of entry.

ED50 (Effective Dose 50) - the amount of material required to produce a specified effect in 50% of an animal population. (See qualification in the definition of LD5O).
EINECS - acronym for European Inventory of Existing Commercial Chemical Substances.
ELINCS - acronym for European List of Notified Chemical Substances.
Embryotoxins - retard the growth or affect the development of the unborn child. In serious cases they can cause deformities or death. Mercury compounds and certain heavy metals, aflatoxin, formamide and radiation are known embryotoxins.
Etiologic agents - microscopic organisms such as bacteria or viruses, which can cause disease.
Evapouration rate - the rate at which a liquid changes to vapour at normal room temperature.
Explosive (flammable) limits - the lower explosive (flammable) limit (lel) is the lowest concentration of vapour in air which will burn or explode upon contact with a source of ignition. The upper explosive flammable) limit (uel) is the highest concentration of vapour in air which will burn or explode upon contact with a source of ignition.
Explosive (flammable) range - the range between the lower explosive limit (lel) and the upper explosive limit (uel).

Exposure limits - established concentrations which, if not exceeded, will not generally cause adverse effects to the worker exposed. Exposure limits differ in name and meaning depending on origin. For example: permissible exposure levels (pel's) are legally enforceable exposure limits, set by various OSH bodies including OSHA (USA). Pels are not available for all chemicals. Different exposure limits include:
TWA Time-Weighted Average: The average airborne concentration of a biological or chemical agent to which a worker may be exposed in a workday or a work - week.
STEL Short Term Exposure Level: - The maximum airborne concentration of a chemical or biological agent to which a worker may be exposed in any 15 minute period, provided the TWAEV is not exceeded.
CEILING Ceiling Exposure Level: The maximum airborne concentration of a biological or chemical agent to which a worker may be exposed at any time.
SKIN: This notation indicates that direct or airborne contact with the product may result in significant absorption of the product through the skin, mucous membranes or eyes. Inclusion of this notation is intended to suggest that preventative action be taken against absorption of the agent through these routes of entry.
Threshold Limit Values (TLVs) are exposure guidelines developed by the American Conference of Governmental Industrial Hygienists (ACGIH). They are not legally enforceable, but because they are updated regularly, they represent good professional practice. They are expressed as follows:
TLV-TWA Threshold Limit Value - Time-Weighted Average: The time-weighted average concentration for a normal 8 hour work day and a 40 hour work week, to which nearly all workers may be repeatedly exposed, day after day, without adverse effect.
TLV-STEL Threshold Limit Value - Short Term Exposure Limit: a 15 minute time-weighted average exposure which should not be exceeded at any time during a work day even if the 8 hr TWA is within the TLV. Exposures at the STEL should not be repeated more than 4 times a day and there should be at least 60 minutes between successive exposures at the STEL.
TLV-C Threshold Limit Value - Ceiling: the concentration that should not be exceeded during any part of the working exposure.
f/cc - fibres per cubic centimeter of air
FDA - U.S. Food and Drug Administration
Flammable limits - See 'Explosive Limits'
Flashback - occurs when the flame in a gas torch bums back into the torch or hose; this is often accompanied by a hissing or squealing sound, and a pointed or smoky flame.
Flash point - the lowest temperature at which a flame will propagate through the vapour of a combustible material to the liquid surface. It is determined by the vapour pressure of the liquid, since only when a sufficiently high vapour concentration is reached, can it support combustion. It should be noted that the source of ignition need not be an open flame, but could equally be, for example, the surface of a hot plate, or a steam pipe.
Freezing point - the temperature at which a liquid becomes a solid, at normal atmospheric pressure.
Hazard codes - see UN hazard codes
Hazardous decomposition products - formed when a material decomposes (breaks down) because it is unstable, or reacts with materials such as water or oxygen in air.
Hazardous polymerization - Polymerization is a process of forming a polymer by combining large numbers of chemical units or monomers into long chains (polyethylene from ethylene or polystyrene from styrene). Uncontrolled polymerization can be extremely hazardous. Some polymerization processes can release considerable heat or can be explosive.
Hematopoietic agent - chemical which interferes with the blood system by decreasing the oxygen-carrying ability of haemoglobin. This can lead to cyanosis and unconsciousness. Carbon monoxide is one such agent, familiar to smokers.
Hepatotoxin - chemical capable of causing liver damage.
Hypoxia - a condition defined by a low supply of oxygen.

Inhibitor - material which is added to a chemical to prevent an unwanted reaction. For example, bht (2,6-di-t-butyl-p-cresol) is often added to tetrahydrofuran to prevent potentially dangerous polymerization.
Ingestion - means taking a material into the body by mouth (swallowing).
Inhalation - means taking a material into the body by breathing it in.
IARC - international agency for research in cancer. The IARC home page is at http://www.iarc.fr/
Irritant - chemical which may cause reversible inflammation on contact.
Lc5o (lethal concentration 50) - the concentration of a chemical which kills 50% of a sample population. This measure is generally used when exposure to a chemical is through the animal breathing it in, while the ld5o is the measure generally used when exposure is by swallowing, through skin contact, or by injection.
Ld50 (lethal dose 50) - the dose of a chemical which kills 50% of a sample population. In full reporting, the dose, treatment and observation period should be given. Further, ld5o, lc5o, ed5o and similar figures are strictly only comparable when the age, sex and nutritional state of the animals is specified. Nevertheless, such values are widely reported and used as an effective measure of the potential toxicity of chemicals.
LDLO - Lethal Dose Low
LEL (Lower Explosive Limit) - See Explosive Limits.
Local exhaust ventilation - involves the capture of pollutants at the source.
Median lethal dose (mdl) - see ld5o.
Mel (maximum exposure limit) - the maximum permitted concentration of a chemical to which a worker may be exposed over an extended period of time. Typically, mels are quoted in ppm for an 8-hour reference period, though shorter periods may be quoted for some materials. Mels are, in many countries, enforceable by law.
Melting point - the temperature at which a solid material becomes a liquid.
MSDS - a widely used abbreviation for material safety data sheet, which contains details of the hazards associated with a chemical, and gives information on its safe use.
Mutagen - an agent that changes the hereditary genetic material which is a part of every living cell. Such a mutation is probably an early step in the sequence of events that ultimately leads to the development of cancer.
Na number - see “un number”.
NIOSH (national institute for occupational safety and health) - sets oels and provides services in occupational health and safety investigations in the usa. The niosh home page is at http://www.cdc.gov/niosh/
Nephrotoxin - a chemical which may cause kidney damage. Common examples include antimony compounds, dimethyl sulphoxide, dimethylformamide and tetrahydrofuran.
Neurotoxin - chemical whose primary action is on the cns (central nervous system). Many neurotoxins, such as some mercury compounds, are highly toxic, and must only be used under carefully controlled conditions.
Nuisance material – material that can cause transient irritation or discomfort, but which has no long-term or systemic effects.
OEL (occupational exposure limit) - a (generally legally-enforcable) limit on the amount or concentration of a chemical to which workers may be exposed.
OCCUPATIONAL EXPOSURE LIMITS - CONTROL LIMITS; oel-cl (hazardous chemical substances regulations)
An oel-cl is the maximum concentration of an airborne substance, averaged over a reference period, to which employees may be exposed by inhalation under any circumstances, and is specified together with the appropriate reference period in table 1 of annexure 1.
OCCUPATIONAL EXPOSURE LIMIT-RECOMMENDED LIMIT; oel-rl (hazardous chemical substances regulations)
An oel-rl is the concentration of an airborne substance, averaged over a reference period, at which, according to current knowledge, there is no evidence that it is likely to be injurious to employees if they are exposed by inhalation, day after day, to that concentration.

Odour threshold - the lowest airborne concentration, usually in part per million, of a vapour in air which can be detected by smell.
OES - occupational exposure standard
Oxidizing material - gives up oxygen easily or can readily oxidize other materials.
PEL (permissible exposure limit) - a time-weighted average (twa) or absolute value (usually prescribed by regulation) setting out the maximum permitted exposure to a hazardous chemical – see "exposure limit"
Peroxidizable materials – materials that can form peroxides in storage, generally when in contact with the air. These peroxides present their most serious risk when the peroxide-contaminated material is heated or distilled, but they may also be sensitive to mechanical shock. The quantity of peroxides in a sample may be determined using a simple peroxide test strip.
Ph - a measure of the acidity or basicity (alkalinity) of a material when dissolved in water.
Photoallergic contact dermatitis - a skin condition brought on by exposure to light following skin contact with certain types of chemicals, such as sulphonamides.
Pictographs - widely-used pictorial representations of the hazards presented by chemicals.
Poison class a or b - classified by the US Department of Transport into two classes. Those in class a are highly toxic materials which, even in very small quantities, present a hazard to life. Examples of such gases are cyanogen, phosgene and hydrocyanic acid. Class b poisons, though less toxic, are presumed to present a serious threat to health during transportation.
Polymer - a natural or man-made material formed by combining units, called monomers, into long chains.
Polymerization - a process of forming a polymer by combining large numbers of chemical units or monomers into long chains.
PPB or ppb (parts per billion) - used to specify the concentration (by volume) of a gas or vapour at very low concentration, or a dissolved material at high dilution.
PPM or ppm (parts per million) - used to specify the concentration (by volume) of a gas or vapour at low concentration, or a dissolved material at high dilution.
Pyrophoric materials – materials that ignite spontaneously in air. Since a wide variety of chemicals will burn if heated sufficiently, it is usual to define a pyrophoric material as one which will ignite spontaneously at temperatures below about 45ºc.
Reactive materials - materials that may undergo vigorous condensation, decomposition or polymerization. They may react violently under conditions of shock or increase in pressure or temperature. They may also react vigorously with water or water vapour to release a toxic gas.
Reproductive toxin - (such as vinyl chloride or pcbs) - a chemical which may cause birth defects or sterility.
Sensitization - the development, over time, of an allergic reaction to a chemical.
Sensitizer - a chemical which may lead to the development of allergic reactions after repeated exposure.
Solubility - the ability of a material to dissolve in water or another liquid.
Solvent - a material which is capable of dissolving another chemical
Specific gravity - the density of a liquid compared to the density of an equal amount of water.
Stability - ability of a material to remain unchanged in the presence of heat, moisture or air.
STEL (short term exposure limit) - the maximum permissible concentration of a material, generally expressed in ppm in air, for a defined short period of time (typically 5 minutes). These values, which may differ from country to country, are often backed up by regulation and therefore may be legally enforceable. – see "exposure limit"
Systemic poisons – poisons that have an effect which is remote from the site of entry into the body.
Td50 - td5o may be defined as follows: for a given target site(s), if there are no tumours in control animals, then td5o is that chronic dose-rate in mg/kg body wt/day which would induce tumours in half the test animals at the end of a standard lifespan for the species. Since the tumour(s) of interest often does occur in control animals, td5o is more precisely defined as: that dose-rate in mg/kg body wt/day which, if administered chronically for the standard lifespan of the

species, will halve the probability of remaining tumour less throughout that period. A td5o can be computed for any particular type of neoplasm, for any particular tissue, or for any combination of these. The range of statistically significant td5o values for chemicals in the cpdb that are carcinogenic in rodents is more than 10 million-fold.

Teratogen - chemical which may cause genetic mutations or malformations in the developing fetes. Agents or compounds that a pregnant woman takes into her body that generate defects in the foetus.

TLV (threshold limit value) - the maximum permissible concentration of a material, generally expressed in parts per million in air for some defined period of time (often 8 hours). These values, which may differ from country to country, are often backed up by regulation and therefore may be legally enforceable. See “exposure limits”.

TLV-c (ceiling exposure limit) - an exposure limit which should not be exceeded under any circumstances. See “exposure limits”.

Toxicity - ability of a substance to cause harmful effects.

Trade name - the name under which a product is commercially known.

TWA (time weighted average) - term used in the specification of occupational exposure limits (oels) to define the average concentration of a chemical to which it is permissible to expose a worker over a period of time, typically 8 hours. See “exposure limits”

UEL (upper explosive limits) - see “explosive limits”.

UN hazard codes

Class 1	Explosive
Class 2	Gases
Class 3.1	Flammable liquids, flash point below -18C
Class 3.2	Flammable liquids, flash point between -18C and 23C
Class 3.3	Flammable liquids, flash point between 23C and 61C
Class 4.1	Flammable solids
Class 5.1	Oxidizing agents
Class 5.2	Organic peroxides
Class 6.1	Poisonous substances
Class 7	Radioactive substances
Class 8	Corrosive substances
Class 9	Miscellaneous dangerous substances
NR	Non-regulated

UN Number - a four-digit number assigned to a potentially hazardous material or class of materials. UN (United Nations) numbers are internationally recognized and are used by fire fighter and other emergency response personnel for identification of materials during transportation emergencies. NA (North American) numbers are assigned by Transport Canada and the US Department of Transport to materials they consider hazardous and to which a UN number has not been assigned.

Vapour - a gaseous form of a material which is normally solid or liquid at room temperature and pressure.

Vapour density - the density of a vapour compared to the density of an equal amount of air.

Vapour pressure - the pressure of a vapour in equilibrium with its liquid or solid form.

Ventilation - the movement of air.

Vesicant - a chemical which, if it can escape from the vein, causes extensive tissue damage, with vesicle formation or blistering.

VOC’s - volatile organic compounds.

Volatility - the ability of a material to evaporate at normal atmospheric pressure and temperature.

List of Sources to Help Identify Hazards of Chemicals

EPA FACT Sheets: www.epa.gov/enviro/html/emci/chemref/index.html
ASTDR ToxFAQs: www.atsdr.cdc.gov/toxfaq.html

EPCRA Overview: http://yosemite.epa.gov/oswer/ceppoweb.nsf/contenl/ehs_2003.htm
Integrated RISK Information System: www.epa.gov/IRIS/
Workplace Hazardous Materials Information System (WHMIS): www.hc-se.gc.ca/hecs-sesc/whmis/index.htm
Occupational Health and Safety Administration (OSHA): www.osha.gov

MSDS of Solvents Pertaining to the Report
Please note:
Paraffin in South Africa is known as kerosene in the USA.
Glycerine or glycerol in South Africa is known as glycerin in the USA.
Many of the occupation exposure limits in the MSDS sheet should be considered as guidelines – Limits set by South African legislation are enforceable and will take precedence.
TCE, chloroform, dichloromethane have been reported to be carcinogens
Ensolv (Brand name for n-propyl bromide) – irritation to the lungs where there is a pre-existing lung condition - some skin/eye irritation reported, Should be used in well ventilated area to avoid headaches, dizziness and nausea
When exposed to more than one chemical / agent, synergistic effects are often reported in the literature. That is, the combined effects of two or more agents are often worse the sum of the individual effects

References and links to international MSDS sources
http://www.sciencelab.com/msdsList.php
http://www.mallbaker.com/europe/msds/default.asp
http://www.elcosh.org/docs/d0800/d000828/d000828.html
http://www.albatross-usa.com/pdf/elecchemmsds/AlbatrossVDS3000MSDS.pdf
http://www.coastwidelabs.com/MSDS.htm

Useful sources for local MSDS
Note: Suppliers of Hazardous Chemical Substances have a duty to supply an up-to-date MSDS to the purchaser/user of the substance. Users must ensure that the MSDS is obtained and held on file and regular checks should be done to ensure that that MSDS are not out dated. (In particular with regard to Local Emergency Contact information)

http://www.msdssearch.com/
http://www.mycrochem.co.za/msds/
http://www.engen.co.za/home/apps/content/products_services/msds/CategoryList.aspx
http://www.euapps.shell.com/MSDS/GotoMsds
https://cglapps.chevron.com/msdspds/HomePage.aspx
http://www.totaltec.co.za/drawmenu.php?guid=1
http://www.ikusasachemicals.co.za/www.ikusasachemicals.co.za/index.html

6. Legal requirements

Appendix D of the original CSIR report contained text of the most pertinent RSA legal requirements and has been omitted from this extract, mainly due to pending changes in legislation. To ensure that users have access to the most current legal requirements the links to the Department of Labour website have been included instead.

Users of this publication should regularly check on this website to assure that the most current versions of the OHS Act and Regulations are referenced for compliance purposes.

Links to applicable RSA legal requirements
http://www.labour.gov.za/legislation/acts/occupational-health-and-safety/read-online/amended-occupational-health-and-safety-act

http://www.labour.gov.za/legislation/regulations/occupational-health-and-safety/regulation-ohs-general-safety-regulations
http://www.labour.gov.za/legislation/regulations/occupational-health-and-safety/regulation-ohs-construction-regulations-2003
http://www.labour.gov.za/legislation/regulations/occupational-health-and-safety/regulation-ohs-hazardous-chemical-substances

Section 7

SABITA HSE AWARDS SCHEME

1. Eligibility

All current Ordinary Members of SABITA that were members on the 1st day of March preceding the award period.

2. Award period

Annually from 1 September to 31 August of each year. Applications for participation must reach SABITA not later than 30th June in the award period. Assessment will take place during November/December of each year and an award ceremony will be held not later than 28 February of each year.

3. Award categories

2.1 Best sustained performance in OVERALL HSE Management for period

2.2 Recognition of progress in successful implementation of an HSE management system

2.3 CEO merit awards for other notable HSE achievements

4. Prerequisite requirements for participation

4.1 General requirements – all categories

4.1.1 **MUST NOT** have "suffered" a recordable fatal incident in its operations for the period

4.1.2 **MUST** have reported the required HSE statistical information to SABITA for the period

4.2 Additional category-specific requirements

4.2.1 Best *sustained* performance in OVERALL HSE Management

a) **MUST** demonstrate that **ALL** elements and Expectations of the SABITA HSE MS have been completely implemented

b) **MUST** have a Total Recordable Case Frequency (TRCF) rate of <10 for the period under review

4.2.2 Recognition of progress in successful implementation of an HSE management system

a) **MUST** demonstrate that *implementation was in progress* **FOR AT LEAST 60%** (6) of the *mandatory award scheme expectations* during the **FIRST** period of participation and **thereafter 100%** (10) for subsequent award periods

b) **MUST** have a Total Recordable Case Frequency (TRCF) rate of <15 for the period under review

4.3 CEO merit awards for other notable HSE achievements

No specific performance requirements are linked to this category. The purpose is to allow for recognition of notable initiatives of Members (and individual employees) that have made significant contributions to the enhancement of HSE management within their own organisations or the Bitumen industry in general.

5. Award category elements

5.1 Best sustained OVERALL HSE performance. The following will be assessed:

Ten (10) *mandatory award scheme elements (SABITA HSE-MS expectations)*

Two (2) additional SABITA HSE-MS expectations nominated by the participant

Three (3) additional "mystery" SABITA HSE-MS expectations (to be determined by a draw from the remaining expectations)

5.2 Recognition of progress in successful implementation of an HSE management system. The following will be assessed:

5.2.1 All the *mandatory award scheme elements* (minimum 6) that have been declared as *implementation in progress*

5.2.2 Any additional SABITA HSE-MS expectations nominated by the participant

6. Assessment criteria and scoring system

6.1 The SABITA HSE-MS consists of 8 Core Expectations and 26 (sub) Expectations each with required processes or actions to meet the Expectations. These expectations are individually numbered and represent the Scheme Elements that will be assessed for award purposes.

6.2 Each of the Award Scheme Elements will be scored in accordance with the following points system:

Score	Meaning
3	Fully satisfies requirements
2	Substantially satisfies requirements
1	Partly satisfies requirements
0	Does not satisfy requirements

6.3 In addition a "weighting" factor of 1 – 4 is applied to each of the required processes or actions of a sub-expectation:

Weighting	Meaning
4	Mandatory (Legal and HSE-MS critical requirement)
3	Very high importance (HSE-MS critical requirement)
2	High importance (Considered essential to support HSE-MS critical requirements)
1	Low to Medium importance (Not critical but should be considered)

6.4 The score of each of the elements assessed for award purposes is multiplied by the weighting factor, and aggregated to determine the Total Points scored by the participant.

6.5 The participant with the highest score is declared winner of the category award.

7. Mandatory Award Scheme Elements (Selected from the required processes and actions of the sub-expectations)

Code	HSE-MS Expectation #	HSE-MS Core Expectation
MASE 1	4.1.1.4 & 4.1.2.1	Leadership and Commitment
MASE 2	4.2.1.2 & 4.2.2.1	Policy and Strategic Objectives
MASE 3	4.3.1.1 & 4.3.2.1	Organization, Responsibilities, Resources, Standards, & Documents
MASE 4	4.3.3.1 & 4.3.3.2	
MASE 5	4.4.1.1 & 4.4.2.1	Hazards and Effects Management
MASE 6	4.4.5.1 & 4.4.6.1	
MASE 7	4.5.1.1 / 4.5.3.1 & 4.5.4.2	Planning and Procedures
MASE 8	4.6.1.3 / 4.6.2.2 & 4.6.3.3	Implementation, Monitoring, and Reporting
MASE 9	4.7.1.1 & 4.7.3.1	Audit
MASE 10	4.8.1.1	Management review

8. Other Award Scheme Elements (Selected from the 26 sub-expectations)

Additional elements nominated by participants (2) and mystery elements to be decided by a draw (3) will be selected from the HSE-MS Expectations not included in the Mandatory elements. These element selections are indicated on the application form by the corresponding HSE-MS numbering as relevant. ***For example: Selecting the expectation # 4.5.2 includes # 4.5.2.1 & 4.5.2.2 for Award Scheme assessment purposes.***

Appendix 1 Application for participation in SABITA HSE Awards Scheme

1. Participant details

Company name & branch:			
Contact person:		**Contact phone no:**	
Current Total Recordable Case Frequency (TRCF) rate:			

2. Award category and nomination of elements to be assessed

Note: 1. Mark selection in appropriate block with ✓

2. See page 3 for explanation of Award Scheme Element Codes (ASE Codes)

2.1 Best sustained performance in OVERALL HSE Management			
In addition to the **10 mandatory award scheme elements** (SABITA HSE-MS expectations) the following **2** SABITA HSE-MS expectations are nominated for assessment:			
Selection 1		**Selection 2**	
2.2 Progress in successful implementation of an HSE management system			
The following **mandatory award scheme elements** (SABITA HSE-MS expectations) are nominated for assessment: ***Note: A minimum of 6 mandatory elements must be nominated!***			
Selection 1		**Selection 2**	
Selection 3		**Selection 4**	
Selection 5		**Selection 6**	
Selection 7		**Selection 8**	
In addition to the **mandatory award scheme elements** the following SABITA HSE-MS expectations are nominated for assessment:			
Selection		**Selection**	
Selection		**Selection**	
Selection		**Selection**	
2.3 CEO merit award for other notable HSE achievement			

Please use the nomination form on next page for nominating individuals or groups in this award category. As a guide the nominee/s must have shown initiative by satisfying at least 1 of the 5 criteria listed below.

1. **HSE-MS implementation –** For innovative excellence in implementation of HSE initiatives in the workplace
2. **Active role in safety –** For being a strong advocate and champion of health and safety
3. **Improvement –** For demonstrating significant improvement over previous conditions
4. **Consistency –** For maintaining good safety performance over a number of years
5. **Product or process development and implementation –** For special effort given to a specific aspect of safety in the Bitumen industry

Nomination form - CEO merit award for notable HSE achievement

Nominate an individual

Nominee name:	**Job title:**

Company:	**Company phone number:**

Nominate a group

Name of group:
List the names of each member of the group separated with commas:

Accomplishments
Describe why (not more than 150 words) this individual or group deserves this award. Include examples and specifics. Convince the judges!

Nominated by:	**Job title:**

Company:	**Company phone number:**

E-Mail (Required):

3. Endorsement by CEO of participating Member Company

I submit that the information provided in this application is accurate and hereby fully endorse this application to be considered for recognition in terms of the SABITA HSE Awards Scheme.

Date: …….. CEO signature: ……

Appendix 2 Assessment and score sheet - SABITA HSE Awards Scheme

Participant:	Year:	Date of assessment:

Award category:	

Assessors:	1.	2.

Section A - Assessment of Mandatory Award Scheme Elements

Code #	Requirement	Comments	Scoring		
			W F	Score	
4.1.1.4	Review HSE performance data at each Executive Management meeting		2		
4.1.2.1	Individual responsibilities in connection with HSE Policy and HSE-MS expectations are included in the Job Descriptions of each employee		4		
4.2.1.2	Develop overall Strategic Objectives to support compliance with the Policy, and ensure that specific HSE targets, at appropriate levels in the Organisation, are set and are fully aligned to achieve coherent implementation of the HSE-MS expectations		2		
4.2.2.1	Maintain a register (list) of Legal Requirements and Mandatory Standards that shall be implemented to comply with the expectations of this HSE-MS		2		
4.3.1.1	Identify and document HSE critical tasks and positions, and ensure that staff and contractor personnel are competent to perform these tasks		4		
4.3.2.1	Document HSE critical positions and the links to HSE critical tasks in the MO Hazard Register		3		
4.3.3.1	Maintain an indexed list of relevant Legal Requirements, Standards and Procedures in connection with identified HSE critical tasks and associated hazards		4		
4.3.3.2	Include periodic review of Legal Requirements, Standards and Procedures in the Management of Change Procedure to ensure relevant Standards and Procedures remain current		3		
4.4.1.1	Apply the Hazards and Effects Management Process to prepare a MO (company specific) Hazard Register consistent with the SABITA generic template		4		
4.4.2.1	For all Major Hazards (classified as HIGH risk in the RED zone of the RAM) a documented demonstration of ALARP shall be provided by applying BowTie or equivalent methodology		3		

Code #	Requirement	Comments	Scoring		
			WF	Score	
4.4.5.1	The Hazard Register, or relevant sections thereof, shall be made available to employees (including contractors) performing HSE critical tasks		4		
4.4.6.1	Establish and maintain a Management of Change Procedure to ensure that permanent or temporary changes to organisation, equipment, plant, materials, standards or procedures and changes associated with laws and regulations are subjected to Risk Assessment to evaluate the potential HSE impacts of the change		4		
4.5.1.1	Set HSE targets that include at least some of the following (or similar) measures: ➢ % Reduction in Total Recordable Case incidents. KPI = TRCF ➢ # of consecutive days worked without a Recordable Case incident. KPI = DWRC ➢ # of HSE-MS self assessments (whole or part of MS). KPI = % Achieved vs set target ➢ # of workplace inspections per year. KPI = % Achieved vs set target ➢ Achieving SABITA HSE Certification within ..... (specified time frame, months/years)		2		
4.5.3.1	Accountability and responsibility for workplace HSE targets and action plans is clearly documented in the following: ➢ Annual MO declaration of HSE Objectives and Targets (For guidance see Supplementary section to this document) ➢ Contractor agreements and Health and Safety Plans where applicable ➢ Annual Performance Appraisal targets of individual employees		2		
4.5.4.2	Each anticipated scenario of Emergency Response Plans shall be tested AT LEAST once per year during a planned practical exercise and the results recorded in a documented evaluation report. Plans shall be reviewed as defined in the Management of Change procedure and AT LEAST once per year as part of the Management HSE-MS review process		3		
4.6.1.3	Contractors operate a management system consistent with the requirements and provisions of this HSE management system		3		

Code #	Requirement	Comments	Scoring		
			W F	Score	
4.6.2.2	Determine and clearly define the following in the procedure:- ➢ The appropriate level of management participation in incident investigations ➢ The process for tracking and close out of recommended corrective actions resulting from incident investigations ➢ The process for sharing learning's from internal and external incident investigations				
4.6.3.3	Establish a remedial action plan for recording corrective actions for audit non-compliance findings		**2**		
4.7.1.1	Establish an audit policy and plan to cover all operations of the Organisation		**2**		
4.7.3.1	All HSE-MS self-assessments, internal audits and independent audit reports shall be personally reviewed and endorsed by the Executive Management team member responsible for the relevant operation, department or unit **AND** the Senior Manager responsible for HSE-MS implementation. Responsibility for close-out of SERIOUS (HIGH risk findings) shall be confirmed or escalated to a more senior level if necessary		**3**		
4.8.1.1	A formal Executive Management review of the HSE-MS is conducted at least once a year to ensure its continuing suitability, adequacy and effectiveness		**3**		
		Sub total A			

B - Assessment of other selected Award Scheme Elements

Code #	Requirement	Comments	Scoring		
			W F	Score	
		Sub total B			
		Total A + B			