ANCHOR MARINE SERVICES PTY LTD

MARINE SURVEY | NAVAL ARCHITECTURE | CLIENT REPRESENTATION

SAFETY MANUAL

REVISION NO.2

AUGUST 2017

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INTRODUCTION

Anchor Marine Services was established in late 2011 to supply technical consulting and marine survey services. The Mission of AMS is to serve the interest of our clients and the public in our operations by promoting the security of life, property, and the natural environment, by representing the actual material state of marine structures, and verification of operational / engineering requirements as contracted by our clients. (Please refer to the AMS Mission Statement).

In accordance with the mission of AMS, personnel of AMS are required to hold a standard of compliance with best practice or above, both for personnel of AMS and all others working around them. AMS personnel are required to take part in and actively contribute to all Safety related practices and processes in place on any vessel or facility attended.

This manual provides general work-safety, hazardous assessment, and control guidelines for AMS Surveyors and other AMS personnel as applicable, to apply in the environments under which they will work.

Newly hired and contracted AMS personnel shall read the AMS Safety Manual and acknowledge that they have read it within two weeks of being hired by signing and submitting the acknowledgement form found at the end of this manual.

SECTION 1 – HEALTH AND SAFETY POLICY STATEMENT

As a core value, our company has a total commitment to health and safety. We have as a key target, a zero harm objective for all people that we come into contact with. We have a direct responsibility to people whether employees, contractors, sub-contractors, clients, and all people working for these entities, and by extension their families. We also have an indirect responsibility to the communities in which we operate, or which our operations may affect downstream.

Anchor Marine Services expects that all people that we come into contact with are responsible for the safety of all others around them, and take the appropriate steps to comply with all Acts, Regulations, and policies, developed by all statutory authorities (as a minimum) and other bodies (site specific rules).

While commitment to the HSE requirements of other companies is a requirement for all AMS personnel when working in conjunction with other entities, AMS reserves the right to take steps to enhance the protective measures in place for any task concerning protection from injury and illness.

At all Times:

- Comply with mandatory health and safety standards and procedures.
- Assist all those working around you to comply with SS&P.
- Stop work immediately if any work appears to be unsafe.
- Use all PPE, in the correct manner, required for the task that you are conducting.
- Handle all materials properly, safely and lawfully.
- Dispose of all materials properly, safely and lawfully.
- Consult the MSDS for all materials before use.
- Ensure you understand all emergency procedures for the worksite you are at, and that all visitors and Persons under your care understand the same.
- Report ALL HSE incidents to your manager. This includes all injury, illness, adverse condition, incident, spill, release of material. Follow-up that action has been taken to correct, prevent or control these conditions.
- Report all risks, hazards, or concerns yourself, do not delegate or assume that anyone else will make a report.
- Give due diligence, and consideration to all complaints and reports, or warnings from all sources, especially with respect to HSE issues.

Do Not:

- Conduct any work for which you are not trained, or deemed competent to undertake.
- Conduct any work if you are medically unfit, sufficiently rested, or in a state of sufficient alertness.
- Attend any site if under the influence of alcohol or illegal drugs.
- Conduct any work if you may be impaired by legal or prescribed drugs.
- Use or tolerate, threats, intimidation, erratic or anti-social behaviour, intimidation or violence in the workplace.
- Carry weapons, (standard or improvised) unless authorised to do so.

It is the responsibility of every person engaged by AMS to be familiar with, accept and take responsibility for compliance with the AMS Health and Safety Policy.

We consider the safety and health of our personnel to be of the utmost importance and ask your full cooperation in making this policy and program truly effective.

ANCHOR MARINE SERVICES - Director

Mr Justin Bentink

AMS Health and Safety Policy Instructions

1.1 PURPOSE - The Purpose of this instruction is to provide administrative controls and procedures to ensure that all AMS operating personnel are in compliance with national and local occupational safety and health management system requirements.

1.2 RESPONSIBILITY - All AMS personnel are individually responsible for their own safety and are required to bring any known or potential safety violations to the attention of their immediate supervisors (AMS and onsite HSE representatives). It is also desired that all personnel will adopt a healthy attitude towards their own physical and mental well-being.

It is the Surveyors' responsibility to advise their Principal Surveyor (or Staff Member in-Charge) of any physical limitations which could endanger their well-being while at the job site.

Each person should use common sense and good judgment at all times. If you feel you are personally unsafe due to illness or being overtired, advise your Principal Surveyor (or Staff Member in-Charge) in order that arrangements may be made for you to take the time to recover, rest or correct the problem before proceeding with a job that may result in increased risk of injury or illness.

1.3 This manual is intended to provide AMS personnel involved in vessel inspections, industrial activities, and other types of fieldwork and office activities with information essential to the safe performance of their duties and the maintenance of their health. It is the policy of AMS that the safety and health of AMS personnel be the first consideration in the performance of their assignments.

Sub-contractors are included and considered personnel of AMS when acting in a role for the interest of AMS.

1.4 As AMS personnel, you should know that the guidelines set forth in this Safety Manual are influenced by certain governmental and/or local regulatory administrations that have provided in-sight for the basic formulation of the safety instructions contained in this manual. This manual is intended to give AMS personnel information and an overview of hazards that may be present in their place of work. **It is not intended** to list or discuss all regulations or obligations imposed on employers by the various regulatory administrations having responsibility for safety and health in employment. Nothing in this manual is intended to replace or supersede any governmental or local authority's regulations or requirements for the implementation of or content of a premise safety plan.

1.5 Compliance with the provisions of this manual **is mandatory** for AMS personnel. Should an incident occur that is determined to have been caused by behaviour that is in violation of the AMS Safety Manual, disciplinary action may be taken. The level of action taken will be determined by the Board of Directors. Disciplinary action may be up to and including termination.

All AMS personnel are encouraged to submit any material or suggestions relative to improving the occupational safety and health program.

1.6 Any AMS personnel who is not routinely assigned to field duties, but may be required to occasionally make visits to Marine and Industrial sites shall comply with the guidelines set forth in this Safety Manual. For matters relating to safety and health, these persons shall report to the local AMS Staff Member in-Charge of the geographical area in which the work site is located.

SECTION 2 – ACCIDENT INVESTIGATION AND REPORTING

Basic Accident Investigation and Reporting Technique

2.1 Effective investigations are imperative to the success of a safety program. The purpose of accident investigation is to identify causative factors and develop corrective action to prevent accident recurrence, mishaps or near misses. Effective investigations should:

1. **Describe what happened --** Thorough investigations can sift through sometimes conflicting evidence and arrive at an accurate description of the incident.

2. **Determine the causation –** Any investigation should be detailed and thorough in order to reach a conclusion of the causes of the incident

3. **Determine the risks --** Good investigations provide the basis of deciding the likelihood of recurrence and the potential for major loss -- two critical factors in determining the amount of time and money to spend on corrective action.

4. **Develop controls --** Adequate controls that minimize or eliminate a problem can only come from a sound investigation, which has truly identified the problem. Otherwise, the problem will appear again and again but with different symptoms.

5. **Define trends --** Few accidents and incidents are truly isolated cases. When a significant number of good reports are analysed, emerging trends can be identified and so controls can be set.

6. **Demonstrate concern --** Accidents give people vivid pictures of threats to their well-being. It is assuring to see a prompt, objective investigation in process. Good investigations aid personnel relations.

2.2 All lost time accidents should be promptly reported and investigated by the Safety Delegate. Techniques to follow when conducting an investigation are as follows:

1. Visit the accident scene as soon as possible to insure that facts are still fresh in witness's minds.

2. Interview personnel as soon as they are physically and mentally able.

3. Interview other witnesses to the accident either at the scene or as soon after the accident as possible.

4. Obtain signed statements from witnesses if applicable or available.

5. Document details graphically -- use photographs, sketches, or diagrams if appropriate.

6. Save or preserve all physical evidence as necessary.

2.3 The Staff Member in-Charge shall be responsible for carrying out the investigations of any lost time and reportable incidents and near miss cases and for ensuring that proper steps are taken to ensure that recommended and approved corrective and preventative actions are taken. Corrective and Preventative actions will include, as needed:

1. Replacing all defective or broken tools and equipment.

2. Revising work methods to eliminate or to prevent unsafe procedures.

3. Retraining of personnel.

4. Monitoring the hazard to insure it remains corrected or controlled.

5. Following up by revisiting the incident and its scenario after a reasonable period of time has elapsed to confirm that the corrective and preventative actions implemented by the Management of the premises are in place and found effective.

6. Disciplinary action for violation of AMS policies, and instructed safe work procedures.

Report of Work Related Injury / Illness (Form)

Name of Injured person:_____ Date Reported:_____

Date of Incident:_____ Time:_____ Location:_____

Nature of Injury – Description

Check all Applicable:

Abrasion, Scratch	Amputation	Asphyxia, drowning
Bruise, crushing and contusion	Burn – chemical, heat	Concussion
Dislocation	Effects of Electricity	Fracture
Internal injury	Laceration, cut	Puncture wound
Sprain	Strain	Weld Flash
Other – Describe		

Part(s) of the Body Injured – Check all applicable.

Head

Scalp, Skull	Eye (right / left)	Ear (right / left)
Face	Nose	Mouth, teeth

Neck and Trunk

Neck	Shoulder (right / left)	Chest
Abdomen	Pelvis, groin	Back

Upper Limbs

Upper arm (right / left)	Elbow (right / left)	Forearm (right / left)
Wrist (right / left)	Hand (right / left)	Fingers (Thumb, Index, Middle, Ring, Small)

Lower limbs

Hip (right / left)	Thigh (right / left)	Knee (right / left)
Shin (right / left)	Ankle (right / left)	Foot (right / left)

Description of Injury/Illness and the events leading to the incident

Contributing to Injury/Illness Substandard Conditions

Defective tools, equipment or materials	Inadequate warning system
Inadequate or excessive illumination	Inadequate or improper PPE
Inadequate guards or barriers	Inadequate ventilation
Inadequate staging	Poor housekeeping
Slippery surface	other – describe

Contact

Type of Contact	**Contact With**
Caught between	Airborne matter (blast grit, paint overspray, etc)
Fall on same level	Electricity
Fall to below	Heat
Slip	Liquids (oil, water, mud, etc.)
Struck against	Ship's structure
Struck by	Toxic Substance
Struck by falling object	other – describe
Other - describe	

Other Factors

Lack of attention	Tiredness
Lack of training	Stress
Pressure from owner/yard	other – describe

Has the injury or illness resulted in lost time beyond the date of injury?

_____

Number of Lost days

_____

Number of days restricted to light duties

_____

Where there any lost wages

_____

Name of person to be contacted at the incident site.

_____

Location From / To, where injured person was moved or taken.

_____

Names of any witnesses

_____

Name of person submitting report _____

Signature _____

Confined Space Checklist (Form)

The Following checklist is to be completed by AMS personnel prior to confined space entry, and in addition to confined space owner/management confined space entry permits and procedures.

(The following points should be considered before entering…) THE FINAL DECISION IS YOURS

SPACE ENTRY

YES NO Is entry necessary?

YES NO Someone will accompany you into the space?

TESTING

YES NO Are the instruments used in atmospheric testing properly calibrated

YES NO Was the person performing the tests a certified Marine Chemist, Competent Analyst, or equal, or a (competent) person designated by the facility or vessel management to so?

YES NO Was the atmosphere in the confined space tested?

YES NO Was Oxygen at least 20.8% and - not more than 22%?

YES NO Were toxic, flammable, or oxygen-displacing gases/vapours present?

PPM / %

Hydrogen sulphide _____ Carbon monoxide _____ Methane _____ Carbon dioxide _____

Benzene _____ _____

Other (list) _____

PHYSICAL AGENTS

YES NO Is the space free of asbestos fibres?

YES NO Is the space free from airborne sandblasting grit?

MONITORING

YES NO Will the atmosphere in the space be monitored while work is going on?

Remember – atmospheric changes occur due to the work procedure or the product stored and vessel movements and temperature changes. The atmosphere may change very quickly.

VENTILATION

YES NO Has the space been ventilated before entry?

YES NO Will ventilation be continued during entry?

YES NO Is the air intake for the ventilation system located in an area that is free of combustible dusts and vapours

and toxic substances?

YES NO If atmosphere was found unacceptable and then ventilated, was it re-tested before entry?

ISOLATION

YES NO Has the space been isolated from other systems?

YES NO Has electrical equipment been locked out?

YES NO Have disconnects been used where possible?

YES NO Has mechanical equipment been blocked, chocked, and disengaged where necessary?

YES NO Have lines under pressure been blanked and bled?

CLOTHING/EQUIPMENT

YES NO Is special clothing required (boots, chemical suits, glasses, etc.)?

YES NO Is special equipment required (e.g., rescue equipment, communications equipment, heavy-duty raft, life vests, etc.)?

YES NO Are special tools required (e.g., spark proof, intrinsically safe)?

TRAINING

YES NO Have you been trained in confined space entry and do you know what to look for? (If not, you should not enter into a confined space.)

STANDBY/RESCUE

YES NO Will there be a standby person on the outside in constant visual or auditory communication with the person on the inside?

YES NO Will the standby person be able to see and/or hear the person inside at all times?

PERMIT

(The permit is an authorization in usually writing that states that the space has been tested by a qualified person that the space is safe for entry; what precautions, equipment, etc. are required; and what work is to be done.)

YES NO Has a confined space entry permit been issued?

YES NO Is the permit up to date?

SECTION 3 – SAFETY AND HEALTH TRAINING

3.1 Purpose

Accidents and injuries on-the-job normally do not "just" happen; they are typically the result of unsafe acts or conditions. The objectives of AMS Occupational Safety Training are:

- To instruct personnel in the requirements of the job assignment.
- To familiarize personnel with applicable Safety and Health Standards.
- To instruct personnel with respect to Safety Procedures upon entering a client's premises.
- To enable personnel to recognize and avoid unsafe conditions.

3.2 Background

Forming safe personal work habits and acquiring safety consciousness is the continuing responsibility of every person. Safety has been called a "state of mind". Safety is an individual responsibility and also an individual benefit.

3.3 Responsibility

3.3.1 Personnel responsible for supervising, planning, attending, or conducting inspections in a shipyard or repair facility, terminal, industrial plant, construction site or mineral/hydrocarbon exploration or production facility shall be properly trained in their functional duties prior to independent field assignment. Training includes a mix of on-the-job training, workshops, and classroom instruction and includes as appropriate:

1. Piping and Mechanical Systems
2. Electrical Installations
3. Boilers and Pressure Vessels
4. Quality Assurance
5. Steel Construction
6. Corporate Administration
7. Safety Procedures
8. Hazardous Materials

3.3.2 Personnel responsible for planning or participating in confined space entry shall be trained in hazards and safety procedures. Training shall include:

- An explanation of the steps used to recognize, evaluate and control the hazards associated with confined spaces including oxygen deficient atmospheres, flammable and toxic atmospheres.
- The role of the Marine Chemist and the Shipyard Competent Person.
- The reasons for the use of proper personal protective equipment and other safety equipment and procedures required for confined space entry and exit.
- How to respond to emergencies.
- A description of how to recognize probable air contamination from exposure symptoms in themselves or others and methods for alerting attendants.
- Training in the proper use of atmospheric monitoring instruments including field calibration, basics of the work being performed, anticipated hazardous substances and any condition which could significantly alter the atmosphere within or outside the confined space.

3.3.3 Personnel who are required to travel by helicopter on a routine basis are required to undergo training in related hazards and safety procedures. Training should include:

- helicopter egress,
- use of life rafts,
- distress signalling,
- hyper/hypothermia (as applicable),
- and use of personal flotation devices.

After initial completion of the helicopter egress course, it must be retaken as required by local conditions in order to continue to go offshore i.e. oil company requirement or local laws.

3.3.4 Awareness of potential health and safety hazards in an office environment is also important. Knowledge of how to control such hazards is critical to maintaining a safe and healthful work environment in the office. For this purpose, personnel who work an office environment should review the Code of Safe Practices and Lifting Techniques found in the appendices of this manual. AMS is committed to instructing personnel in safe and healthful work practices.

To achieve this goal, reviews will be conducted for personnel on general and specific safety procedures for each job. Additional Instruction prior to each job will be conducted in special circumstances if required, such as;

1. To all new personnel to a particular job.
2. To all personnel given new job assignments for which training has not previously been received
3. Whenever new substances, processes, procedures, or equipment are introduced to the workplace and represent a new hazard
4. Whenever the employer is made aware of a new or previously unrecognized hazard.

3.4 Records

AMS shall maintain a record of personnel receiving occupational safety training. The records shall show the name of the individual, type of training and dates.

SECTION 4- SAFETY POLICY COMMUNICATION

4.1 Purpose

The purpose of the AMS Occupational Safety and Health Communication Program is to ensure that the contents of this manual are communicated to personnel and to inquire as to any Safety and Health concerns which may arise because of changes in conditions or new activities.

4.2 Discussion

The scope of AMS activities which involve significant risks of occupational injury or illness and are carried out on client premises (premises is understood to include vessels and other marine structures). In general, premises owned or controlled by clients are subject to the jurisdiction and laws of the corresponding local or national governments. There are, however, a significant number of instances in which immediate regulatory oversight is minimal.

4.3 Responsibility

4.3.1 The responsible Staff Member In-Charge will establish and disseminate instructions for personnel who must enter and perform their assignments on client premises. The instructions shall be in compliance with national and local regulations and shall include, but shall not be limited to:

- Name of Client Company
- Address and Location of Work Site
- Nature of the Business
- Description of Assignments
- Instructions for Verifying Regulatory Compliance
- Any Restriction or Personal Protective Equipment Required
- The instructions will further direct personnel to report unsafe work practices.

4.3.2 Personnel should not hesitate to communicate all matters of safety and health concerns.
Methods of communication:

- Open Door Policy— AMS supports informal communications through its open door policy with management. This policy encourages personnel to report safety concerns without fear of reprisal.
- Hazard Reporting—Personnel are encouraged to report workplace hazards or near misses as per the guidelines provided in this manual, via electronic near miss/unsafe working conditions report, or directly to Staff Member in-charge and AMS Directors.
- Electronic Communications – Safety information will be distributed via e-mail.

SECTION 5 – ACCIDENT EVALUATION AND CONTROL

5.1. Purpose

To stress the need for meeting safety and health investigation and reporting requirements. To provide factual data to the Regional/District, Division, and Corporate Safety personnel so that corrective action can be taken to prevent recurrences.

5.2. Background

Mishap investigation and reporting is essential to maintaining a safe environment and enabling personnel to carry out assignments effectively.

5.3 Definition of Terms

Reportable Incidents

All work related injuries that occur while on the job, even if medical treatment is not required. Near misses or incidents that occur outside of work (not work related) are not considered reportable.

Note: All personnel are required to complete and submit a "Report of Work Related Injury/Illness" form immediately after an injury occurs, even if medical treatment is not required.

Injury/Illness (Lost Time Incidents)

Work related Injury/Illness that renders the injured person unable to perform any of their duties or return to work on a scheduled work shift, on any day immediately following the day of the accident or incident. Generally, lost time incidents will require more than first aid treatment by a physician, dentist, surgeon or registered medical personnel.

Near Miss

A Near Miss is an event where no contact or exchange of energy occurred and thus did not result in personal injury.

Any unsafe working condition should be reported electronically as a near miss.

5.4. Responsibilities

The Director / Safety Manager has the responsibility for investigating and reporting of mishaps and will be responsible for:

a. Conducting safety and occupational health investigations and reporting on any mishaps or incidents that involve AMS personnel in the performance of their assignments;
b. Evaluating findings and making recommendations for corrective action as appropriate.
c. Communicating findings to the Director and/or requesting assistance when required.

Responsibility may be delegated to the Staff Member in-Charge.

For Immediate 24Hr Safety notification Call +61 0428 000 900 – Mr Justin Bentink, AMS Director

5.5. Actions

5.5.1 The Staff Member in-Charge, who is responsible for the activities of the injured/ill person, shall file a report in a form acceptable to the local and national authorities **within twenty-four (24) hours** of receiving knowledge of every actual or alleged occupational injury (or illness) to any AMS personnel that results in lost time beyond the date of the injury (or illness) or requires medical treatment beyond First Aid. The report shall include as a minimum:

- Time and date of injury or illness.
- Name, job title, and affiliation of person reporting the mishap.

- Site of mishap or incident.
- Name of person to contact at site of the mishap.
- Name and address of injured person.
- Clear description of incident, injury, or illness, (i.e., broken left leg, injured right eye, etc.).
- Location from/to which the injured person was removed/taken.
- Identity of any witnesses or attendants at the site.
- Description of how the mishap or incident occurred.

When an injury or illness is reported, the immediate supervisor is responsible for assuring the injured employee receives prompt medical attention. Medical attention must be offered to any injured personnel, despite severity.
In all cases of serious injury, illness, or death; a report of injury/illness must be made to Local and State (Provincial) authorities having jurisdiction within 24 hours after the time the Local Office learned or should have learned of the injury. A "serious injury or illness" is one that requires in-patient hospitalization for more than 24 hours for other than medical observation, or one in which the AMS employee or contractor suffers the loss of a body member, or suffers any serious degree of permanent disfiguration.

These cases must be reported immediately to the AMS Directors.

5.5.2 The Staff Member in-Charge who is responsible for the activities of the injured/ill person shall file a report, within 24 hours, of all work related reportable incidents (injuries and illnesses) with their immediate supervisor.

5.5.3 It is the responsibility of the Staff Member in-charge to verify that any employee, who has been sent from work due to an injury or illness, has a medical release from their doctor prior to returning to the workplace.

5.6. Near Misses

In order for AMS to take proactive measures to alert AMS personnel of potential work place hazards, a means of recording near misses is available to all personnel. When reporting a near miss the following information should be provided:

- Probable cause (workplace layout, awareness, equipment failures, etc.)
- Contact with an object or substance which nearly occurred (step, fall, burn, struck by, etc.)
- Recommended preventative action (safety poster, training, equipment replacement, etc.)

NOTE: All near misses which directly involve the safety of AMS personnel must be reported. In addition, any near miss incidents occurring in an AMS workplace which could result in serious injury or death to non-AMS personnel should also be reported.

5.7. Slips and Falls

According to IACS societies, historically, approximately 66% of the on-the-job injuries sustained by Surveyors are a result of slips and falls. It is imperative that our field staff pay particular attention when working in the vicinity of decks, gratings, ladders and walkways as these areas may be slippery and hazardous due to:

- Cargo Residues
- Welding Rod Ends
- Spilled Liquids
- Drainage
- Scrap Metal
- Mud

All personnel must remain cognizant of these potential hazards and ensure that each worksite has adequate lighting and good housekeeping.

SECTION 6 – CORRECTIVE ACTIONS

6.1 Purpose

To monitor work environments to which AMS personnel may be exposed. To detect and report any unsafe or unhealthy condition which may exist and to institute corrective procedures.

6.2. Discussion

Because AMS personnel perform extensively in work environments totally under the control of others, it is important that AMS personnel take steps to familiarize themselves with the working environment and with the protective equipment appropriate to the task and the environment.

6.3. Action

Upon visiting a client's premises (premises include vessels and other marine structures), AMS personnel shall verify that the client has safety procedures in effect. If during the course of work AMS personnel encounter a condition or procedure that may compromise the safety of AMS personnel, they should stop work immediately and contact their supervisor. This unsafe condition shall be investigated by the Director / Safety Manager who shall resolve the matter with the client. If the matter cannot be resolved, and depending on the seriousness of the problem, AMS personnel may refuse to continue with the assignment.
The Director / Safety Manager or a designated staff member shall investigate the safety system and physical condition of a client's premises under any of the following conditions:

- An injury to AMS personnel has occurred on the premises
- A complaint of unsafe working conditions or practices has been made

A Safety Report shall be filed by the Staff Member in-Charge who shall summarize the information for internal distribution.

6.4. Corrective and Preventative Actions

The Staff Member in-Charge shall be responsible for carrying out the investigations of any lost time and reportable incidents and near miss cases and for ensuring that proper steps are taken to ensure that recommended and approved corrective and preventative actions are taken. Corrective and Preventative actions will include, as needed:

- Replacing all defective or broken tools and equipment.
- Revising work methods to eliminate or to prevent unsafe procedures.
- Retraining of personnel.
- Monitoring the hazard to insure it remains corrected or controlled.
- Following up by revisiting the incident and its scenario after a reasonable period of time has elapsed to confirm that the corrective and preventative actions implemented by the Management of the premises are in place and found effective.
- Disciplinary action for violation of AMS policies, and instructed in safe work procedures. Disciplinary action can be up to and including termination depending on the severity of the infraction.

SECTION 7 – WORK SITE & CONFINED SPACE ENTRY

7.1. Purpose

To provide general information and instructions regarding hazards which may be encountered in the various work environments in which AMS personnel may be placed to work, and to offer general guidance for working safely in most work environments.

8.2 Discussion

Since essentially all activities which may expose AMS personnel to hazards in the work place will be carried out on premises under the control of others it is not possible to anticipate all hazards. This chapter has been constructed to identify the most probable hazards and describe procedures applicable for the different types of activities and work environments AMS field personnel may encounter.

7.3 Responsibilities

7.3.1 Industrial -

Upon entering an industrial work site where hazards can be presumed to exist, AMS personnel are to verify that the client company has in place a safety plan which has been accepted by the authority having jurisdiction and which has identified and provided protection against any known or anticipated hazards in its operations. AMS personnel are to comply fully with the safety instructions of the Client Company. In European countries, reference the European Agency for Safety and Health at Work at http://uk.osha.eu.int/.

AMS personnel on field assignments shall be ensure they have with them certain protective clothing and equipment, such as, but not limited to, hard hats, safety (eye) glasses, safety shoes, hearing protection, O_2/combustible gas multi-meters recognized by an approval authority (e.g. UL), work gloves, safety harness, personal flotation device and flashlights as required by the environment and the assignment. If entry into a confined space is required, an O_2/combustible gas multi-meter must be used.

7.3.2 Shipbuilding and Repair Facilities -

AMS personnel are to verify that the shipbuilding or ship repair facility has in place an accepted safety plan and organization. In shipbuilding and repair facilities AMS personnel will be expected to perform assignments largely independent of the Client Company. However, AMS personnel are to become familiar with the client's company safety requirements and to comply with them in all respects. AMS personnel are to have protective equipment as listed in Subsection 7.3.1 available for use at all times.

7.3.3 Marine Transportation (Vessels)

All AMS personnel, who are assigned to attend a vessel afloat, in dry-dock or aground due to accident, are to be familiar with ships and other floating equipment. They shall have available the protective equipment described in Subsection 7.3.1 available for use at all times.

When attending a vessel afloat, in dry-dock or aground AMS personnel should be aware of particular hazards of the job as referenced here and in Appendix 4 of this manual. Such hazards include, but are not limited to, unguarded open hatches, loose or missing floor plates, unguarded openings at ship's sides, vertical and inclined ladders, cargo handling equipment, line handling gear, hot surfaces, flammable and toxic substances, unguarded machinery, an unsteady working platform (ship motions), electrical apparatus, transfers between ship and shore or between ship and ship and the normal hazards usual to a ship. If entry into a confined space is required, the provisions of Section 7.5 of this manual apply.

7.3.4 Offshore Mineral Exploration or Production

For purposes of this manual, the provisions of Subsection 7.3.3 above apply to offshore activities.

7.4 Access to Structures and Vessel Transfers

The most common methods of accessing vessel structure are by using:

- Aerial Lifts
- Staging
- Ladders
- Rafts

NOTE: Walking on cargo is not an acceptable means of access and must be avoided as loose granular material, such as grain, sand, coal, or similar material, can crust or bridge over and break loose under the weight of a person, engulfing and suffocating them. The method of access must be appropriate to the height, location, conditions and survey to be undertaken. The following are some safety considerations to keep in mind when using any of these methods.

7.4.1 Aerial Lifts

Aerial lifts are one of the most common devices used to conduct work from elevated locations and are commonly used to replace traditional shipyard scaffolding. Aerial lifts should be rated for more than one person and be operated by suitably authorized personnel. Aerial lifts are defined as, "any vehicle-mounted device, telescoping or articulating, or both, which is used to position personnel." AMS personnel shall not operate any shipyard, shipboard and contractor supplied equipment (such as one man wire lift platforms).
Commonly used terms in the shipyard for aerial lifts include: JLG™, Genie High Lift™, Condor Lift™, Snorkel Lift™, Cherry Picker

Safety Considerations:

- Lift controls must be tested daily, prior to starting work.
- Operators must be trained/qualified personnel.
- AMS personnel must work within the basket and shall not sit or climb on the edge or use planks, ladders or other devices for a work position.
- Body belts (such as harnesses) with lanyards must be used.
- Load limit must not be exceeded.
- Brakes must be set, outriggers used if so equipped, and wheels chocked if on incline.
- Unless designed to do so in accordance with OSHA provisions, aerial lift trucks may not be moved when the boom is elevated in a working position with workers in the basket.
- Upper and lower controls are required and must be plainly marked. Lower controls must be provided for overriding the upper controls. Except in an emergency, lower lift controls shall not be operated without permission from the work in the lift.
- As a prerequisite, it should be evident that the vehicle has been properly maintained. Periodical certification and testing may be accepted as appropriate evidence.
- Special precautions should be made when aerial lifts are used on vessels (for example barges, floats) to ensure the vessel and the lifting device is stable.
- Personal flotation devices (PFD) shall be used when working over water.
- Caution should be taken for potential crushing hazards (for example, booming into the overhead, pinch point).

7.4.2 Staging

Scaffolds, or staging, are devices used to provide an elevated working surface. Staging may be of several different designs and is often constructed to fit the ship.
Staging must be adequate for the work performed because falls are a significant hazard in the shipyard. Staging must be constructed by a competent person in accordance with local safety requirements and must be regularly inspected for continued safety.

Before working on or near any scaffold, workers should ensure that scaffolds are:

- Safely secured and supported,
- Level,
- Provided with safe access (such as ladders),
- Adequately decked (for example, have a work surface and platform), and
- Provided with guardrails.

7.4.3 Ladders

The safe construction and use of ladders can protect workers who are required to access multiple levels and when working from the ladder. Training workers on safe ladder use and how to assess the condition of the ladder before use is an important aspect of a safety and health program.

Potential Hazards:

- Structural failure of the ladder or its components causing the worker to fall.
- Inappropriate ladder placement (such as ladder angle) causing the worker to fall.
- Unsecured ladder causing the ladder and worker to fall.
- Inappropriate work practices (such as over-extending, climbing with equipment in hand, not facing ladder when climbing down), causing the worker to fall.
- Electrical shock or electrocution when using metal ladders.

Requirements and Example Solutions:

- Defective ladders must not be used and must be removed immediately.
- When splicing ladders, special precautions are required.
- Portable ladders used for access must be secured and extend at least 900mm above the upper landing.
- Manufactured portable metal or wood ladders must be in accordance with recognized national or local standards.
- Portable metal ladders must not be used near electrical shock hazards (such as conductors or electric arc welding).

Additional Requirements:

- Hand lines or tool bags must be used to keep workers hands free when using ladders.
- Only one worker is allowed on a ladder unless the ladder is designed for additional workers.
- Portable straight ladders must have a 4-to-1 ratio. Ladders must not be used in a horizontal position as platforms, runways, or scaffolds.
- Portable ladders must be used when the ship's ladders in the cargo holds are defective.

IACS Recommendation 78, Safe Use of Portable Ladders for Close-up Surveys:

Many times the AMS Surveyor will be conducting close up surveys with the vessel at sea before arriving in the shipyard. Surveyors should be aware of this IACS recommendation and use this as a guideline for the safe use of portable ladders:

- The Owner should ensure that equipment selected for temporary work affords adequate protection against the risks of falls from a height.
- The manner in which portable ladders can most safely be used by workers should be specified.
- Portable ladders should rest on a stable, strong, suitably sized, immobile footing so that the rungs remain horizontal. Suspended ladders should be attached in a manner so that they cannot be displaced and so that swinging is prevented.
- The feet of portable ladders should be prevented from slipping during use by securing the stiles at or near their upper and lower ends, by any anti-slip device or by other arrangements of equivalent

effectiveness. Slip resistant feet should not be used as substitute for the care in placing, lashing or holding a ladder upon slippery surface.

- Portable ladders should meet the following criteria: • Not more than 5 M (16.4 ft.) in length for freestanding portable ladders.
- Non-self-supporting and self-supporting portable ladders should support at least four times the maximum intended load.
- The minimum clear distance between side rails for all portable ladders should be according to a recognized standard.
- The rungs and steps of portable ladders should be designed to minimize slipping, e.g. corrugated, knurled, dimpled, and coated with skid resistance material.
- Ladders should be maintained free of oil, grease and other slipping hazards.

7.4.4 Rafts - See Section 7.5.5.

7.4.5 Transfers between Vessels

- The launch should be suitable for its purpose and have appropriate lifesaving appliances (life preservers) on-board and available for use.
- A crewmember (in addition to the helmsman) must be available to assist with the transfer.
- Boarding arrangements must be in accordance with IACS and IMO requirements.
- Emergency recovery arrangements must be established prior to the transfer taking place.
- A heaving line must be provided to transfer the surveyor's equipment on-board.
- The surveyor has the right to abort the transfer if the sea state (in his/her opinion) is not acceptable.
- The surveyor is to wear a personal floatation device during the actual transfer between vessels.

7.4.6 Hold Harmless Documents

On occasion, before going on board a vessel or into a shipyard or facility, surveyors may be requested to sign "hold harmless" or "access" agreements. These agreements are contractual in nature and usually state that AMS agrees to hold the shipyard or owner harmless for anything that happens aboard the vessel or in the shipyard, often including the negligence of the shipyard or owner.

It is the policy of AMS not to sign these documents as is and to attempt to limit the liability.

AMS is willing to indemnify others for the negligence of AMS and the AMS Surveyor only. When requested, these agreements should immediately be forwarded to AMS Directors for Legal advice to be obtained. These agreements are handled on a case by case basis and often AMS is able to supply a simple insurance certificate showing our coverage and our Surveyors are able to board. In the event that the Surveyor determines that it is necessary to sign the document (only after attempting to contact the Surveyor's direct supervisor), the Surveyor should sign his/her name and state they were requested to sign or they would be refused entry and that the document is for that day/visit only. The Surveyor should request a copy of the document and the document should be forwarded to AMS Directors as soon as possible.

When possible, when accepting a request for survey, the person creating the work order, particularly from a new facility, should ask if the surveyor will be required to sign any documents before entry. If yes, then a copy of this document should be obtained in advance and forwarded to Legal for review before the attendance.

7.5 CONFINED SPACE ENTRY POLICIES

7.5.1 General

a. In no case are personnel to enter a confined space on his own initiative to attempt rescue or render assistance to someone who is, or appears to be, the victim of an accident or is otherwise in difficulty.

b. The following minimum safe conditions are required for entry into a confined space without respiratory protection.

- Atmospheric oxygen not less than 20.8% by volume or more than 22 % by volume. The optimum oxygen level is between 20.8% and 21%.
- Combustible gases 0 % and in no case more than 1% (ISGOTT 1%) of lower explosive limit. Specific to Crude Oil Washing Surveys, the hydrocarbon content should be 1% or less of the lower explosive limit.
- Toxics within acceptable limits (with due regard to specific dangerous cargoes and 8% previous inerting operations), Permissible Exposure Limit (PEL) for hydrogen sulphide is 0 ppm, and for benzene it is 1.0 ppm. The action level is 0.5 PEL. (Refer to Appendix 4, paragraph 3.4.)

c. All AMS personnel have the personal responsibility of safeguarding themselves. Nothing in these instructions should be interpreted to require AMS personnel to take any action believed to be hazardous. Should such a situation present itself, personnel should contact their supervisor immediately.

d. AMS personnel shall not enter spaces where the use of respiratory protection is required to do routine inspection. For emergency situations, refer to Appendix 4, para. 3.16.

e. AMS personnel must use caution when re-entering confined spaces after unattended periods and/or where such spaces contain oxygen/acetylene hoses, painting apparatus, and blasting equipment, or other equipment capable of polluting the atmosphere.

f. All AMS personnel assigned to duties which may involve confined space entry are to receive Confined Space Safe Practices Course and are to be familiar with the use of atmospheric monitoring devices (oxygen/combustible gas analyser, Draeger tubes, etc.) and be capable of assessing the hazards involved. For personnel performing periodic duty in confined spaces those persons may enter the spaces provided they have taken, as a minimum, the on-line Confined Space Safe Practices refresher course and enter with an AMS person properly trained as noted above. This also applies to personnel who have not had the opportunity to complete all mandatory pre-requisite requirements.

g. All spaces covered by the policy shall (after initial testing) be re-tested at intervals not to exceed twenty-four (24) hours or when conditions change.

h. Surveyors reserve the right to require re-testing before entering confined spaces.

i. Mobile telephones shall not be used in enclosed spaces and any other location where a hazardous condition (atmosphere) may exist.

7.5.2 Confined Space Entry – Maritime

a. Except as hereinafter provided, the following spaces on board a ship or barge, or other marine vessel, shall not be entered unless they have been certified as "safe for workers" (and "safe for hot work", if applicable) by;

- a Certified Marine Chemist,

- an Industrial Hygienist,
- a Shipyard Competent Person,
- or similarly qualified person. A duly authorized person appointed by the vessel's Owners, Deck Officer (normally the Chief Mate) is considered a similarly qualified person.

Definition: Certified Marine Chemist or similarly qualified person - the 'holder' of a valid Certificate which establishing the 'holder' as a person qualified to determine whether construction, alteration, repair, lay-up, or shipbreaking of vessels, which may involve hazards covered by a safety standard, can be undertaken with safety.

In the U.S. such Certificate is issued by the National Fire Protection Association in accordance with the "Rules for the Certification and Re-certification of Marine Chemists."

1. Cargo spaces or other spaces containing or having contained (in the last three cargoes) bulk liquids, gases or solids of a toxic, corrosive or irritant nature,
2. Spaces that have been fumigated,
3. Spaces immediately adjacent to those described above.

b. Except as hereinafter provided, the following spaces on board a ship or barge, or other marine vessel, shall not be entered unless they have been certified as "safe for workers" (and "safe for hot work", if applicable) by a certified Marine Chemist, an Industrial Hygienist, a Shipyard Competent Person, or similarly qualified person. If flammable or toxic vapours are found in the above by a shipyard Competent Person, then a Marine Chemist, an industrial hygienist, or similarly qualified person shall be required for the purpose of certifying the spaces as "safe for workers".

1. Compartments that have been sealed,
2. Spaces that have been coated and closed,
3. Freshly painted and unventilated compartments,
4. Spaces containing cargoes that Absorb oxygen, including but not limited to scrap iron, fruit, molasses, vegetable oils, etc.
5. Double bottoms,
6. Saltwater ballast tanks including peak tanks,
7. Spaces immediately adjacent to hot workspaces (which must be certified safe for hot work).
8. Spaces that have been inerted and spaces adjacent to inerted or loaded cargo tanks (reference IACS Rec. 72 for additional guidance).

c. All spaces must be continuously force ventilated during entry and immediately prior to entry for a sufficient period of time to produce a minimum of three air changes per hour.

d. When entering an enclosed space outside of a shipyard environment, AMS personnel shall enter only if accompanied by a person having responsibility for the work and a backup team of at least one experienced person is to be maintained at the entry to the space. The watch officer or person-in-charge is to be continuously aware of the AMS personnel's position. Rescue equipment including breathing apparatus, resuscitators, smoke masks, rescue lines, harnesses, a stretcher, etc. must be readily available at a central location.

e. Cofferdams, voids, and spaces used exclusively for fresh water (including when these spaces are adjacent to bunker tanks) which have been ventilated in accordance with (c) of this section (or in the case of fresh water tanks; voided within the last 24 hours) may be entered in accordance with 7.5.3.1, Safe Work Practice. If flammable or toxic vapours are found to be present during atmospheric testing, a Marine Chemist, an Industrial Hygienist, or similarly qualified person must certify the space as safe prior to entry.

f. Spaces not listed above may be entered subject to compliance with Items (a) through (h) of "Safe Work Practice" of 7.5.3.1.

g. Special consideration is to be given by AMS personnel when it becomes necessary to enter into a space known to have been subject to a casualty or damage (i.e., subjected to a fire, flooding, gas or liquid spillage, etc.). Special consideration is to consist of at least (but not less than) confirmation of the cause of the damage, type of cargo being carried in the space at time of the damage and possible effects that may have been caused to the existing substances or goods, by the ingress or actions of the involved external agents. Any space that appears to have unsafe conditions must be evaluated by a qualified person and be cleared as safe for entry before AMS personnel can enter in and perform work. Steps must be taken to correct the unsafe or hazardous condition of the space before entering.
h. All spaces covered by the policy shall (after initial testing) be re-tested at intervals not to exceed twenty-four (24) hours or when conditions change.

i. In spaces that have been certified “safe for workers” but NOT “safe for hot work”, the following precautions should be taken to preclude the creation of sparks in such atmospheres:

- Inspection hammers should be of a non-sparking type,
- Flashlights should be rated non-incendive,
- Cell phones and calculators should not be carried into the space,
- Radio communication and Camera equipment should be intrinsically safe, and
- Gloves should not be plastic material (or equivalent).

In addition, AMS personnel are to ensure that other personnel in the tank have taken similar precautions and that any lighting or staging provided meets explosion proof and non-sparking requirements.

7.5.3 Authorization for a ‘Shipyard Competent’ Person to act in lieu of a Marine Chemist or Industrial Hygienist (refer to Appendix 4, paragraphs 3.11-3.14 for additional information.)

When it is claimed that the services of a Marine Chemist or an Industrial Hygienist are not reasonably available, and certain local, national, or other governmental provisions do not apply, the Staff Member in-Charge (if previously authorized by the R/DSM), may authorize his/her staff to accept another person to act in place of the Marine Chemist or the Industrial Hygienist. In such cases, the following "Safe Work Practice" will apply:

7.5.3.1 Safe Work Practice:

a. The person or entity in charge of the vessel or rig (mobile or offshore unit) shall designate a **Shipyard Competent Person** (hereinafter referred to as ‘Competent Person’) who is trained in the use of atmospheric monitoring devices (i.e., oxygen/ combustible gas analyser, Draeger tubes, etc.). Qualifications of designee may be verified by on-site AMS personnel. In the case of MODU's legs, columns, spud cans, mat tanks, pontoon tanks and drill water tanks to be internally examined; testing must include tests for hydrogen sulphide (H_2S). Ballast tanks, which may have contained organic matter, must also be tested for H_2S.
In no case should AMS personnel be considered to be a Shipyard Competent Person or similarly qualified person.

b. The Competent Person shall test all the spaces to be entered using a calibrated, direct reading instrument for the following conditions in the order listed prior to entry:

1. Oxygen content,
2. Flammable gases and vapours,

3. Potential toxic air contaminants.

c. Prior to entry, the Competent Person shall complete an entry permit and make it available to AMS personnel for review. The entry permit shall include:

1. Date and time tests conducted, and validity of permit,
2. Space tested,
3. Results of test (oxygen, combustible gas, toxics, visual examination),
4. Instrument(s) used and date of calibration,
5. Name of Competent Person.

d. Hazardous energy sources communicating with the spaces to be entered are to be identified and locked out.

e. Tank entry in accordance with 7.5.2

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f. Ventilation in accordance with 7.5.2(c) is to be provided.

g. An attendant shall be stationed outside space entered and lines of communication are to be established and clearly understood. Emergency rescue services are to be immediately available.

h. Surveyor reserves the right to require re-testing before entering confined spaces.

7.5.4 Confined Space Entry - General Industry

Before entering a confined space AMS personnel are to be satisfied that the host contractor has documented and implemented a confined space entry program as follows:

a. The host contractor shall designate a Competent Person who is trained in the use of atmospheric monitoring devices, oxygen/combustible gas analyser, Draeger tubes, etc.)

b. The Competent Person shall test all spaces to be entered using a calibrated, direct reading instrument for the following conditions in the order given prior to entry:

1. Oxygen content,
2. Flammable gases and vapours,
3. Potential toxic air contaminants.

c. The Competent Person shall complete an entry permit and make it available to AMS personnel prior to entry. The entry permit shall include:

1. Date and time tests conducted, and validity of permit,
2. Space(s) tested,
3. Results of tests (Oxygen, combustible gas, toxics, visual examination),
4. Instrument(s) used and date of calibration,
5. Name of Competent Person

d. The host contractor shall identify and lock out all sources of hazardous energy communicating with the space(s) to be entered.

e. The Competent Person equipped with air monitoring device shall accompany AMS personnel into each space entered.

f. Forced air ventilation is to be provided (see 7.5.2 c).

g. An attendant shall be stationed outside space entered and lines of communication are to be established and clearly understood. Emergency rescue services are to be immediately available.

h. Surveyors reserve the right to require re-testing before entering confined spaces.

7.5.5 Inflatable Workboats for Inspection of Cargo or Ballast Tanks
The following are required when using inflatable workboats for the inspection of Cargo or Ballast Tanks:

a. Only rough duty, two (2) chamber inflatable boats are to be used.

b. All conditions noted in 8.5.2 or 8.5.3 as applicable are to be observed.

c. Adequate lighting of a certified safe type is to be available.

d. The workboat shall be used only in tanks containing clean ballast water. Rafting should be discontinued if the rise and fall of the raft within a cargo tank (due to the motion of ballast water caused by rolling) makes the operation difficult or hazardous. In making this decision, the team should consider the degree and period of roll, the proximity of rafting to the deckhead or other structure that could damage the raft, or injury to the people in the raft and expected manoeuvring that could add to excessive motion of the ballast water. While the actual limit will vary, a general guide is that the rise and fall of ballast water should not exceed about .25m, equivalent to about 1.5 to 2 degrees of roll per side on a V/ULCC. The water level in the tank should be stationary. On no account shall AMS personnel be in the boat when the water level in the tank is being raised or lowered.

e. All AMS personnel in the compartment are to wear personal flotation devices approved by an administration with capacity for the person using the device.

f. The workboat is to be tethered to the access ladder and an additional person stationed down the access ladder with a clear view of the workboat.

g. Lines of communication are to be established and clearly understood.

h. At no time shall the upside of the boat or raft be allowed to be within 1m of the deepest under deck face flat so that the Surveyor is not isolated from a direct escape route to the hatch.

i. The tank or hold must contain clean ballast water. Even a thin sheen of oil on the water is not acceptable.

7.6 USE OF RESPIRATORY EQUIPMENT
Personnel shall not enter spaces where the use of respiratory protection is required to do routine inspections. For emergency situations see Appendix 4, paragraph 3.16.

7.7 SMOKING
Although AMS has policies in place to restrict smoking in offices and company provided automobiles, AMS does not maintain a policy controlling the use of tobacco products by its personnel outside of those environments. However, personnel are to be aware of their surroundings and the possible hazards that exist when using tobacco products that require and/or maintain an open flame condition (e.g. smoking inside a confined space that may possess a hazardous environment).

Appendix 1 – Hazard Evaluation & Control

1. Purpose

This chapter provides information to AMS personnel concerning the potential hazards encountered in confined spaces.

2. Discussion

Since essentially all the activities, which may expose AMS personnel to hazards in the work place will be carried out on the premises under the ownership and control of others it is impossible to anticipate all hazards. This chapter has been constructed to identify the most probable hazards and describe procedures applicable for the various types of activities and work environments, which AMS personnel may encounter.

3. Hazard Evaluation

3.1 Hazards of Confined Space

For purposes of this manual, a confined space is defined as a space that;

(1) is large enough and so configured that personnel can bodily enter and perform assigned work;
(2) has limited or restricted means for entry and exit and
(3) which is not designed for continuous human occupancy and natural ventilation.

Entry includes ensuing activities in the confined space and is considered to have occurred as soon as any part of the entrant's body breaks the plane of the opening into the space.

Examples of confined spaces in the maritime environment include cargo tanks, cargo space ladder well, fuel and ballast tanks, cargo holds, double bottoms, voids and cofferdams, leg cans, mat tanks, pump rooms, etc. Under certain circumstances some machinery spaces and other limited access areas could also be considered confined spaces.

Additional examples from the industrial sector are tanks, pressure vessels, silos, hoppers, storage bins, vaults, open pits, boilers, sewers, manholes, etc.

The primary hazards are respiratory, the presence of a hazardous atmosphere, the difficulty of exiting the space in an emergency, and the difficulty of rendering assistance when necessary.

Oxygen deficiency is the hazard most often encountered in confined spaces and poses the greatest danger to personnel. The dangers of oxygen deficiency are severe because the senses are useless in recognizing the hazard and its effects are swift and generally irreversible. A confined space can become oxygen deficient when the oxygen in the space is either consumed or replaced. Consumption will result from fire, decomposition of organic matter, drying of paints or coatings, rusting of metals, etc. Oxygen may be replaced by another gas such as carbon monoxide, carbon dioxide, hydrogen sulphide (H_2S), petroleum vapours, inert gas, etc.

Flammable (combustible) Atmospheres are generally the result of flammable gases, vapours, dust mixed in certain concentrations with air, or an oxygen-enriched atmosphere.
Oxygen-enriched atmospheres are those atmospheres that contain an oxygen concentration greater than 22%. An oxygen- enriched atmosphere will cause flammable materials such as clothing and hair to burn violently when ignited.
An atmosphere becomes flammable when the ratio of oxygen to combustible material in the air is neither too rich (Upper Explosive Limit, UEL) nor too lean (Lower Explosive Limit, LEL) for combustion to occur.

Combustible gases or vapours will accumulate when there is inadequate ventilation in areas such as a confined space.

Flammable gases such as acetylene, butane, propane, hydrogen, methane, natural or manufactured gases or vapours from liquid hydrocarbons can be trapped in confined spaces, and since many

gases are heavier than air, they will seek lower levels of a space. In a closed top tank, it should also be noted that lighter than air gases may rise and develop a flammable concentration if trapped above the opening.

The work being conducted in a confined space can generate a flammable atmosphere. Work such as spray painting, coating, or the use of flammable solvents for cleaning can result in the formation of an explosive atmosphere. Welding or cutting with oxyacetylene equipment can also be the cause of an explosion in a confined space and shall not be allowed without a hot work permit. Oxygen and acetylene hoses may have small leaks in them that could generate an explosive atmosphere and, therefore, should be removed when not in use.

The atmosphere shall be tested continuously while any hot work is being conducted within the confined space.
Workers die because,

- They do not recognize the hazards,
- They trust their senses,
- They underestimate the danger,
- They become complacent,
- They try to "save their buddy".

3.2 Oxygen Deficiency
Oxygen is essential to life; normal atmosphere has an oxygen content of 20.8% by volume. In general, a Marine Chemist will not certify a space as safe for workers unless his oxygen indicator shows 20.8%.

In no case should AMS personnel enter into any space where the oxygen content is less than 20.8%.

For emergency situations see Appendix 4, para. 3.16. Oxygen deficiency can only be detected by the use of appropriate equipment; **it cannot be determined through an individual's senses.** Oxygen deficiency may arise through dilution or displacement by gases or vapours of volatile chemicals, which might otherwise not be considered hazardous. Such gases are referred to as simple asphyxiates (e.g., argon, helium and nitrogen).

Chemical or biological reaction processes may consume oxygen. Certain cargoes or residues of cargoes, such as, but not limited to, scrap iron, coal products, grain products, fresh fruits, wood chips (pellets), molasses, and various vegetable-drying oils slowly use up oxygen. Even in open holds such action has resulted in oxygen deficient atmospheres and fatalities. Oxidation, or rusting, of ferrous metals is itself an oxygen consuming process; “torching”, a process by which oxygen in a space is consumed by a burning candle in order to inhibit rusting, is yet another factor. The procedure in which a cargo tank or space is filled with inert gas to render it "safe for hot work" (e.g., for welding) will also displace enough oxygen to make the tank's atmosphere immediately dangerous to life.

Oxygen may be displaced if a supply hose used in inert gas welding is not properly secured at the end of workday. Enough argon or helium may leak during the night or weekend to displace oxygen to a dangerous

level. Spaces in which gas-welding equipment has remained overnight must be tested to ensure a safe oxygen content. [NOTE: Argon gas is heavier than air and will tend to linger in low-lying areas; helium, being lighter than air, will displace oxygen in the upper areas of the space.]

3.3 Oxygen in Excess

A condition where excessive oxygen exists is rare but it can occur, particularly when entry takes place to spaces at time of steel works or works requiring the use of steel cutting equipment. Atmospheres containing oxygen in excess of the normal air content of approximately 20.8% may become a dangerous and explosive hazard. AMS personnel should be familiar with or request information of the shipyard or vendor in respect to their safety policy, instructions to the workers, and precautions instructed to be taken at time of using oxygen/acetylene cutting equipment within confined spaces. In the event it is noted that no safety policy in this respect has been implemented, the AMS personnel are to ask for an immediate remedy to it.

3.4 Toxic Chemicals

Toxic vapours, gases, and particles may be found in many work areas and emergency locations under various conditions. The symptoms of exposure may be severe and immediate, or progressively debilitating years after exposure. The severe immediate effect referred to as acute toxicity, usually results from a single exposure to a high concentration of a toxic substance. A delayed effect, called chronic toxicity, may result from repeated low concentration exposures to toxic substances. The symptoms of low level exposures may take many years to manifest themselves.

Toxic substances may have good or poor warning properties. The presence of a toxic chemical may be quite apparent because of its odour; but personnel **must not rely on their sense of smell to detect chemical vapours**. Some chemicals deaden the sense of smell or cannot be detected by smell at hazardous concentrations (e.g., hydrogen sulphide and propylene oxide). Smoking or consumption of alcoholic beverages may accelerate toxic effects, or make the individual vulnerable to lower concentrations of chemicals, which might not be hazardous without the influence of alcohol or smoking.
For example, alcohol in the blood stream intensifies the effects of inhaled or ingested Halogenated hydrocarbons, such as carbon tetrachloride. The heat in a cigarette may cause vapours to break down to a more toxic product, such as phosgene.

Threshold Limit Values (TLV's). Chemical exposure limits have been established by the American Conference of Governmental Industrial Hygienists (ACGIH) for over 400 commonly shipped chemicals. These exposure limits are expressed in parts per million (ppm) or, in the case of particulates, as milligrams per cubic meter (mg/m3). The ACGIH pamphlet "*Threshold Limit Values and Biological Exposure Indices*", (referred to as the "TLV Guide", a copy of which is on file with the Division Safety Director), **provides annual updates** of both TLV-time weighted average (TWA) and TLV-short term exposure limit (STEL). The TLV's listed in the Guide are recognized by industrial hygienists as concentrations that can be safely tolerated by most individuals for 8 hours per day, 40 hours per week. TLV's are based on the best available information and represent TWA values (i.e., concentrations of atmospheric pollutants may vary above and below the listed value during an 8-hour exposure). Thus, the TLV represents the average concentration over the period of time of measurement.

In addition to the TLV, there is a **short-term exposure limit (TLV-STEL)** for some chemicals where no toxic effects have been reported from high short-term exposures. A STEL is defined as a 15-minute time weighted average exposure, which must not be exceeded during the workday. STEL exposures must not be repeated more than four times per day and there must be at least 60 minutes between exposures. In cases involving sequential or simultaneous exposure to different chemicals, additive toxicity probably occurs, i.e., one

chemical will neither enhance nor inhibit the effect of the other chemical, and the effect of the two together will equal the sum of the two individually. When the chemicals do not follow the additive model, the interaction is synergistic or agonistic; their effect is greater (or less) than the sum of the effects of the two chemicals' independent effects.

Another possibility is **potentiation**. This condition occurs when one substance is made more potent in the presence of the other substance. Thus, the TLV for a mixture of chemical vapours may be exceeded even though the TLV for none of the constituents has been. Some of the chemicals listed in the TLV Guide have "**Ceiling Values" (TLV-C).** These are the maximum values that personnel should not be exposed to, **values that should never be exceeded**. The TLV is a concentration limit established to protect most individuals against long or short-term hazards of a chemical. The ceiling value and values obtained by excursion factor exposure limits are referred to collectively as a "guide". However, they have been codified in 29 CFR 1915.1000 (Subpart Z - Toxic and Hazardous Substances). These are the (U.S.) OSHA
regulation guides for exposure to hazardous chemicals. The OSHA standards are referred to as "**Permissible Exposure Limits" (PEL).**

Toxic Cargoes. Most chemicals exhibit some degree of toxicity. Some chemicals may be lethally toxic in minute quantities; others may have little or no effect at the time of exposure, but cause debilitating effects years later. **Certain chemicals affect the nervous system, causing the individual to feel groggy or nauseous. In this condition, the individual becomes highly susceptible to serious injuries from slipping, tripping, or falling. Certain activities have the potential for adverse chemical vapour exposure**. Do not enter spaces that may contain cargo vapours unless they have been tested and certified "Safe for Workers" by a Certified Marine Chemist or in accordance with a "Safe Work Practice".

Carbon Monoxide (CO).

Carbon Monoxide is a colourless, odourless, and tasteless, non-irritating gas that is slightly lighter than air. CO is the product of incomplete combustion. It is found in smoke and fumes from all burning substances, and in the exhaust gases from all internal combustion engines.

When inhaled, the haemoglobin that part of the blood stream whose normal function is to carry oxygen, Absorbs carbon monoxide. Haemoglobin has an affinity for carbon monoxide about 200 times greater than for oxygen; consequently, Absorption of the gas is quite rapid. As the haemoglobin becomes saturated with carbon monoxide, death ultimately occurs from oxygen starvation.

However, long before that point is reached, pronounced physical disturbances occur. A carbon monoxide concentration of 0.05 percent (500 ppm) may produce unconsciousness in a little more than an hour, and may prove fatal in 4 hours. Higher concentrations may cause almost immediate unconsciousness and death within a few minutes. Resuscitation measures are usually successful with victims of carbon monoxide poisoning if they have not been exposed for too long a time, or to too great a concentration of the gas. Repeated exposures produce the same effect each time.

The danger of carbon monoxide poisoning is greatest in confined spaces where internal combustion engines are operated. It is also known that Carbon Monoxide has been developed in Cargo Spaces carrying cereals/vegetables (organic products) that may generate spontaneous combustion that remain incomplete causing the subject generation of carbon monoxide in relevant quantities. In order to ensure safe entry into such spaces the ventilators should be in operation and the carbon monoxide concentration is to be below 50 ppm. In the case of cargo spaces, as stated above, confirmatory checks of the space atmosphere should be required by the Surveyor at time of first entry when the space has not been entered for an extended period of time while carrying these types of goods due to the cargo hatches remaining closed.

Hydrogen Sulphide.
Hydrogen sulphide (H_2S) is a colourless, flammable gas with an offensive odour reminiscent of rotten eggs. While the human nose can detect the scent of hydrogen sulphide at concentrations as low as 1 ppm or less, **the nose is not a reliable guide. Hydrogen sulphide will deaden the sense of smell. As a person breathes, the strong odour of hydrogen sulphide seems to disappear.**

The primary hazard of **hydrogen sulphide** is its toxicity. Death is very rapid if concentrations in the range of 1,000-2,000 ppm are breathed. Respiratory paralysis with consequent asphyxia will result from exposure to concentrations of 700-900 ppm.

Over time, concentrations of 10-50 ppm may cause headache, fatigue, cough, burning or watery eyes, gastrointestinal upset, dizziness, and insomnia. Eye irritation has been reported from exposure to concentrations below 10 ppm, the current TLV. Personnel may work in the presence of low concentrations (10 ppm) of hydrogen sulphide for several hours or even days before experiencing irritation or discomfort. Symptoms of eye irritation generally start after several hours of exposure and may not appear until after the workday is over.

Personnel may encounter hydrogen sulphide when they are exposed to **"sour" crude oil or in confined spaces containing decaying organic material.** Hydrogen sulphide has also been found in dangerous concentrations in mat tanks and spuds of offshore drilling units.

Remember that hydrogen sulphide has a density greater than air, and it is therefore located at the bottom of confined spaces.

The concentration of hydrogen sulphide released into the air by sour crude can be lethal. During one topping-off operation, for example, the sour crude oil going into a tank had hydrogen sulphide concentration of only 70 ppm; however, the vapour stream coming out of an ullaged opening in the tank measured a deadly 7,000 ppm. Personnel conducting on board inspections during loading operations of sour crude should always stand upwind from all cargo tank opening.

When inspection personnel enter cargo tanks that have contained sour crude, or confined spaces containing organic materials, the hydrogen sulphide level in the atmosphere should be checked.

AGAIN - Remember that hydrogen sulphide has a density greater than air, and it is therefore located at the bottom of confined spaces.

Benzene.
Benzene, also known as benzol, is a toxic substance. The Environmental Protection Agency has classified benzene as a known human carcinogen. The International Agency for Research on Cancer (IARC) and the Occupational Safety and Health Administration (OSHA) have also determined that benzene has been linked to the development of blood cancers and blood disorders several years after exposure.

Benzene is a colourless liquid with a sweet odour. Benzene evaporates into air very quickly and dissolves slightly in water. Benzene is highly flammable. Most people can begin to smell benzene in air at 1.5-4.7 parts of benzene per million parts of air (ppm) and smell benzene in water at 2 ppm. Most people can begin to taste benzene in water at 0.5-4.5 ppm. One part per million is approximately equal to one drop in 40 gallons. Benzene is found in air, water, and soil. Benzene comes from both industrial and natural sources.
Brief exposure (5-10 minutes) to very high levels of benzene in air (10,000-20,000 ppm) can result in death. Lower levels (700-3,000 ppm) can cause drowsiness, dizziness, rapid heart rate, headaches, tremors, confusion, and unconsciousness. In most cases, people will stop feeling these effects when they are no longer exposed and begin to breathe fresh air.

Hexavalent Chromium Compounds – which is written as chromium (VI) or Cr(VI).
There are many hexavalent chromium compounds in industrial use, including: chromate pigments in dyes, paints, inks, and plastics; chromates added as anticorrosive agents to paints, primers, and other surface coatings; and chromic acid used to electroplate chromium onto metal parts to provide a decorative or protective coating.

Hexavalent chromium can also be formed during "hot work", such as the welding, brazing, and cutting of stainless steel or other chromium-containing metals and the melting of chromium metal. In these situations, the chromium metal is not originally hexavalent, but the high temperatures involved in the process result in oxidations that convert the chromium to a hexavalent state.

Workplace exposures to Cr(VI) in welding are dependent upon a variety of conditions including the type of material used, the type of welding performed, and the welding environment.
Welding activities with the greatest potential for exposure to Cr(VI) include welding stainless steel and welding in confined spaces or indoor conditions, on both stainless steel carbon (mild) steel. Welding fumes may generate from the base metal and applied coatings, electrode coatings, or from the filler metal or flux. High-chromium nickel allow electrodes and chromium-containing filler metals produce significant hexavalent chromium fume.
Similarly, certain types of base metals contain greater percentages of chromium than others and will result in more Cr(VI) in the welding fume.
The following types of welding may result in Cr(VI) exposures exceeding the PEL, in order from highest to lowest likely exposures:

1. thermal cutting (plasma cutting);
2. shielded metal arc welding (SMAW);
3. gas metal arc welding (GMAW);
4. flux-cored arc welding (FCAW);
5. air cutting,
6. air gouging;
7. plasma welding;
8. and oxy-fuel welding,

SMAW, GMAW, and FCAW welding use an electrode and filler metal that may contain Cr(VI); therefore, exposures are possible during those operations even when welding on a non-stainless steel base material.

Painting operations with the greatest potential for overexposures to Cr(VI) are spray painting, abrasive blasting for the removal of Cr(VI)-containing paint or primer, sanding, and grinding on Cr(VI)-coated materials. The primary hexavalent chromium compounds found in paints and primers are strontium chromate and zinc chromate.

Foundry, Steel Mill, and Other Molten Metal Handling operations with the greatest potential for overexposure to Cr(VI) are furnace and crane operations, molten metal pouring and transfer, tapping, surface conditioning, hot rolling, torch cutting and gouging, and welding.

The primary occupational health effect associated with hexavalent chromium compounds is an increased risk of lung cancer from inhalation exposures. In addition, health effects associated with exposure to chromium (VI) can include airway sensitizations, or asthma, skin sensitizations, e.g., allergic and irritant contact dermatitis, nasal and skin ulcerations, and eye irritation.

3.5 Welding

Toxic fumes may be generated during certain welding operations, especially in an enclosed space. Ozone and nitrogen oxide gases are produced during heli-arc and argon arc welding.

Ozone attacks the lungs and exposure to as little as 20 ppm could be lethal within a few hours; if ozone is present with about an equal amount of nitrogen dioxide, its toxicity increases.

Nitrogen dioxide also attacks the lungs and has poor warning properties. Dangerous amounts of nitrogen dioxide can be inhaled without discomfort, triggering pulmonary edema, which may be considered chemically induced pneumonia.

Welding of certain metal surfaces can have lethal consequences. For example, the heating of cadmium-plated metals produces highly toxic fumes that can kill in several minutes. Certain welding rods may be coated with highly toxic materials, such as lead, aluminium, and zinc, which require protective measures.
Before proceeding through an area where welding is taking place, the type of welding and the nature of the operation should be ascertained.

If the welders are wearing respirators, then the surrounding atmosphere may be hazardous to breathe and the area is to be avoided.

3.6 Paint Hazards

Painting in an enclosed space without adequate ventilation or respiratory protection is an unsafe practice.
Toluene and certain Ketones used as solvents and thinners can have a narcotic effect. The painter is liable to become nauseous or develop a headache, and may ultimately become unconscious and die.
Personnel should always exercise caution in freshly painted spaces and paint storage areas. In addition to the narcotic effect, the curing process will consume oxygen, making the space oxygen-deficient, and giving off carbon monoxide.

3.7 Fumigation Hazards

Fumigation has resulted in injury and death to workers and crewmembers. Grain cargoes are frequently fumigated during storage in the grain elevator or in transit in rail cars. Subsequent loading on barges or ships may occur while these fumigants remain in the grain, endangering personnel entering such hold spaces. Grain cargoes may also be fumigated on board a vessel or barge.
Signs warning of fumigation operations are required to be posted upon all gangways, ladders, and other points of access to the ship, and entrances to the spaces designated as not safe for workers. In addition, spaces next to fumigated spaces must not be entered into unless tested and found safe for entry.

Any space that has been posted not safe for workers shall NEVER BE ENTERED.

3.8 Solvents Used As Cleaning and Degreasing Agents

Most of these substances exhibit chronic and acute toxicity properties; many are Halogenated hydrocarbons (e.g. carbon tetrachloride).

The most common symptoms resulting from acute exposure to high concentrations of these chemicals are nausea, vomiting, diarrhoea, headache, and unconsciousness. If unconsciousness occurs, it may be followed by sudden death due to fibrillation (rapid, irregular contractions) of the heart or respiratory failure.

Repeated exposure to considerable lower concentrations of these Halogenated hydrocarbons may result in severe kidney and liver damage, which may eventually cause death. These chronic symptoms may not appear for 15 to 20 years after the exposure.

Methyl chloroform, Trichlorethylene, Perchloroethylene, and carbon Tetrachloride may be found in solvents used as degreasing agents. "Carbon-tet," which is being removed from the market, can cause sudden unconsciousness and death in high concentrations, and has been implicated as a carcinogen with repeated, routine exposure to low concentrations. Perchloroethylene has also come under suspicion as a carcinogen. Tetrachloroethane, which is an excellent solvent for a number of paints and lacquers, has no particular warning properties and can produce severe poisoning from continuous exposure to low concentrations.

NOTE: Fluorinated hydrocarbons are generally safer than chlorinated and brominated hydrocarbons.

Exposure to Halogenated hydrocarbons may be encountered in routine operations when such products are being used for cleaning. Care should be taken in enclosed spaces.

Do not enter any spaces in which cleaning solvents are being used.

3.9 Asbestos Fibres

The breathing of minute fibres of asbestos may eventually lead to asbestosis, a debilitating condition of the lungs.

It has also been implicated in otherwise rare forms of cancer, pleural Mesothelioma and peritoneal Mesothelioma, as well as cancers of the lung, stomach, colon, rectum, and esophagus.

Asbestos has been widely used as an insulating material on ships because of its fire-resistant properties. However, recent documentaries and publicity given to its carcinogenic properties have compelled its replacement with less hazardous materials, such as fiberglass. Structures (including ships) in an overhaul status may sometimes undergo a process referred to as “ripping out”. This process of removing asbestos insulation results in dangerously high concentrations of asbestos fibers in the air.

Personnel should be apprised of any asbestos removal operations and shall avoid areas where "rip out" operations are being conducted unless they have the required protective clothing and respiratory protective equipment.

Ventilation and respiratory protection are essential during asbestos removal operations. Asbestos dust, in minute yet dangerous quantities, may persist for months after the apparent removal of asbestos material. The danger appears to be related to fibre size and shape. Those particles most dangerous to humans are microscopic, not discernible by the unaided eye. Also, they are not easily detected by instruments as chemical vapours can be. Fibres must be collected and counted under a special microscope by an Industrial Hygienist.

Asbestos insulating blankets are another source of releasing asbestos fibres into the air. These insulating blankets have been used for furnaces, steam pipes and numerous industrial applications in which heat from steel furnaces and welding torches have posed a danger. Asbestos insulating and welding blankets, as well as asbestos gloves, aprons and full fire suits are manufactured from asbestos fabric and/or lined with asbestos. Like any fabric, these materials are subject to normal wear and fraying. They can also be torn open, releasing asbestos fibres into the work environment.

Although asbestos insulating blankets, welding blankets, aprons and gloves have been phased out over the past few decades in favour of silica and carbon fibre fabrics in most countries, the use of asbestos may continue in some areas.

Surveyors should be become familiar with the material used in the yards they attend and take the necessary precautions if they note damaged or frayed blankets.

3.10 Sandblasting
In sandblasting, a stream of sand is projected under pressure of 60-120 psi to prepare metallic surfaces for the application of paint or other coatings.

This method of abrasive cleaning, which is employed to treat both external and internal surfaces, produces a high concentration of respirable free silica within the working atmosphere.
There is an association between the levels and duration of exposure to free silica and the onset of silicosis. Silicosis is the permanent deposition of particulate material in the lungs (pneumoconiosis) that is caused by the inhalation of finely divided silicon dioxide in the free state.

The silicon dioxide may be in a crystalline form, such as quartz. The particles gradually become concentrated and discrete modular lesions of translucent fibrous tissue develop in the lungs. This fibrous tissue reduces the lungs' ability to supply oxygen to the blood. Although personnel are not directly involved in sandblasting operations, they can still be exposed to silica. The presence of suspended silica has been measured in various areas of operation during non-blasting periods. In many instances where the job sites were located close to or downwind from the blasting site, the workers were exposed to levels of respirable silica dust several times greater than the TLV (see paragraph 3.3). The TLV for silica is dependent on the percent of quartz in the blasting agent.

The higher the percentage of quartz in the agent the lower the TLV. Personnel should ascertain what type of agent is being used; if quartz-bearing sand is being used, the blasting area should be avoided or respiratory protection used. Information concerning the quartz content is normally printed on the bags containing the blasting agent.

3.11 Role of the Certified Marine Chemist –
also applicable to an Industrial Hygienist, a Shipyard Competent Person, or a Similarly Qualified Person

The certified Marine Chemist tests cargo tanks and other confined spaces and boundaries to ensure that these spaces are safe for alterations and repairs.
A space may be designated "safe (not safe) for workers" and/or "safe (not safe) for hot work." In order for a space to be designated "safe for workers," the Marine Chemist must determine that the atmosphere in the space has a minimum of 19.5% oxygen by volume and that toxic vapours are below TLV's, as designated in the ACGIH's TLV Guide

Note: AMS requires a minimum of 20.8% oxygen by volume.

The Marine Chemist must personally determine the condition of the tank or confined space, and test its atmosphere with appropriate instruments to ensure that it is safe.

3.12 Marine Chemist's Certificate
The certificate, which the Marine Chemist prepares on site, must be posted in a conspicuous location aboard where it can easily be examined by anyone who might enter the tanks or other compartments.

The following must be confirmed:

1. Issue time and date,
2. Vessel location,
3. Compare the data on previous cargoes (last three loadings) with the test methods for compatibility.
4. The Surveyor should examine the body of the certificate for the safety designations and additional instructions or precautions, such as ventilation, fire watch, or protective equipment.

The Marine Chemist's certificate should be carefully examined each time a confined space is entered. A Marine Chemist's certificate is valid for up to 24 hours, provided conditions are maintained and the prescribed work has commenced within 24 hours of the certificate. The “Shipyard Competent Person” under certain situations can maintain the certificate issued by the Marine Chemist.

3.13 Competent Person

A Competent Person is a person who has been trained in the hazards of Confined Spaces and is knowledgeable about the use of equipment and procedures for ascertaining that a confined space is safe for entry with respect to the hazards that may exist with the particular Confined Space to be entered.

When the local jurisdiction requires or recommends such persons to be certified, the person performing such work must possess such certification required or recommended.

The Competent Person can check the atmosphere in confined spaces for the level of oxygen and flammable vapours.

The Competent Person **cannot initiate** entry into spaces where previous cargoes were toxic, corrosive, or irritant in nature. Testing by the Competent Person may include toxic vapour tests as required to maintain the conditions of a certificate, as directed by the Marine Chemist.

The employer (contractor) having control of the work on OSHA Form 73 (in the U.S.) or equivalent must designate the Competent Person. The Competent Person must log all tests on OSHA Form 74 (in the U.S.) or equivalent. Such form must be examined to determine that the appropriate testing has been conducted.

3.14 Industrial Hygienist

The Industrial Hygienist (although basically trained in engineering, physics, chemistry, or biology) has usually acquired by additional study and experience knowledge of the effects upon health caused by chemical and physical agents under various levels of exposure. The Industrial Hygienist is involved with the monitoring and analytical methods to detect the extent of exposure, and the engineering and other methods used for hazard control.

An Industrial Hygienist is normally authorized to test for toxic atmospheric contaminants in confined spaces prior to conducting shipyard activities not involving hot work. The results of tests carried out by an Industrial Hygienist are to be reported on OSHA Form 74 (in the U.S.) or equivalent form.

3.15 Potentially Hazardous Situations

In case there are any questions about the certificate, the space must not be entered until the shipyard representative, the ship owner, or a representative contacts the Marine Chemist, or other similarly qualified person, and has the space re-certified.

Despite a Marine Chemist's certificate, personnel must be alert for any signs that might indicate that the space is unsafe. Odours from a space should not be ignored, but **a lack of odours does not guarantee a safe atmosphere** either.

Any unusual circumstance should be regarded as a warning signal. The Marine Chemist's certificate is good evidence, but it is not an infallible document. Unless the information on the document is current, its value is meaningless. Natural occurrences can make a space hazardous quite easily (residues may vaporize, pipelines may clog, and vapours may leak out of rust, scale, or insulation and contaminate the space).

Confined spaces that have contained bulk liquids, gases, or solids of a toxic, corrosive, or irritant nature, and have been certified for entry; must be continuously forced ventilated during the inspection. The Marine Chemist or Competent Person prior to entry must retest spaces to be entered in which ventilation has been removed. If conditions have not changed, ventilation should be re-started before entry is made. At least three air changes should occur before entering the space. The time required for one air change can be verified by determining the volume of the confined space in cubic feet (L x W x H) then dividing by the blower capacity (rating). The capacity is normally marked on the blower and is given in cubic feet per minute (CFM). The resultant answer will give the time in minutes required for one air change. If additional ventilation equipment is utilized, then their total capacity is used for the calculations.

3.16 Respiratory Protection Equipment

AMS personnel must not enter a dangerous atmosphere where the use of respiratory protection equipment is required.

The following is provided for information only in the event that such equipment is needed for exiting a space or compartment in an emergency situation.

A respirator must fit correctly so that its protective capability is delivered. Respirators must fit as perfectly as possible, offering a good seal with the face. Any facial hair between the sealing surface of the face piece and the skin shall not be allowed. This includes stubble, a moustache, sideburns, or a beard.

NOTE: A single day's growth of beard can prevent a good seal.

A person who is trained to test for proper fit and seal must correctly fit all respiratory devices to the wearer. Individuals who may be required to wear and use respiratory protection equipment shall be trained in its proper use and care, and fit-tested for the particular device to be used. The pressure-demand type Self-Contained Breathing Apparatus (SCBA) is the only type that should be used in atmospheres that are immediately dangerous to life or health (IDLH).

Self-Contained Breathing Apparatus (SCBA). The SCBA provides maximum respiratory protection and may be carried by an individual during emergency situations. This device has a self-contained air supply and a full-face piece. It offers the greatest protection against toxic and/or oxygen-deficient atmospheres. Proper fit and positive pressure within the facemask prevent hazardous air from reaching the wearer. A pressure-demand device ensures that positive pressure is maintained to prevent leakage of contaminants into the face piece (and to the wearer).

Supplied-Air Breathing Apparatus. This device relies on air passed through a length of hose to the wearer. The vulnerability of the hose, the possibility of it becoming entangled or snagged, and its 300-foot length limits an otherwise effective respiratory device. This type of protection is not suitable for use in toxic atmospheres.

NOTE: The location of the air supply inlet for the hose should be carefully considered, to avoid pumping contaminated air to the individual wearing the equipment.

Chemical Cartridge or Canister Air Breathing Apparatus. This offers the least degree of protection. Utilizing a chemical filter, this device is effective only against low concentrations of toxic chemicals and relies on the presence of oxygen in the atmosphere. It must be stressed that these units only filter air, they do not supply it. They are only effective for short periods of time, varying with concentrations of vapours being filtered.

The higher the vapour concentrations, the shorter the effective time of the filter. This type of device should be used only when the identity and concentration of the contaminant are known, and when it can be determined that the contaminant will be adsorbed or neutralized by the selected filtering media, and when there is sufficient oxygen present.

Emergency Escape Breathing Device (EEBD). This device provides air for escape only. An EEBD should never be used to enter a hazardous atmosphere. These devices are self-contained and easily carried. They are designed to be easily donned over the head and to provide breathing air for 5 minutes. EEBDs are intended for use when there is potential for adverse exposure to chemicals, such as during cargo transfer operations, topside inspection of loaded (loading) tank vessel or barges.
3.17 Physical Agents

Noise.
Noise induced hearing loss may be temporary or permanent, depending on the level and frequency characteristics of the noise, the duration of exposure, and the susceptibility of the individual. Usually, temporary losses of hearing sensitivity diminish and the original sensitivities are restored within about 16 hours.

Permanent losses are irreversible and cannot be corrected by conventional surgical or therapeutic procedures. Noise-induced hearing loss will initially be observed as a loss of hearing in the higher frequency range (4,000 Hz). If high-level exposures are continued, the loss of hearing will further increase around 4,000 Hz and spread into the lower (2,000 Hz) speech frequency range. Considerable difficulty in hearing conversational speech will be noticed when the hearing loss expands into the lower frequencies.

AMS personnel may be exposed to excessive noise when they are near specific shipyard operations, such as hull sandblasting. They also encounter impact noise when they are in a confined space (e.g., a cargo tank, and pounding or grinding work is being conducted on or in the tank).

When in areas of high noise levels (85 db or higher) ear protection is to be used.

Heat Stress.
Heat stress is defined as the total net heat load on the body, with contributions from exposure to external (environmental) sources, and internal metabolic heat production.

Exposure to heat stress conditions can produce physiological responses or displacement of functions referred to as heat strain, and is characterized by an increase in "core" or "deep body temperature," heart rate, blood flow to the skin, and water and salt loss due to sweating.

Conditions of excessive heat stress may occur either when the physical work is too heavy or the environment is too hot. As heat impinges upon personnel working in temperate environments, the first response is a sensation of discomfort. This discomfort increases as thermo-regulatory adjustments are made to

counteract thermal stresses on the body. Inefficiency in the performance of non-physical tasks, an increased propensity to minor accidents, and changes in the emotional tone of workers are found in association with these changes in sensation and body temperature.

As the heat stress on the body increases, the following heat disorders may manifest themselves:

Prickly Heat.
This is a condition in which dysfunction of the sweat glands, prevents sweat from reaching the skin surface and evaporating. The worker suffers from distressing sensations of prickling, tingling, and burning over the skin surface as the body tries to lose heat by sweating. Red, itchy rashes appear on parts of the body that have been covered by clothing. These rashes may persist for several days or weeks.

Heat Cramps.
These are painful intermittent spasms of the voluntary muscles following hard physical work in a hot environment. Cramps usually occur after heavy sweating, and often begin at the end of a work shift.

Heat Exhaustion.
Profuse sweating, weakness, rapid pulse, dizziness, nausea, and headache evidence heat exhaustion. The skin is cool and sometimes pale and clammy with sweat. Body temperature is normal or subnormal. Nausea, vomiting, and unconsciousness may occur.

Heat Stroke.
In this condition, sweating is diminished or Absent; the skin is hot, dry, and flushed. If uncontrolled, increased body temperature may lead to delirium, convulsions, coma, and even death. Medical care is urgently needed.
The primary method to reduce heat stress on the body is the acclimatization of personnel. In a heat-stressful situation, a person acclimatized to heat will have a lower heart rate, a lower body temperature, a higher sweat rate, and more dilute (containing less salt) sweat than a person who is not acclimatized at the start of exposure to excessive heat.

Both work and heat stress are required to initiate the body changes that result in acclimatization. Working in the heat for about two hours per day for a week or two will result in essentially full acclimatization. Acclimatization can be reduced by a measurable amount after only a few days of not working in hot working conditions. During and after acclimatization periods, fluid (water) and electrolyte (salt) levels must be maintained.

Personnel new to the marine field and personnel returning from illness or leave should be given adequate time to acclimate to hot working conditions.
If work is to be performed under the above conditions, the heat exposure limit must be maintained at or below the applicable TLV established by the ACGIH to protect personnel from the risk of acute heat illness. Note that the TLV's established by ACGIH are based on the worker wearing light summer clothing. They are not valid when wearing protective clothing, since this clothing impairs the body's normal heat exchange mechanisms (i.e., evaporation, convection, and Radiation).

Extreme Low Temperature.
AMS personnel working in cold environments need to understand the interaction between ambient temperature, wind speed, relative humidity, personnel protective equipment and task being performed. In order to limit the risk during operational activities due to cold stress and further prevent local cold injuries and general freezing, specific preventative measures should be evaluated and introduced during the planning and execution of the daily work activities.

3.18 Dusts

- Asbestos. See paragraph 3.9.
- Silica (Sandblasting). See paragraph 3.10.

Lead.

Lead can be absorbed into the body by inhalation or ingestion. Lead poisoning can cause severe damage to blood forming, urinary, nervous and reproductive functions, affecting the brain, nerves, muscles, child bearing and reducing sexual activity.

Lead accumulates in the body and poisoning can occur at low exposures over long periods (chronic) as well as at high exposures (acute). Personal protective equipment may be required including respiratory protection for exposure levels exceeding 50 micrograms per cubic meter. Exposures to lead ingestion occur primarily in activities related to painted metal structures during repair, renovation, maintenance and demolition and in general industry activities such as foundries.

AMS personnel are to satisfy themselves that exposure levels requiring respiratory protection will not be exceeded before entering such areas.

To minimize effects in case of contamination, shower thoroughly and change clothes after exposure.

NOTE: ALL AMS PERSONNEL SHOULD BE AWARE OF THE SAFETY PRECAUTIONS BEING USED BY THE WORKERS AROUND THEM. IF THE WORKERS ARE WEARING SPECIAL PROTECTIVE CLOTHING OR RESPIRATORY GEAR, THEN AMS PERSONNEL SHALL AVOID THE AREA.

3.19 Ionizing Radiation

The term radiation as used in this manual refers to a number of types of electromagnetic energy of varying wavelengths. Ionizing radiation refers to those wavelengths, which produce electric charges in air or other matter with which they come in contact. Ionizing radiation can take the form of both electromagnetic radiation (gamma and x-rays) and particulate radiation (neutron, alpha, beta, proton etc.). Ionizing radiation can damage living tissue and vital organs.

AMS personnel who may be engaged in areas adjacent to radiation areas are to be provided with personal monitoring devices; they are not to enter the radiation safety area without prior approval of their supervisor, and in such cases will be required to wear a personal radiation monitoring device.

3.20 Non-ionizing Radiation

Non-ionizing radiation is also part of the electromagnetic spectrum, and includes, in addition to visible light, infrared and ultra-violet light, lasers, microwaves and radio waves.

Ultraviolet.

Excessive exposure to ultraviolet radiation can result in serious damage to the eyes and skin damage associated with “sunlight”. Sunlight is the principal source of exposure to UV, but various welding processes also produce it.

Microwave.

The term microwave refers to electro-magnetic radiation normally propagated in the atmosphere by FM and radar transmitters. The primary effect of exposure to microwaves of sufficient intensity and time is an intolerable rise of body temperature.

Radio Frequency Radiation.

The most common sources of high frequency radiation (HF) are HF whip and broad band antennas. Exposure to HF can aggravate existing dermatitis, impair vision and cause temporary sterility. AMS personnel should stay at least 12 ft. from HF antennas at all times unless it is known for certain that they are not operating at more than 250 watts. Each person is cautioned to avoid areas where non-ionizing radiation can be expected to be present.

Appendix 2 - Code of Safe Practices

AMS has established the following rules, not all-inclusive, for the safety of all personnel. These rules exist to provide a safe working environment and to prevent accidents and injuries. As a condition of employment and continued employment, and per contract, all personnel are expected to observe and comply with all AMS safety rules, both general and specific to the department and/or job.

General Safety

1. Immediately report to your supervisor any unsafe condition, practice, procedure, equipment, or act.

2. Report all work related accidents, injuries, or incidents to your supervisor immediately, regardless of how minor you may believe them to be.

3. Horseplay, practical jokes, scuffling, and other acts which tend to have an adverse influence on the safety or well-being of personnel or others is prohibited.

4. Running in the facility is not permitted.

5. Use handrails when going up or down stairs or ladders.

6. Personnel who attempt to report to work under the influence of alcohol or drugs are dangerous and, if detected, will be prevented from working and will be subject to immediate disciplinary action up to and including discharge or termination of contract.

7. Comply with all safety-related warning signs.

8. Keep aisles, exits, and passageways unobstructed and well lighted.

9. Do not leave material, inventory, etc. on the floor, which could result in tripping hazards.

10. Materials and equipment are not to be stored against doors, exits, fire ladders, or extinguisher stations.

11. Never stack material precariously on the top of lockers, file cabinets, or other relatively high places.

12. Do not stack material in an unstable manner.

13. Smoking is not permitted inside AMS offices.

14. Always use proper lifting techniques.

15. Firearms or explosive substances are not allowed on the premise.

16. Use defensive driving techniques when driving and do not drive when overtired.

Fire Protection

1. Keep fire fighting equipment and fire exits clear and ready for immediate use. Know the evacuation routes from your work area.

2. Do not use fire extinguishers unless you know how to use them. Workers responding to fire or other emergencies should be suitably trained.

Electrical

1. Never tamper with electrical equipment.

2. Inspect electrical cords before use and report any electrical problems, frayed cords, or exposed wiring immediately.

3. All cords running into or across walk areas must be taped down or inserted through rubber protectors to preclude them from becoming tripping hazards.

4. Keep papers and other combustible materials away from electrical cords.

Office Area

1. Keep file drawers and desk drawers closed when not in use.

2. Do not open more than one upper drawer of a file cabinet at a time, particularly the two top drawers of tall file cabinets.

3. Never overload file cabinet drawers, always fill bottom drawers first, always use handles to open drawers.

4. Files and supplies should be stored in such a manner as to preclude damage to the supplies or injury to personnel when they are removed.

5. Keep floors clear, clean and unobstructed. Pickup pencils, paper clips, and other objects that could cause a slip.

6. Keep all legs of your chair on the floor. Tilting could result in a fall.

7. Report any worn carpet immediately.

8. Never store boxes or other materials where people might trip.

9. Avoid hurrying around corners.

Computer Operators

1. Posture

- Feet flat on floor.
- Knees should be at about a 90-degree angle (or more).
- Adjust chair to provide lower back support.
- Hip angle slightly more than 90 degrees.
- Shoulders relaxed.
- Elbows at about a 90-degree angle.
- Type with straight wrists.
- Tip head slightly down to view screen.
- Shift your position throughout the day to keep muscles loose and ease tension.
- Experiment to find what is comfortable for you.

2. Equipment Positioning

Keyboard

- Place on stable level surface.
- Keyboard should be directly in front of you with home row about elbow height.
- Move entire hand to reach function keys.
- If desired, a padded wrist rest will be provided to you.
- Keyboard can be flat or at low angle. If possible, and comfortable for you, vary angle slightly during the day.
- Use a light touch - don't pound!

Monitor

- Top of screen should be at, or just below, eye level.
- Line of sight should be about 15 degrees below horizontal.
- If you wear bifocals, see a doctor about special VDT glasses.
- Sit comfortable viewing distance from screen (usually 450- 600mm from eye to screen).
- Tilt screen to minimize glare and/or close window curtains.
- If desired, glare screens and/or hoods are provided.
- Keep screen and glare filter clean.
- Set brightness, level low, and contrast level to achieve crisp letters, against background.

Work Materials

- Source materials should be at same height, angle, and distance as computer screen.
- Keyboard shall be in front of you as you type with other materials arranged to the sides of the monitor.
- Task lighting and/or document holders will be provided upon request.

3. Exercise/Alternative Work Breaks

Do not sit for several hours in one position. Perform other work tasks and move around. Take short work breaks or alternate work tasks to alleviate fatigue

Appendix 3 - Lifting Techniques

Injuries caused by manual material handling are the most frequent type of on-the-job accidents. However, these injuries are preventable and the following are some of the things you must do to avoid injury:

Preparing for the Lift

- Clear any movable obstacles out of your way, and know where unmovable ones are.
- Cautiously heft the object you'll be moving to check its weight and centre of gravity.

Alternatives to Lifting

For difficult lifting tasks, you should:

- Ask a co-worker for help.
- Use a pushcart or other material handling device.

Pushing a load is easier on the back than pulling is. If you must pull something:

- Face the object squarely, with one foot at least 300mm in front of the other.
- Keep your back straight, bend your knees slightly, and pull in one smooth motion.

Performing the Lift

This is the part that causes most on-the-job back injuries. The keys to safe and easy lifting are:

- Fact the object squarely and get as close to it as possible.
- Balance yourself solidly, with one foot slightly in front of the other.
- Squat down, bending your knees. Keep your back straight and as nearly upright as possible.
- Grip the object firmly.
- Take a breath and hold it. Tighten your abdomen.
- Keeping your back straight, LIFT WITH YOUR LEGS to a standing position.
- Make the lift smoothly and under control.

Carrying and Lowering

- When carrying an object, grip it firmly and hold it as close to your body as possible.
- Use a safe technique for setting the load down.
- Keep your back straight.
- Tighten your abdomen.
- Bend at the knees.
- Whenever possible, store heavy loads off the floor.

Special Dangers

- Don't lift objects over your head.
- Don't twist your body when lifting or setting down an object.
- Don't reach over an obstacle to make a lift. Move whatever is in your way or go around it.
- Don't carry a load that obstructs your vision.

Acknowledgement Form

AMS Safety Manual

Name:

Company:

I acknowledge that I have reviewed the AMS Safety Manual and that my review was completed on

_____day of_____ of the year_____.

I understand that any violation of the policies or procedures contained within the AMS Safety Manual may subject me to discipline up to and including termination of my position.

Employee / Contractor: _____ (Name Printed)

Signature: _____

DATE: _____