

PROCEEDINGS



LEMBAGA LETRIK NEGARA
TANAH MELAYU



**BENGGKEL
PANDUAN
KESELAMATAN
(MEKANIKAL)**



10 - 12 MAC 1986



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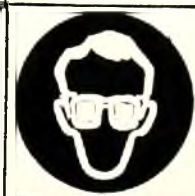
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<u>KANDUNGAN</u>	MUKA SURAT
1.0 RUMUSAN EKSEKUTIF	3
2.0 OBJEKTIF BENGKEL	6
3.0 UPACARA PEMBUKAAN DAN PERASMIAN	6
4.0 METHODOLOGI	9
5.0 RESOLUSI RESOLUSI BENGKEL	10
6.0 PERBINCANGAN KUMPULAN DAN PANEL	12
6.1 SESSI 1	13
6.2 SESSI 2	20
6.3 SESSI 3	32
6.4 SESSI 4	52
6.5 SESSI 5	70
6.6 SESSI 6	77
6.7 SESSI 7	89
7.0 UPACARA PENUTUPAN	99
8.0 PENGHARGAAN	102
LAMPIRAN	
LAMPIRAN A : ATURCARA BENGKEL	104
LAMPIRAN B : SENARAI-SENARAI PESERTA	106
B.1 SENARAI PESERTA BENGKEL	106
B.2 SENARAI KUMPULAN	108
B.3 Pengerusi Bengkel	109
B.4 RAPPORTEUR BENGKEL	109
B.5 JAWATAN KUASA PETUGAS	109

B.6	JAWATAN KUASA PENGELOLA	109
B.7	SENARAI JEMPUTAN HARI PEMBUKAAN	109
LAMPIRAN C : TUGAS DAN TANGGUNG JAWAB		
C.1	PENGERUSI BENGKEL	110
C.2	RAPPORTEUR BENGKEL	110
C.3	PENGERUSI KUMPULAN	110
C.4	RAPPORTEUR KUMPULAN	110

1.0 RUMUSAN EKSEKUTIF

1.1 The Workshop for reviewing of the "Deraf Panduan Keselamatan (Mekanikal)" was held from 10 - 12 March, 1986 at ILSAS. The Workshop was officially opened by Y.B. Dato' Pengurus Besar. Participants consisted of 29 professionals from LLN, 4 from Factories and Machinery Department, 1 from SIRIM, 1 from Fire Department, 1 from Electrical Inspectorate and 1 from Institution of Engineers Malaysia. The Workshop Task Force consisted of 9 Senior Officers from the LLN.

1.2 The workshop was conducted in 3 modules. The participants were divided into 5 groups for the first module who went through the entire draft document during the three days. They subscribed their views and comments and these were discussed in the second module in which 2 members of each group namely the group Chairman and Rapporteur, the Main Chairman and members of the Task Force took part.

1.3 The Task Force summarised the outcome of the above said discussions held with the Panel and these were tabled in the form of Resolutions for adoption. In the third Module these resolutions and adoptions were communicated to all participants for their concurrence.

4.0 Highlights of the Workshop

4.1 The document shall be called "Arahan Keselamatan (Mekanikal)".

- 4.2 The Workshop recommends the appointment of Safety Officers in all the Board's major power stations and suggests that redeployment of manpower is from retired power stations for this purpose.
- 4.3 Safety Officers should be trained so as to be effective in carrying out their tasks. The Workshop recommends that consideration to be given for overseas training of Safety Officers. Such trained Officers could on their return form the nucleus of a reference group and help ILSAS to conduct courses on safety.
- 4.4 The Chief Engineer (Operations) is to define gazetted areas in power stations where the use of helmets protective shoes and other safety equipments would become mandatory.
- 4.5 Members of the workshop expressed anxiety regarding the availability of copies of Technical Instructions issued several years ago. The Chief Engineer (Operations) has been requested to compile all relevant technical instructions and engineering instructions, and system operations instructions and that these are issued to all major power stations for their reference and retention.
- 4.6 The target date for implementation has been set as 1st September, 1986.
- 4.7 Finally, it was recommended that the LLN issue a "Safety Policy Statement" to stimulate safety consciousness among employees. The green crescent with the words "UTAMAKAN

KESELAMATAN" is to be adopted as LLN's symbol of safety. Annual safety awards are recommended for stations with good safety records. Citations are recommended to individuals who contribute towards the enhancement of safety by actions beyond the call of duty.

5.0 The Workshop deliberations proceeded with a keen sense of dedication and professionalism by the participants. The Task Force worked long hours with a concerted effort to complete as much of the task as it could in the given 3 days. Contributions by visiting participants deserved merit and everybody left the workshop feeling satisfied at having contributed towards the enhancement of safety in the LLN safety consciousness.

6.0 The facilities provided by ILSAS during this purpose was second to none and help the team to work late hours. In general, this workshop was a success. It was proposed however to review the "Arahan Keselamatan (Mekanikal)" every 2 years in the light of feedback from users with a view of updating the same.

7.0 The workshop came to a close with words of appreciation from the Chief Engineer (Generation Operations) and a commitment from the Director of ILSAS regarding courses that should be run on safety by September 1986.

8.0 We wish to record our appreciation to the Y.B. Dato' Pengurus Besar for his patronage and for facilities extended by way of manpower and resources for this workshop.

2.0 OBJEKTIF BENGKEL

(a) Mengkaji serta membuat perubahan dimana perlu pada deraf Panduan Keselamatan (Mekanikal) untuk memenuhi keperluan keselamatan perusahaan Lembaga Letrik Negara.

(b) Membincangkan masalah-masalah yang mungkin timbul semasa perlaksanaan Panduan tersebut dan mencadangkan tindakan-tindakan yang perlu diambil untuk mengatasinya.

3.0 UPACARA PEMBUKAAN

Upacara pembukaan resmi dimulakan dengan Ucapan Pengerusi Majlis diikuti oleh Ucapan alu-aluan Pengerusi Bengkel. Ucapan Pengerusi Bengkel adalah seperti dilampirkan. Pengerusi Bengkel menjemput Dato' Pengurus Besar, LLN memberi kata-kata aluan dan seterusnya meresmikan Bengkel ini.

Pengurus Besar didalam ucapan beliau merasa bangga bengkel ini diadakan. Beliau berharap kakitangan Lembaga dan juga penglibatan ahli-ahli dari agensi kerajaan yang berkaitan dapat membuat suatu Buku Panduan Keselamatan (Mekanikal) yang lengkap. Beliau menengaskan buku ini adalah perlu terutama sekali LLN telah beroperasi lebih dari 40 tahun. Ini adalah disebabkan sebagai contoh di Port Kelang Fasa 1 telah melibatkan 7 kematian kepada kakitangan pekerja-pekerja di tapak. Ini adalah satu rekod yang tidak baik dan berharap di fasa ke dua dapat dipertingkatkan keselamatan pekerja. Beliau seterusnya membuka Bengkel Panduan Keselamatan (Mekanikal) dengan resminya.

Ucapan Pengurus Besar adalah dilampirkan.

UCAPAN PEMBUKAAN RESMI
OLIH Y.B. DATO' JALALUDDIN BIN ZAINUDDIN
PENGURUS BESAR, LEMBAGA LETRIK NEGARA

Tuan Pengerusi, Tuan-tuan dan Puan-puan,

Adalah sangat mengembirakan bagi saya pada pagi ini dapat memberi ucapan atas tajuk Keselamatan Perindustrian dihadapan para jemputan yang arif dan pegawai-pegawai kanan LLN sekalian. Saya juga berasa bangga kerana bersama-sama kita dimajlis ini ialah ahli-ahli daripada Jabatan Kilang dan Jentera, Jemaah Pemeriksa Elektrik, Institut Jurutera-jurutera Malaysia, Jabatan Perkhidmatan Bomba, dan SIRIM.

Dengan penyertaan badan-badan ini saya yakin bengkel ini akan berjaya membantu meninggikan kesedaran keselamatan perusahaan di Malaysia.

Sebagai sebuah badan kemudahan awam yang besar seperti LLN ini sudah pasti ujudnya pelbagai bencana yang terlibat dengan aktibiti-aktibiti asas LLN yaitu penjanaan, penghantaran dan pembahagian tenaga elektrik. Sementara keutamaan dititik beratkan keatas keselamatan elektrik, keselamatan mekanikal serta kimia perlu juga diselaraskan.

Pada lazimnya andaian dibuat bahawa kemalangan hanya akan ditimpa pada orang lain dan bukannya diri sendiri. Inilah yang mendorong orang ramai dan khususnya pekerja-pekerja LLN mamandang ringan tentang amalan keselamatan. Kita perlu mencontohi syarikat-syarikat asing di Malaysia yang mengenakan amalan keselamatan yang tinggi.

Walaubagaimana pun kita tidak boleh mengenenepikan usaha gulongan tempatan yang tertentu seperti Persatuan Keselamatan Perusahaan kerana ianya telah pun ditubuh bagi menggalakkan kesedaran keselamatan di Malaysia. Sebagai menyambut secara positif kegiatan persatuan ini LLN menjadi ahli pada tahun ini.

Sebagai menyedari kehendak keselamatan, LLN telah melantik Jurutera Keselamatan Perusahaan pertama sejak pada tahun 1979. Adalah tepat waktunya pada masa kini, penimbangan diberikan keatas keselamatan sebagai bidang khusus dan ianya perlu dipandang serius.

Sebagai yang diketahui keselamatan akan sedikit sebanyak mempengaruhi kita semua dan dari itu komitmen perlu diberi olih semua peringkat di dalam organisasi.

Kita perlu berusaha sedaya upaya bagi meninggikan taraf keselamatan kerana kemalangan adalah begitu tinggi kosnya dari segi keawangan, tenaga manusia dan kelengkapan. Adalah menjadi kenyataan bahawa kita dipertanggungjawabkan dari segi moral untuk

memastikan tempat kerja yang selamat dan keliling tempat kerja yang sihat kepada semua pekerja.

Adalah tepat pada ketika ini saya ingin mendesak semua golongan supaya tidak bertolak ansur diantara keselamatan dengan keuntungan yang tinggi atau cepatnya siap kerja didalam melakukan tugas harian kita. Untuk meninggikan lagi prestasi bidang keselamatan dalam LLN, LLN dari masa kesemasa mengkaji peralatan-peralatan baru untuk digunakan pada tempat-tempat dimana keselamatan perlu dipertingkatkan. Sebagai contoh penggunaan gas, angin dan vacuum gears dengan lebih luas sebagai mengurangkan kegunaan sistem minyak untuk mengurangkan resiko kebakaran dan letupan. Tidak dapat dinafikan bahawa kemalangan berlaku didalam LLN dan tarafnya adalah hanya dari pengalaman pahit sehingga kepada kehilangan jiwa. Oleh kerana kebanyakan kemalangan dapat dielakkan, kita patut mencuba mengambil langkah sebeberapa praktik yang perlu untuk memastikan keadaan tempat kerja yang selamat. Ini dapat dicapai dengan menanamkan semangat kesedaran keselamatan dan meninggikan taraf tempat kerja yang selamat.

Thema hari terbuka LLN pada tahun ini ialah Keselamatan Elektrik yang merangkumi aspek-aspek keselamatan elektrik bagi pengguna-pengguna kediaman, keselamatan elektrik bagi pengguna-pengguna perusahaan, perindustrian dan pelombongan, keselamatan elektrik semasa menjalankan tugas dan keselamatan elektrik bagi projek-projek utama yang dilaksanakan oleh LLN.

Berlandaskan thema ini adalah diharapkan usaha dipertingkatkan untuk menerapkan kepada orang awam dan juga pekerja LLN tentang perlunya keselamatan.

Saya berasa bangga peserta-peserta bengkel ini bukan hanya dari kalangan pekerja-pekerja LLN sahaja malah dihadiri oleh ahli-ahli mahir dari badan-badan tertentu. Dengan kerjasama dari semua peserta, saya yakin akan terdapat pertukaran idea dan juga kemahiran yang akan membolehkan pembentukan panduan keselamatan mekanikal yang lengkap diwujudkan.

Dengan itu saya dengan bangganya membuka bengkel ini dengan resminya.

4.0 METHODOLOGY

A Task Force was formed to draft Mechanical Safety Guidelines for the use of LLN staff. A Workshop was considered necessary to allow further deliberation before such guidelines could be adopted and implemented. The participants of this Workshop comprised of experienced Senior LLN staff from the relevant mechanical and chemical disciplines. For further exchange of ideas and expertise officers from the Factories and Machinery Department, Electrical Inspectorate, Institution of Engineers Malaysia and SIRIM were invited to participate.

Draft proposals were distributed to all participants three weeks before the Workshop so as to allow participants more time to come well prepared for the Workshop. The Workshop was carried out in three modules i.e. Group Discussions, Panel Discussions and Sessions for the Adoption of Resolutions.

Participants were divided into five groups. The aim of dividing them into groups was to have a close deliberation on the contents of the draft proposal. After each group discussion, the respective groups submitted comments, amendments and additions to be submitted for the Panels consideration and discussion. They were also to raise issues relating to the implementation of the Safety Guidelines in the LLN.

Members of the Panel comprised of the Main Chairman, each group chairman and rapporteur, members of the Task Force and the Main Rapporteur. The aim of the Panel Discussion was to discuss and adopt any comments, amendments and additions to the draft. It was also to formulate resolutions for adoption in the Workshop. The adoption on the resolutions was held in the presence of all participants.

5.0 RESOLUSI-RESOLUSI BENGKEL

5.1 The Panduan Keselamatan (Mekanikal) shall be called "Arahan Keselamatan (Mekanikal)" or "Safety Instructions (Mechanical)."

5.2 The Task Force shall design a format and write out procedures for the issue of a Permit-to-Work Certificate (Mechanical) for Contractors. This shall be similar to the existing Permit-to-Work Certificate (Electrical) for Contractors.

5.3 The Chief Engineer (Generation Operations) shall produce a format for a Mechanical Authorisation Certificate. This shall be similar to the existing Authorisation Certificate (Electrical).

5.4 All Heads of Departments shall be issued with copies of the revised Safety Instructions and given a period of one calendar month to familiarise themselves before the effective implementation date of 1st September 1986.

5.5 The Lembaga Letrik Negara recognises that the Factories and Machinery Acts requires Shift Charge Engineers, in charge of boilers to hold a valid engineer's certificate of competency for steam boilers and steam engines issued by the Factories and Machinery Department. In view of this the Chief Engineer (Generation Operations) shall negotiate with Factories and Machinery Department to find ways and means of facilitating the issue of such certificates to existing Shift Charge Engineers in the board.

5.6 The wearing of helmets, safety shoes and other appropriate personal protective equipment shall be made mandatory in gazetted areas. The Chief Engineer (Generation Operations) shall define all such areas to be gazetted.

5.7 The use of the Key safe (lock out box) system is desirable in the interest of safety and shall therefore be implemented at all Power Stations.

5.8 Station management shall appoint, in writing, employees who are required to operate any heavy and/or articulated equipment.

5.9 It is a Factories and Machinery Department requirement that all crane hooks be provided with safety catches. Existing hooks not so provided, shall be recalled, and replaced by those with safety catches.

5.10 It is strongly recommended that Safety Officers be trained in all aspects of safety. Training would ensure effectiveness and professionalism in implementation of safety procedures. Trained officers could also form the nucleus of a reference group to assist ILSAS to organise and operate safety courses.

5.11 In the interest of enhancing safety in power stations, station management shall provide a list of tools required for each and every maintenance job. This will ensure the use of right tools for the right job.

5.12 The Chief Engineer (Generation Operations) shall compile all relevant technical instructions, engineering instructions and system operations instructions and issue them to all power stations for their reference and retention.

5.13 Lembaga Letrik Negara shall issue a policy statement on safety to promote safety consciousness amongst its employees. Such a policy statement shall declare top management's commitment in making all work areas within Lembaga Letrik Negara safe.

5.14 Lembaga Letrik Negara shall adopt the 'green crescent' with the words 'Utamakan Keselamatan' on it as its safety symbol.

5.15 The present practice of lodging Permit-To-Work shall cease. Instead, the Permit-To-Work shall be cancelled to enable plant to be operated. A new Permit-To-Work shall be issued for maintenance work to continue thereafter.

5.16 Safety awards shall be made annually to stations with good safety records. Special safety citations shall be given to staff for actions beyond the call of duty in preventing major accidents. Such awards shall be given on the recommendations of the Head of Department.

5.17 Chemicals designated as 'poison' under the Poisons Ordinance 1952, requiring permits/licences shall be applied for by the registered station chemist.

5.18 All matters pertaining to the handling and usage of hazardous and concentrated chemicals in stations shall be referred to the Station Chemist.

5.19 The target date for implementation of the "Arahan Keselamatan (Mekanikal)" shall be 1st September 1986.

6.0 PERBINCANGAN KUMPULAN DAN PANEL

The workshop has been divided into seven (7) sessions. In this proceeding session is termed as Sessi. Each Sessi deliberated over specific sections of the draft Safety Guidelines as shown below:-

SESSI 1	SECTION 1.1 TO SECTION 2.11
SESSI 2	SECTION 3.1 TO SECTION 3.3
SESSI 3	SECTION 3.4.10 TO SECTION 3.5.8
SESSI 4	SECTION 3.6
SESSI 5	SECTION 3.4.1
SESSI 6	SECTION 3.4.2 TO SECTION 3.4.9
SESSI 7	SECTION 3.7

The results of each sessi is presented into two parts. The first part is the recommendations derived from the panel discussion. The second part is the version which will be compiled into the final Safety Instructions (Mechanical). The underlined sentences appeared in the second part are the necessary changes made to the earlier draft Safety Guidelines.

6 . 1

SESSI 1

RECOMMENDATIONS

1. The Panduan Keselamatan (Mechanikal) shall be called Arahan Keselamatan (Mekanikal) or Safety Instructions (Mechanical).
2. The Task Force shall come out with the format and procedures for the issue of the Permit to Work Certificate (Mechanical) for Contractors.

This shall be similar to the existing Permit-to-Work Certificate (Electrical).

3. The Chief Engineer (Generation Operations) shall also come out with the format of the Mechanical Authorisation Certificate. This shall be similar to the existing Authorisation Certificate (Electrical).
4. The Lembaga Letrik Negara recognises that the Factories and Machinery Department's requirement with respect to Engineer's Certificates of Competency for steam boilers and steam engines is mandatory.
7. It is agreed that the Key safe (lock out box) is a good practice and shall be implemented in the Lembaga Letrik Negara.

GROUP/PANEL DISCUSSION

SECTION 1

GENERAL PROVISIONS

1.1 STATUTORY REQUIREMENTS

The following constitutes certain legal provisions which must be complied with:

- (i) Electricity Act 1949.
- (ii) Electricity (Board Supplies) Rules 1949 made under Section 89 of the Electricity Act.
- (iii) Electrical Inspectorate Regulations 1984 made under Section 38 of the Electrical Inspectorate Act 1983.
- (iv) Factories and Machinery Act 1967.
- (v) Factories and Machinery (Safety, Health and Welfare) Regulations 1970.
- (vi) Factories and Machinery (Steam Boilers and Unfired Pressure Vessels) Regulations 1970
- (vii) Factories and Machinery (Certificates of Competency-Examinations) Regulations 1970.
- (viii) Factories and Machinery (Persons-In-Charge) Regulations 1970.
- (ix) Factories and Machinery (Fencing of Machinery And Safety) Regulations 1970.
- (x) Factories and Machinery (Notification, Certificate of Fitness and Inspection) Regulations 1970.
- (xi) Factories and Machinery (Electric Passenger and Goods Lift) Regulations 1970.
- (xii) Factories and Machinery (Building Operations and Works of Engineering Constructions) Regulations 1986.
- (xiii) Factories and Machinery (Lead) Regulations 1984.
- (xiv) Petroleum Safety Measures Act 1984.
- (xv) Uniform Building By-Laws 1983.
- (xvi) Atomic Energy Licensing Act 1984.

- (xvii) Radioactive Substances Act 1968.
- (xviii) Chemists Act 1975.
- (xix) Environmental Quality Act 1974.
- (xx) Poisons Ordinance 1952.

And any other Statutory Requirements enforced from time to time.

All Lembaga Letrik Negara Engineers, Technical Assistants and other supervisory personnel are expected to be thoroughly familiar with such provisions of the above mentioned Acts, Rules and Regulations as are related to their particular areas of work. These documents are to be made readily accessible at all stations and worksites.

1.2 OBJECTIVE OF SAFETY INSTRUCTIONS (MECHANICAL)

The Lembaga Letrik Negara has made the following safety instructions for the protection of the Lembaga Letrik Negara employees, consumers, contractors and others, to govern the working and control of all functions relating to the electricity supply throughout the Lembaga Letrik Negara installations and to ensure the safety of all who may work on the Lembaga Letrik Negara installations.

These instructions are in addition to and not in lieu of any of the legal provisions in Section 1.1 or the Lembaga Letrik Negara's own technical instructions, engineering instructions and system operation instructions and any other safety instructions issued by the Lembaga Letrik Negara from time to time.

1.3 RESPONSIBILITIES

It is the responsibilities of all Persons who may be concerned with the operation of, and work on the Lembaga Letrik Negara installations, to make themselves thoroughly conversant with the statutory requirements and safety instructions governing any work they may have to undertake on the system and equipment. Ignorance of the statutory requirements and the safety instructions as well as the Lembaga Letrik Negara technical instructions, engineering instructions and system operation instructions will not be accepted as an excuse or mitigation for neglect. The **Person-in-charge** of a working party shall ensure at all times that members of his party thoroughly understand all the implication of work they have to do and adhere to the safety instructions.

1.4 ISSUE OF SAFETY INSTRUCTIONS

Head of Departments shall ensure a copy of safety

instructions to be issued to such employees of the Lembaga Letrik Negara as may be concerned with the operation of, or work on any Lembaga Letrik Negara installation. A person in receipt of the Safety Instructions shall sign a receipt for his copy which shall be kept in good condition.

1.5 PERSONAL SAFETY EQUIPMENT

Safety equipment which has been provided by the Lembaga Letrik Negara for the protection and use by persons required to work on the Lembaga Letrik Negara installations must be properly used on all appropriate occasions. Each item of safety equipment must be examined by the **Person-In-Charge** and the user to check that it is in good condition subject to wear and tear before and after use. When in doubt the user shall confirm with the **Safety Officer** the reliability of safety equipment. Equipment found not in good condition must be clearly marked "DEFECTIVE" and returned to stores and the user shall be issued with a suitable replacement.

1.6 REPORTING OF DANGEROUS SITUATIONS

When any person sees any dangerous or unsafe situation, he shall take remedial action, if possible, and immediately report such an occurrence to the **Person-In-Charge**.

1.7 DANGEROUS OCCURANCES AND ACCIDENTS

All dangerous occurrences and accidents shall be reported in accordance with the Lembaga Letrik Negara's standing instructions and statutory requirements.

1.8 PROCEDURE FOR ISSUE OF CERTIFICATES OF AUTHORISATION AND CERTIFICATE OF COMPETENCY (MECHANICAL)

The procedure for issue of Certificates of Authorisation and Certificates of Competency will be in accordance with the Lembaga Letrik Negara standing instructions.

1.9 VARIATION OF INSTRUCTIONS

In exceptional circumstances these safety instructions, without prejudice to any statutory requirement may be varied to such an extent as shall be authorised in writing by the local head of department after consultation and approval by the Lembaga Letrik Negara's Standard, Technical Advisory and Work Safety Committee.

SECTION 2

DEFINITIONS

2.1 AUTHORISED PERSON (MECHANICAL)

A person over 21 years of age appointed in writing by the Chief Engineer (Generation Operations) to carry out specific work on the lembaga Letrik Negara systems, equipment or plant.

The certificate of appointment shall state the location and equipment plant or section of the system to which it applies. (See Appendix 3 for sample of certificate)

The **Authorised Person** is empowered to isolate plant, to make it safe to work on, and to issue and cancel **Permits-To-Work Certificate (Mechanical)** within the terms of his appointment.

2.2 CAUTION NOTICE

A notice in approved form attached to the control station of an equipment conveying a warning against interference with such equipment.

2.3 COMPETENT PERSON

A person over 21 years of age who holds a valid Certificate of Competency issued by the Station Superintendent or head of department. An **Authorised Person** is deemed to be a **Competent Person**.

2.4 DANGER

A risk of loss of life, or bodily injury or to health .

2.5 DANGER NOTICE

A notice in approved form attached to equipment or sections of plant to draw attention to the **Danger** of approach to or interference with such equipment or section.

2.6 INSTALLATION

Any plant or equipment designed for the supply, or use, or both, as the case may be, of energy, including prime movers with all necessary plant, buildings and land in connection therewith, pipelines, supply lines and consuming equipment if any.

KEY SAFE (Lock-Out-Boxes)

An approved device for the secure retention of all keys used to lock means of isolation, earthing or other safety devices necessary for the issue of a **Permit-to-Work Certificate (Mechanical)**. It may consist of a box fitted with a number of locks of a type operated by non-interchangeable keys. In addition, one lock of each safe shall be of a type that can be operated only by a key in the possession of an **Authorised Person**.

PERMIT-TO-WORK CERTIFICATE (MECHANICAL)

A declaration in the form as shown in Appendix 1 to these instructions signed and given by an **Authorised Person** to a **Competent Person** in charge of work for the sole purpose of making known to him exactly what equipment is isolated from all **Danger** and on which it is safe to work. A **Permit-to-Work Certificate (Mechanical)** must be issued to a **Competent Person** in charge of each **Working Party**.

PERMIT-TO-WORK CERTIFICATE (MECHANICAL) FOR CONTRACTORS

A declaration in the form as shown in Appendix 2 to these instructions, signed by an **Authorised Person**, endorsed and given by a **Competent Person** to the Contractor's **Person** in charge of the working party.

10

SAFETY OFFICER

An officer appointed by the Lembaga Letrik Negara to be responsible for all aspect pertaining to safety practices and accident prevention in the working area.

11

SHIFT CHARGE ENGINEER

The shift engineer in charge, or other person appointed by the Lembaga Letrik Negara for regulating the generation of electrical energy and for the operation of machinery/equipment at the generating station. The **Shift Charge Engineer** shall be an **Authorised Person**.

In the case of steam stations the **Shift Charge Engineer** shall hold a valid Engineer's Certificate of Competency for steam boilers and steam engine issued by the Factories and Machinery Department.

12

WORKING PARTY

A **Competent Person** and those working under his immediate supervision.

6.2

SESSI 2

RECOMMENDATIONS

- (1) Wearing of Safety Helmets and other safety devices shall be made mandatory in areas gazetted by the Chief Engineer (Generation Operations).
- (2) The Task Force shall look into available local standards on Hand Singnals for Controlling Operation of Overhead and Gantry Cranes.

SECTION 3

SAFETY RULES FOR WORK ON MECHANICAL PLANT

3.1. GENERAL SAFETY PRECAUTIONS

3.1.1 Before commencing work on any Lembaga Letrik Negara's installations, physical isolation and locking-off of the plant from ALL sources of **Danger** shall be adopted as the prime safety precaution.

3.1.2 Where work is to be carried out on plant that is electrically driven, switches and/or isolators controlling the supply of electricity to all the motors shall be locked in the "open" position, and fuses or links withdrawn where practicable and the key locked in a **Key Safe**. Circuit Breakers are to be racked out wherever possible.

3.1.3 **Danger Notices** shall be attached to all the points of isolation (Mechanical and Electrical).

3.1.4 Where personnel safety equipment such as belts, harnesses, helmets, goggles, protective shoes and special clothing are required, all such equipment and their use shall be mandatory.

3.1.5 Where portable ladders, cranes, scaffolding or conveyor belts are to be used, all such equipment, associated ropes and block and tackles used, shall be inspected regularly and ensured to be in good working condition.

3.1.6 Where ladders, as indicated in 3.1.5 above, are to be used in the presence of electrical equipment, the ladders shall be of the insulated type so as to enhance electrical safety. Such ladders shall be inspected to ensure that insulation is not damaged prior to any work being undertaken.

3.1.7 No plant shall be continuously operated with any of its trip interlocks or safety devices disabled.

3.1.8 For fired and unfired pressure vessels, hoisting and lifting machinery, a valid Certificate of Fitness issued by the Factories and Machinery Department is deemed necessary.

3.1.9 Locks used for isolation shall be of the non-standard type. Master keys must not be used.

3.2 SAFETY OF PERSONNEL

3.2.1 Falling

- (a) Access openings and holes in the ground or floors shall not be left unfenced. Where such openings are of temporary nature Caution Notices shall be posted.

- (b) Barriers around any opening shall be safely secured.
- (c) Safety belts shall be worn when working at a level 3 metres or more above ground on a platform, unless proper scaffolding with closed floorings, handrails and toe boards along the open sides have been installed. The user shall ensure that safety belts are in sound condition and properly fastened to a safe and secure connecting point.
- (d) Cat-walks or crawling boards shall be made use of when working on roofs made of fragile materials.
- (e) When replacing ducts and cover plates it shall be made certain that they are firmly located in their correct position.
- (f) Oil, grease or any other spillage shall be removed as soon as possible.
- (g) Passageways, stairways and working areas shall be kept tidy. Tools and equipment shall not be left lying about in areas where workers may trip over them. All railings removed shall be replaced. Scrap and rubbish shall be removed to a place for disposal.
- (h) The right ladder or scaffolding shall be used for the job. Make-shift methods to reach a height have caused many accidents. Boxes or drums shall not be used to reach heights.
- (i) Ladders shall be examined immediately before use to ensure that they are in good condition and shall be erected at a safe angle. As a guide it is safe to erect at a slope of 4 in 1. The ladder must be secured by lashing it or by having a man to 'foot' it.
- (j) Large or heavy objects shall not be carried up a ladder.

3.2.2 Lighting

- (a) Lighting shall be adequate for the job at all times, with special emphasis on work being carried out in dark places or at night. Minimum industrial standards shall be in accordance with recommendations of SIRIM, BS, or IEC.
- (b) All lighting leads and cables shall be so placed so as not to cause any danger or obstruction to the workers in their vicinity and shall comply with Clause 29 of Factories and Machinery (Safety, Health and Welfare) Regulations of 1970 (Revised 1983).
- (c) All portable temporary lighting used shall be supplied from an isolation transformer with reduced voltage and

comply with the recommendations of paragraphs 13 and 14 in page 405 the Electricity Regulations of 1951 (Revised 1977).

3.2.3. Electricity

- (a) Lamps or other instruments not of an approved type shall not be used. Make shift testers and long bare metal probes are prohibited.
- (b) Extra care shall be taken with cables, connections and other electrical equipment when working in damp places, or where there is a lot of earthed metal work around.
- (c) Any electrical connection shall not be interfered with or touched before being checked by a Competent Person.
- (d) A check shall be made before use to ensure that electrical plugs, sockets, glands and cables are intact and that the cable is not worn or frayed. The ratings of plugs, sockets, glands and cables for the task in hand shall be ensured by a Competent Person.
- (e) Any faulty electrical equipment which may constitute a Danger shall be reported immediately.
- (f) The location of the nearest isolator switch shall be determined before starting work.
- (g) No work shall be done on live equipment without a Permit-to-Work.
- (h) Before commencing work, it shall be ensured that all electrical equipment used are effectively earthed.
- (i) Before commencing work, an authorised person shall identify the right electrical equipment or plant that is to be worked upon and that it has been isolated from all sources of supply. Wherever possible, the plant shall be earthed.
- (j) All electrical hand-tools shall be double insulated and operated at 110V through an isolation transformer.

3.2.4 Good House Keeping

- (a) On completing a job, the work place shall be left clean and tidy. All tools and equipment shall be returned to their original storage places.
- (b) Any spilt oil or grease shall be cleaned up immediately after work has been completed for the day. The presence of grease and oil is particularly

dangerous on stairs, steps, hand-rails and passage-ways and special attention shall be paid to these areas.

- (c) Gang-ways, passage-ways, stair-ways and marked aisles shall always be kept clear from all obstructions.
- (d) Oily rags or cotton waste are fire hazards. They shall always be put away in a non combustible container separate from other rubbish containers.

3.2.5 Personnel Protective Equipment

- (a) Suitable protective equipment shall be used as required: helmets for the head, goggles for eyes, masks for the face, respirators for lungs, gloves for the hands, safety shoes for the feet, ear plugs/-mufflers for the ears, etc.
- (b) Eyes shall be protected by wearing goggles or safety glasses when welding, cutting, grinding, chiselling, drilling, turning and machining are being carried out.
- (c) Suitable hand gloves shall be worn when handling hot, sharp, rough or corrosive materials.
- (d) Safety helmets shall be worn at all LLN installations gazetted as Safety Helmet Areas. In all other areas, the use of safety helmets is encouraged.
- (e) Reflective safety vests shall be worn when working along a public road.
- (f) Breathing apparatus shall be used when tracing toxic gas leakages.
- (g) Life jackets shall be worn when working in a place where there is a likelihood of drowning.
- (h) The appropriate personnel protective equipment shall be worn when handling chemicals.

3.2.6 Safety And The Supervisor

Supervisors/Foremen are responsible for taking all reasonable action to safeguard personnel and equipment under their control. In order to do this they shall ensure that each person under their control is aware of the safety requirements for a particular job.

The following principles shall be observed by Supervisors/Foremen:

- (a) Know the provisions of the Safety Instructions.

- (b) Instruct workers clearly and precisely on work procedures and safety precautions to be taken.
- (c) Ensure that all personnel under their control understand the safety procedures that are to be applied under various circumstances with reasons for same.
- (d) Use only the safest method for doing work. Do not take "short-cuts".
- (e) Ensure that the correct tools and equipment are issued and used by workers.
- (f) Provide appropriate protective equipment of approved type and insist upon its use by workers.
- (g) Maintain good housekeeping at all times.
- (h) Take possible remedial action on any hazard discovered and report same immediately to his Supervisor.
- (i) Promptly report accidents to his Supervisor and take positive action to prevent recurrence.

3.2.7 Safety And The Worker

- (a) A workman shall take remedial action where possible and report immediately to his supervisor/foreman any hazard he discovers in the course of his work.
- (b) Every workman shall make use of all safeguards, safety devices and appliances provided for the protection of personnel and equipment.
- (c) Every workman shall supply his Supervisor/Foremen full and accurate details of any accidents experienced or witnessed.
- (d) No workman shall, without reasonable cause or do anything likely to endanger himself or fellow workmen, or cause damage to plant and property.

3.2.8 Demolition Of Structures

The following are safety rules for minor demolition operations:

- (a) The public and all unauthorised personnel shall be kept at a safe distance away from structures that are to be demolished by use of barricades and signs, or protective temporary walls, as the case may be. A watchman may be assigned when necessary.
- (b) Utility services (gas, steam, electricity) outside

the building shall be disconnected. Water lines shall be maintained as long as possible, or a temporary water source installed, for fire protection and for wetting down the site to reduce dust.

- (c) Before start of demolition, all stored materials and all glass doors and windows throughout the structure shall be removed.
- (d) Structure being supported by part of the building to be demolished shall be temporarily supported before demolition work commences.
- (e) When demolishing walls, scaffolds supported independently of the walls being demolished, shall be used.
- (f) Debris shall be removed promptly.
- (g) Any area where material is being dumped shall be barricaded and screens placed where necessary to protect workmen from flying pieces.
- (h) Workmen shall not carry out work below others standing at a higher level.

3.2.9 Excavation And Shoring

- (a) Pre-excavation conditions (superimposed loads, soil structure, hydrostatic pressure and the like) shall be studied, in order to evaluate changes that might occur, or situations that might develop so as to plan the job ahead, based on these findings. Locations of power cables and pipe mains shall be identified and necessary isolations carried out.
- (b) Shoring, built in accordance with standard engineering practice or procedure, shall be provided on excavations where there exists a possibility of a cave-in.
- (c) The bottom depth and contents of buried tanks and piping shall be indicated on location markings. If the contents are flammable or toxic, proper protective equipment shall be readily available in case of rupture. Such tanks and piping shall be drained, purged or otherwise made safe.
- (d) Excavations shall be barricaded to prevent people from falling into them. When an excavation shall remain open for the duration of the construction work, barricades and fences shall be installed and warning signs displayed. In some cases, watchmen and flagmen are needed. The work area shall be guarded by flares, lanterns or flashing lights at night.

- (e) Men who work in ditches are in **Danger** of being struck by objects knocked into the ditch. Tools and materials shall not be placed near ditches.
- (f) Unless men working below ground level are protected by a roof, materials or tools shall not be passed over their heads.
- (g) Provision for quick escape shall be provided.
- (h) Heavy loads shall not be placed adjacent to excavated areas.

3.2.10 Machine Excavation

- (a) No shovel, dragline or other digging machines shall be excavate close to underground facilities that shall be left in place. Establish proximity limit for machine operations and complete the excavation by hand digging.
- (b) When hand excavation is being done, workmen shall be warned about driving picks, pavement breakers or other powered tools through the envelope of buried facilities. Attaching the tool air hose to a driven ground will give the workmen protection in the event of sudden contact with an underground electric line. Either the air hose shall be of the conductive type or the power equipment adequately provided with grounding device.

3.2.11 Open Excavation

- (a) Materials excavated by machine shall be thrown at least one (1) metre from the edge of the excavation but not into aisles or work area.
- (b) Pick-and-shovel men working in excavations shall be kept far enough apart to prevent injury to one another.
- (c) Excavated materials shall be placed at least one(1) metre from the walls of the excavation unless toe boards have been installed to prevent fallback.

3.2.12. Trench Excavation

- (a) A trench one (1) metre or more in depth shall be provided with ladders to facilitate safe entry and exit. The ladders shall extend from the bottom of the trench to at least one (1) metre above the surface of the ground.
- (b) In hand-excavated trenches, the ends of braces to stringers shall be secured to prevent the braces from being knocked out of place.

3.2.13 Masonry

- (a) If concrete is being chipped in an area where combustible gas is present, that part of the slab being chipped shall be kept under constant stream of water or the slab itself kept under water.
- (b) When workmen are repairing furnaces or underground flues, care shall be taken to protect them from objects which other workmen may drop overhead. When men are working below ground, all openings shall be properly guarded to prevent persons or materials from falling into them. Guard-rails which have been removed for any reason shall be replaced.
- (c) Do not back-fill against newly constructed concrete walls. Concrete will only attain full structural strength after about seven days.
- (d) Loads such as guys or stays shall not be put through brickwork until it has set firmly, and only in places where it will safely withstand the stress.

3.3 PERMIT-TO-WORK CERTIFICATE (MECHANICAL)

3.3.1 A Permit-to-Work Certificate (Mechanical) shall be obtained before any work of the following or similar nature is carried out:-

- (a) Work on boiler and its auxiliary plant.
- (b) Work on steam turbine generator and its auxiliary plant.
- (c) Work on pressure vessels and pipework.
- (d) Work on fuel handling and treating equipment.
- (e) Work in combustion chambers and gas passes of pulverised fuel, gas and oil fired boilers.
- (f) Work in confined spaces.
- (g) Work on a hydrogen cooled machine involving opening up of any part of machine casing which normally contains hydrogen.
- (h) Work on or near overhead crane tracks or other equipment.
- (i) Work on hydro-electric plant and circulating water systems.
- (j) Work on apparatus containing or operated by

compressed air or gas.

- (k) Work on diesel generating and auxiliary plant.
- (l) Work on gas turbine generating and auxiliary plant.
- (m) Work on chemical services plant (e.g. Water Treatment Plant, Chlorination Plant, Dosing Plant, etc.)
- (n) Any other work for which the **Shift Charge Engineer** or the **Authorised Person** considers a **Permit-to-Work Certificate (Mechanical)** is necessary.

3.3.2 The **Competent Person** in charge of a **Working Party** shall apply for a **Permit-to-Work Certificate (Mechanical)** from the **Authorised Person**.

3.3.3 The **Authorised Person**, before issuing a **Permit-to-Work Certificate (Mechanical)** shall satisfy himself that the plant has been correctly isolated and that the requirements stated in 3.1.1, 3.1.2 and 3.1.3 have been complied with. However, in areas where the **Authorised Person** has any doubts or reservations with regards to expertise, consultation with the appropriate departments shall be deemed necessary. A joint inspection between the **Authorised Person** and the **Competent Person** shall be carried out before effecting repair.

- 3.3.4
- (a) The **Permit-to-Work Certificate (Mechanical)** shall be issued by the **Authorised Person** to the **Competent Person** in charge of the **Working Party**. The work shall be carried out under the supervision of the recipient.
 - (b) The **Competent Person** shall sign the original and duplicate of the **Permit-to-Work Certificate (Mechanical)**. The original shall be retained in his possession at all times whilst work is in progress. The duplicate shall be kept in the **Shift Charge Engineer's** office or other appointed place.
 - (c) The issuer of the **Permit-to-Work Certificate (Mechanical)** shall ensure that the contents of the **Permit-to-Work Certificate (Mechanical)** are clearly understood and agreed by the recipient.
 - (d) Where work is to be carried out by more than one **Working Party** a **Permit-to-Work Certificate (Mechanical)** shall be issued to the **Competent Person** in charge of each **Working Party**.
 - (e) If the **Competent Person** to whom a **Permit-to-Work Certificate (Mechanical)** has been issued has to be relieved before the work is completed, the relief (another **Competent Person**) shall be approved by the **Authorised Person** and shall sign under the signature

of the original Competent Person who will hand over the Permit-to-Work Certificate (Mechanical) to him. The relief shall retain the Permit-to-Work Certificate (Mechanical) during the progress of the work, and upon completion of work, the last Competent Person to be in charge of the work shall "CLEAR" the Permit-to-Work Certificate (Mechanical) and hand it back to the Authorised Person.

- 5.5 When the work covered by the Permit-to-Work Certificate (Mechanical) is completed or stopped, the Permit-to-Work Certificate (Mechanical) shall be "CLEARED" by the Competent Person (i.e. he shall sign the Clearance Certificate on the back of the Permit-to-Work Certificate (Mechanical) and its duplicate, stating that he has warned all his men that the equipment is no longer safe to work on), and it shall be handed back to the Authorised Person who shall "CANCEL" it.
- 5.6 A joint inspection by the Authorised Person and the Competent Person in charge of the work shall be carried out before "CANCELLATION" of every Permit-to-Work Certificate (Mechanical). "CANCELLATION" of a Permit-to-Work Certificate (Mechanical) is to be carried out by the Authorised Person writing "CANCELLED" across the face of the Certificate and initialling it after it has been "CLEARED".
- 5.7 No plant shall be normalised and safety precautions withdrawn until ALL Permit-to-Work Certificates (Mechanical and Electrical) on that plant have been "CANCELLED".

6.3

SESSI 3

RECOMMENDATIONS

- (1) It is mandatory in accordance with the Factories and Machinery Regulations to provide safety latches on all lifting hooks. In compliance with this requirement it is recommended that Chief Engineer (Generation Operations) survey the existing lifting hooks and take measures to regularise the present practice.
- (2) The Task Force shall obtain tables of safety factors for hoist support and their maximum load from Factories and Machinery Department. This shall be incorporated as appendix to the Instructions.
- (3) A system of records on inventory of slings and lifting tackles be instituted. This record shall include details of identification, capacity, date of issue, location and receipt, statutory requirements, disposal system and lost tackle register.
- (4) The Task Force shall obtain from SIRIM their standard on inching up/down of loads.
- (5) Where sky-climbers are used the Head of Department shall ensure that these are maintained weekly during the period of use either by companies registered with the Factories and Machinery Department or by trained Lembaga Letrik Negara personnel.
- (6) Heads of Department shall ensure that all lifts in their stations are fitted with a back up Battery power supply to ensure safe return to ground floor in the event of a power failure.
- (7) The Task Force shall study the Port Klang Power Station Instructions Manual pertaining to "The Simon Snorkel" and shall include this as an addendum to these Instructions.

3.4.10. Lifting and Handling

3.4.10.1 General

- (i) No crane shall carry workers above ground unless specifically designed for this purpose.
- (ii) Only employees appointed in writing by the Head of Department shall operate heavy and articulated equipment. Lifting equipment shall only be operated by designated persons.
- (iii) The operator shall be responsible for cleanliness of all heavy equipment assigned to him. He shall report any defect or unusual condition therein to his Supervisor.
- (iv) At no time shall the operator allow anybody to be located directly under a boom or a suspended load.
- (v) The operator shall not allow any unauthorised employee to operate equipment assigned to the former or allow unauthorised persons to ride on the equipment.
- (vi) Operators shall receive directional signals only from a single duly authorised employee designated for this purpose. A Standardised system of signals shall be used for all lifting activities. (See Appendix 3 for illustrations of signals. Note: The use of a whistle by an authorised employee is merely to attract the attention of the crane driver and other workers in the vicinity to indicate that lifting/handling is in progress.)
- (vii) All booms shall be retracted and lowered after each work shift except when otherwise authorised by the supervisor in charge.
- (viii) The operator shall determine safe clearance on overhead obstructions and building openings, and shall only proceed when satisfied that clearances are adequate.
- (xi) Operators shall conduct regular inspections of all hoists/winches with special attention to load hooks, ropes, brakes, and limit switches.
- (x) The safe working load and the Factories and Machinery Department registration number of each hoist/winch shall be displayed conspicuously on the hoist body of the machine.

- (xi) Flanges on hoist drums with single-layer spiral grooves shall be free of projections that could damage a cable.
- (xii) Hoist supports shall have adequate safety factor for the maximum loads imposed, in accordance with the requirements of the Factories and Machinery Department.
- (xiii) Safety latches on hooks are mandatory.
- (xiv) Material hoists operating on rails, tracks or trolleys, shall have positive stops or limiting devices either on the equipment, rails, tracks or trolleys to prevent overrunning safe limits and where necessary shall be equipped with overspeed devices.
- (xv) A load shall be picked up only when it is directly under the hoist/winch cables, so as to avoid exceeding the allowable stresses for such mechanism and to prevent swinging.
- (xvi) All cranes and lifting tackles used shall be adequately maintained, operated and regularly inspected in accordance with the relevant provisions of the Factories and Machinery Act, 1967.
- (xvii) No persons shall climb on any crane, rail, trolley or other lifting machine without the knowledge of the driver operating the crane or lifting machine.
- (xviii) None of the moving parts of a hoist or lifting machine shall be dismantled unless all parts of the hoist or lifting machine are so secured or placed so as to remain stable.
- (xix) Do not allow anyone to board or alight from a crane while it is in motion.
- (xx) Be sure that the weight to be lifted is known and is less than the safe working load stamped on the tackle.
- (xxi) No load shall be lifted above a reasonable height until it is confirmed that the hoist and brake that can hold the load without slippage.
- (xxii) Swing of load shall be controlled by tether rope.
- (xxiii) The operator shall not leave his machine with its load suspended. No work shall be carried out on any suspended load.

- (xxiv) Audio and visual warning signals shall be used for warning when lifting loads.
- (xxv) All crane machinery, apparatus and appliances including ropes, chains and slings shall be inspected regularly by persons assigned to this task, and the date, findings and actions taken shall be recorded.
- (xxvi) Each control button of an electric lifting machine shall be clearly marked for its function.
- (xxvii) Defective equipment shall be marked and removed to a specified place where there is no possibility of it being used until repairs or disposal have taken place.
- (xxviii) Up-to-date records shall be maintained giving information on all lifting tackle available for use at the site or station.
- (xxix) All items shall have an identifying number marked on them. This same number shall also be on the record card which shall be maintained for each item in the lifting tackle store. This record system shall also provide a means of identifying all items which have overrun their statutory period of inspection, with arrangements for taking these items out of service.
- (xxx) Where items are found missing and are outside the prescribed examination period, such item shall be deleted from the records and details shall be entered into a "Lost Tackle Register."

3.4.10.2 Slinging and Rigging

- (i) No chain, rope or lifting tackle shall be used unless it is of good construction, sound material, adequate strength and free from patent defect. Chains, ropes, lifting tackles and other lifting gears such as shackle, U-bolts and eye bolts shall be properly maintained and inspected before use.
- (ii) Kinked slings, wire ropes and those showing signs of wear, fraying and rust shall not be used. Defective ropes shall be turned in for replacement.
- (iii) A small eyebolt shall not be used on a large hook.
- (iv) Chain blocks shall not be used for horizontal lifts. A pull lift or telfer shall be use for such applications.
- (v) Ensure that no lifting truck is overloaded, check weight to be lifted and Safe Working Load of gear.

- If in doubt about the weight of an object consult the supervisor.
- (vi) A sling shall never be shortened by tying knots in it or wrapping round a crane hook. Use a shorter sling instead.
 - (vii) All sharp corners shall be packed with timber or sacking and when wrapping slings round metal objects pack out the object to be lifted.
 - (viii) All loose parts of a lift shall be secured and never proceed to lift until after being completely satisfied that it is secure.
 - (ix) A lift shall be ensured to be free before lifting. When lifting covers off studding, use of a chain block to inch the cover clear is recommended so as to make sure that covers are lifted level.
 - (x) When lifting the load shall not be snatched and jerky movements shall be avoided, as these put extra strain on the slings.
 - (xi) Slings shall not be dragged along floors, exposed to acid and/or other injurious chemicals.
 - (xii) A suspended load shall never be left unattended.
 - (xiii) When work has finished, slings shall be hung on racks clear of the floor.
 - (xiv) No wire rope shall be used in raising or lowering or as a means of suspension if in any length of ten diameters, the total number of visible broken wires exceeds 5% of the total number of wires in the rope or if a strand is broken.
 - (xv) Wire or fibre rope slings containing fibre cores are not be suitable for lifting hot objects.
 - (xvi) Chain slings which have been joined together by wires or shackles shall be rejected, and such methods of lengthening or slinging shall never be used.
 - (xvii) The use of one leg of a double or multiple leg sling for a single point lift shall be avoided. Chain and rope slings stretch in normal use and the use of only one of its legs will cause it to become longer than the other leg or legs.
 - (xviii) If slings are reeved, care shall be taken to ensure that the portion of the slings forming the bight does not exceed 120 degrees. If this cannot be achieved, the Safe Working Load of the sling shall

be halved.

- (xix) When loads are being carried, slings not in use shall not be carried on the same hook.
- (xx) As the load is lowered it shall be halted just clear of the floor, checked and then lowered gently.
- (xxi) When two slings or multi-leg slings are used, the load shall be evenly loaded, the angle between the legs be kept as small as possible and shall not exceed 90 degrees. The greater the angle the smaller the safe working load. (See Appendix ... for a guide to the relationship between Safe Working Load and angle of lift.
- (xxii) When lifting, the load shall be directed just clear of the floor in the first instance.
- (xxiii) Shackles with incorrect and/or damaged pins shall not be used and all eyebolt threads shall be undamaged if they are to be used.
- (xxiv) Dynamo eyebolts shall be considered obsolete. All eyebolts shall be collared.
- (xxv) An eyebolt that has been modified and/or 'Home Made' eyebolts shall never be used.
- (xxvi) Only properly designed eyebolts tested to a proof load of twice the Safe Working Load shall be used. They shall never be painted in the mistaken belief that this is beneficial.
- (xxvii) When a sling is connected to an eyebolt at an angle, the greater this angle becomes the more strain is put on the eyebolt and allowance shall be made for this force. (Appendix ... shall be the guide as to the anticipation of change of Safe Working Load when selecting eyebolts for a job)

3.4.10.3 Manual Lifting and Handling

- (a) Suitable gloves shall be worn when handling glass, rough, sharp or hot materials, to protect against cuts, scratches, punctures and burns.
- (b) Safety boots or shoes shall be worn to protect toes from falling loads.
- (c) Safe team lifting requires co-ordination. Only one designated man shall give instructions.
- (d) See that there are no obstructions in the direction you will be going. Loads in trucks and barrows shall be secured, well distributed and shall not obstruct

vision.

- (e) Ensure that men do not lift beyond their strength. Size up the load and, if necessary, make a trial lift of a few centimeters. Do not attempt to lift alone any load that is too heavy, too large or awkward.
- (f) Where possible use the appropriate mechanical handling equipment.
- (g) Before taking hold of an article, examine it and remove or avoid rugged or sharp edges, protruding nails, splinters, grease, oil or corrosive materials.

3.4.10.4 Cranes

(A) MOBILE CRANES

- (a) Each controller and operating lever shall be marked with the motion it controls and its directions.
- (b) Operating a crane on soft or sloping ground or close to the sides of trenches or excavations is dangerous. The crane shall always be level before it is put into operation. Outriggers can be relied upon to give stability only when used on solid ground. Heavy timber mats or suitable steel plates shall be used whenever there is doubt as to the stability of the soil on which a crane is to be operated.
- (c) The use of any makeshift methods to increase the capacity of a crane, such as timber with blocking or adding counterweight, is prohibited.
- (d) Workers shall not ride or be allowed to ride a load that is being hoisted, swung or transported.
- (e) Never move the load or the crane unless you are sure that you understand the floor signal.
- (f) Only one man shall give lifting instructions. However, any emergency stop signal given by anyone shall be obeyed.
- (g) When filling the fuel tank of a crane, always provide a metallic contact between the container and the tank.
- (h) Never lift a load with a weight greater than the operating capacity for a given boom, angle and radius. Keep lifting height to a minimum when handling loads close to the maximum load.

- (i) The load shall not be left suspended but be lowered to the ground before the operator leaves the crane.
- (j) Start and stop the slewing of the boom smoothly. Fast slewing would cause loads to swing, thus increasing the radius beyond the crane's capacity which might eventually tip the crane over or cause boom failure.
- (k) The crane shall be kept stationary when lifting loads.
- (l) Be sure that there is adequate clearance before attempting to move the machine under bridges, power lines, or other low overhead objects. When travelling the mobile crane along highways or streets, the boom shall rest on its rack.
- (m) The crane shall never be positioned nor left unattended near embankments, deep excavations, banks, ridges, etc.
- (n) The slew brake shall be properly set when travelling the crane.
- (o) Before the operator leaves the crane the engine shall be stopped and the ignition key shall be removed, the engine clutch shall be disengaged and the boom hoist pawl engaged.
- (p) Before operation, be sure that the carrier service brakes and outriggers are properly set and the crane levelled.

(B) OVERHEAD TRAVELLING CRANES
(CABIN DRIVEN AND PENDANT DRIVEN)

- (a) Each crane shall have its safe working load capacity and Factories and Machinery Department registration number on both sides in conspicuous figures, readable from the floor or ground. If a crane has two hoist blocks, each block shall have its Safe Working Load displayed on both its sides. The crane shall not be loaded beyond its Safe Working Load except for overload testing.
- (b) Nobody, including those who work near cranes or assist in hooking on or arranging loads, shall stay directly under loads. Supervisors shall ensure that this is strictly followed.
- (c) A crane operator shall never attempt to make repairs himself but should report to his supervisor any condition that might make the crane unsafe to operate.

- (d) When not in use, the crane shall be parked with the load hook (and the slings if they remain on the hook) fully raised. The operator shall throw all controls into the "off" position, open the main switch and remove the key.
- (e) An indication light shall be visible from the floor to indicate when the crane supply is "on."
- (f) Every precaution shall be taken to prevent cranes from colliding into one another. Safety stops shall be installed.
- (g) Do not allow the load to swing against the rigger or other workers. Make certain that they are in the clear.
- (h) When raising or lowering the load, see that it safely clears adjacent stockpiles or machinery. The main hook shall not be used in confined spaces or holes to avoid catching fixed or permanent structures, unless specifically designed for such purposes.
- (i) No person shall work on or near the wheel track of an overhead travelling crane in any place where he would be liable to be struck by the crane, unless effective measures have been taken by warning the driver of the crane to ensure that the crane does not approach within 6 meters of that place and a **Permit-To-Work Certificate (Mechanical)** has been issued before work commences.

3.4.10.5 Other Lifting Machines

(a) Chain Blocks

- (i) Chain blocks must be kept in good condition by regular inspections. Special attention must be given to see that hooks and chains are always in good condition. Never try to shorten a chain with a bolt or nail, it may break or slip, causing an accident.
- (ii) Never attempt to use a chain block for a load greater than the capacity of the block.
- (iii) Chain blocks shall not be left supporting their load capacity or near load capacity for a long period of time. Let down or support the load to relieve strain on the block.

(b) Lifting with jacks

- (i) Make sure the footing is substantial; use boards or blocks at right angle to the lift.
 - (ii) Centre the jack properly for the lift; if there is danger of the head slipping, use a board or the wedge on top of the jack to keep it in position.
 - (iii) Place the jack so as to allow an unobstructed swing of the handle.
 - (iv) Do not lean over a jack handle or handle socket under load; the handle might fly up and strike you.
 - (v) Never leave a jack standing under load with the handle in the socket.
 - (vi) Never rely on jacks alone to support any load you have to work under. Use plenty of substantial blocking, have an ample factor of safety.
- (c) Hand Operated Chain hoists
- (i) Chain hoists shall be of larger capacity than the load required to be lifted.
 - (ii) Supports for the hoist shall be strong enough to carry the load imposed on them.
- (d) Fork Lifts
- (i) The forklift shall be driven with due care and at reasonable speed.
 - (ii) Extreme care shall be exercised by the operator when approaching areas where his view is obstructed, or where pedestrians or other vehicles may have difficulty in seeing the approaching fork lift.
 - (iii) Inspect all loads to be moved to determine proper load position, to maintain stability, and to avoid overloading. When moving loads, keep fork or load as close as possible to the ground or floor. Never drive with the platform elevated.
 - (iv) The load shall be kept below eye level. Where this is impracticable, operator shall drive the forklift backward so that he can see where he is going.
 - (v) Do not drive with greasy hands.
 - (vi) Slow down on wet, slippery, and rough surfaces.
 - (vii) Workmen shall not be permitted to ride or work on the platform. Where possible, materials shall be unloaded mechanically from raised platform.

- (viii) Except for the operator, nobody is allowed to ride on the fork lift.
- (ix) Fork-lifts shall be installed with audio and visual warning devices.
- (e) Sky-Climber
 - (i) All statutory requirements by Factories and Machinery Department on sky-climbers shall be complied with.
 - (ii) At least two persons who possess good knowledge about the operation of the sky climber shall be present. If the sky climber fails, they shall be able to bring it down manually.
 - (iii) Additional safety ropes must be incorporated with the sky climber so that workers with safety belts can hook the life line to the safety ropes.
 - (iv) Safety cables must always be incorporated to the sky climber in addition to the normal running cables. This will prevent the sky climber from falling if the running cable snaps.
 - (v) Brake test shall be carried out every time a sky-climber is used.
 - (vi) Anchorage or support points shall have an ample factor of safety.
 - (vii) Tools and loose objects shall be made secure by tying.
 - (viii) Power supply to sky-climber motors shall be made secure and appropriate caution boards displayed.
 - (ix) Sky-climbers shall not be used in strong winds.

3.4.10.6 Lifts

(A) GENERAL RULES

- (a) All statutory requirements by Factories and Machinery Department on lifts shall be complied with.
- (b) Only Personnel Authorised by the Inspector of Machinery shall maintain and repair lifts.
- (c) A Valid Certificate of Fitness issued by Factories and Machinery Department shall be displayed in the car.

- (d) Keys for unlocking of landing door latches shall be kept in the premises by the person responsible for the operation of the lift and in a location readily available to an **Authorised Person** during an emergency.
- (e) Enclosures shall be kept in good condition to prevent injuries to persons entering and leaving the car.
- (f) Lifts shall be regularly inspected and properly maintained.
- (g) The rated safe load of a lift shall be indicated by a conspicuous label.
- (h) Appropriate "No Smoking" sign shall be conspicuously displayed inside the elevator. Standard sign is as shown in Appendix 4.
- (i) Never use lifts in case of fire or in the event of an earthquake.
- (j) Goods lifts shall be provided with cages and properly guarded.
- (k) Loads shall be properly arranged and secured to prevent their falling from goods lifts.
- (l) The following notice shall be exhibited in a permanent place adjacent to the entrance of every machine room:-

**BAHAYA
BILEK JENTERA
DILARANG MASUK TANPA KEBENARAN.**

- (m) All lifts shall be backed up by a D.C. inverter power supply of adequate capacity for the lift to descend to ground level in the event of a power failure.

(B) RULES FOR OPERATORS

- (a) Know the safe capacity of your elevator; never overload it.
- (b) The operator shall promptly report any abnormal/defective condition.
- (c) Crowding, horseplaying and lighted cigar/cigarettes and the like shall not be permitted in the car; require passengers to face the entrance but at a

safe distance from it.

- (d) Operators shall maintain good house-keeping inside the elevators.
- (e) In case of an emergency, remain calm and institute applicable emergency measures.

(C) RULES WHEN DOING REPAIR WORK.

- (a) Before doing repair/maintenance work, opened lift gates shall be provided with a barricade designed so as to provide ample working space for the repairman at the floor level and at the same time to protect employees/ public from hazard of falling in.
- (b) Before doing repair/maintenance work, the power source shall be shut off, locked and cautioned. A Permit-to-Work Certificate shall be obtained.
- (c) **Danger Notices** shall be clearly displayed at strategic locations around the lift under repair/maintenance.

3.4.11 Scaffolding And Ladders

- (a) All scaffolds shall be erected, used and maintained accordance with the relevant clauses specified in the Factories and Machinery (Building Operations and Works of Engineering Construction) Regulations 1986.
- (b) Toe boards and handrails shall be fixed to all scaffold platforms of more than 3 metres high.
- (c) Any ladder which is used shall be placed at the correct angle, and secured. Ladders erected against scaffolding shall project at least one metre above the platform of the scaffold.
- (d) Ladders in use shall stand on level and firm footing. Loose packing shall not be used to support the base.
- (e) Scaffolding shall be constructed of sound materials, securely fastened and supported. Planks for scaffolds shall be free of knots and other imperfections and painted red on both ends for identification, and shall not be used for any other purpose. As a general rule the distance with single planks shall not exceed one (1) metre with planks 32mm in thickness, 1.5 metres with planks 38mm in thickness or 2.6 metres with planks 50mm in thickness. Planks shall be secured to the put-logs.
- (f) Never construct a scaffold with a span longer than

2.6 metre between supports.

- (g) Scaffolding shall only be erected and dismantled under close supervision of experienced personnel. System scaffolding shall be erected according to manufacturer's instructions.
- (h) Scaffolds (tubes, couplers and boards) and ladders shall be carefully inspected before use.
- (i) Scaffolds shall be provided with a roof made of light lumber, heavy canvas or heavy wire screen, when other men are working overhead.
- (j) Do not allow men to jump on or hang tools on any part of, nor heavy materials to be dropped on, or anything to be thrown from the scaffold.
- (k) Workmen shall not work on a scaffold installed outdoors during storm or high wind.
- (l) A safe means of access to the scaffold, either by stair or permanent ladder shall be provided. If portable ladder is used, it shall be in good condition and its upper end securely fastened to prevent tipping or slipping.
- (m) When hoisting load, do not let it swing against or catch on scaffolds.
- (n) Good housekeeping shall be observed on scaffolds at all times.
- (o) Scaffolds shall rest on solid foundation to prevent settling, and plumbed and securely fixed at the bottom to prevent shifting.
- (p) Toeboards, of at least 50mm to 100mm in height, shall be installed at the outer edges of the platform to prevent tools and other materials from falling off. In spite of this protection, however, precaution shall be taken, especially during the process of raising the platform to a new elevation, to prevent objects from falling on the men below.
- (q) Pipe members shall be of steel tubing complying with B.S.1139 'metal scaffolding' or equivalent standard.
- (r) Supporting ropes shall be securely fastened to prevent slip-off in the ends of the pipes.

3.4.12 Ladders

- (a) If ladders are used for two-way traffic, provide one for ascending and another one for descending.

- (b) The upper ends of the side rails of ladders shall project no more than one-fourth (1/4) of the total length of the ladder above the point where it is resting, and with lower ends set on stable footing.
- (c) In placing a ladder, the distance from foot of ladder to structure against which it is leaning shall be approximately one-fourth (1/4) the length of the ladder.
- (d) Avoid working on a high ladder in a strong wind.
- (e) When a step ladder is used, it shall be ensured that its legs are fully spread to its maximum stop before climbing.
- (f) Always carry a ladder with the anti-slip device (rubber) towards the rear and the front end pointing upward. Be extra careful when approaching doorways and corners. When two (2) men are carrying a long ladder, each man shall be close to his end of the ladder.
- (g) Never place ladder in front of door without first locking the door or placing man on guard.
- (h) Keep both hands free for climbing or descending. Do not carry tools in your hands.
- (i) Always face the ladder when climbing or descending.
- (j) Only one person shall be on a ladder at one time. However, where two (2) employees will work at the same area on different levels (without using the same rung) they may be allowed to use one ladder provided that the upper end is properly rested and secured on a fixed structure and the lower end is on a stable footing.
- (k) Defective ladders shall be repaired or otherwise destroyed.
- (l) Untreated portable ladders shall not be left exposed to the elements when not in use, but shall be kept in a sheltered place to avoid warps and cracks.
- (m) Prohibition against use of defective ladder; No ladder of the following shall be used:-
 - (i) with missing, broken or defective rung.
 - (ii) with broken or split side rails.
 - (iii) of faulty or defective construction.

- (iv) with any of the rungs depending for its support solely on nails, spikes, or other similar fixing.
- (n) Every ladder shall, so far as practicable, be securely fixed so that it can move neither from its top nor from its bottom points of rest.
- (o) Ladders shall not be painted in order that defects can be identified easily.
- (p) Ladders shall extend at least 1 meter above the stepping off point in order to provide an adequate hand hold.
- (q) A register of ladders shall be kept at all stations. Ladders shall be numbered for identification and inspected at least once every three months and the results recorded in the register.
- (r) Ladders shall only be used up to 9 metres. Above this height ladder landing platforms, if necessary enclosed in a ladder access tower, must be provided.

3.4.13 SIMON SNORKEL

To be added as addendum

3.5 WORK IN CONFINED SPACES SUCH AS VESSELS, CULVERTS, FLUES, SEWERS, TUNNELS AND UNDERGROUND CHAMBERS.

3.5.1 No person shall enter nor work be carried out in any tank, tunnel, pipeline, aqueduct, associated turbine or pump until:-

- (a) The tank, tunnel, pipeline, aqueduct, associated turbine or pump is isolated from all sources of water, drained and vented to atmosphere and supplies of compressed air and chemical injections, are, isolated.
- (b) The supply to motors operating all valves, intake gates, or headstocks are isolated and locked off and all hand operated mechanisms locked. The power supply water to hydraulically operated valves will remain available where necessary to successfully seal off the valves.
- (c) **Danger Notices** are attached at points of isolation and shut off.
- (d) The keys used for locking are placed in a **Key Safe**.
- (e) Permission has been obtained from the operations-/shift charge engineer associated with the work, who

shall retain in his possession a copy of each Permit-to-Work Certificate (Mechanical) issued until it has been cancelled.

- (f) A Permit-to-Work Certificate (Mechanical) is issued to the Competent Person in charge the Working Party
- (g) Before issuing a Permit-to-Work Certificate (Mechanical) the Authorised Person shall ensure that the confined space shall be free of toxic gases. Consultation with the Chemist is necessary.
- (h) All persons entering such places shall be identified before entry by the Competent Person of the Working Party to the Authorised Person who shall in turn ensure that only the identified persons enter the confined space.
- (i) In areas where there is Danger of flooding temporary dewatering facilities shall be provided.

3.5.2 Work or inspection parties shall consist of not less than two persons. Precautions shall be taken to prevent unauthorised entry.

3.5.3 A person shall be stationed at each point of entry to prevent unauthorised entry and to answer emergency situations. If however, persons have not been stationed at each point of entry during the whole of the period of access to tunnel or similar equipment, a final inspection shall be carried out, with persons stationed at each point of entry to prevent further unauthorised entry.

3.5.4 Before the Permit-to-Work Certificate (Mechanical) is cancelled, the person in charge of the work or the inspection party shall ensure that all persons have been withdrawn.

3.5.5 Reservoir Main Scour or Drain Valves

- (a) When overhauling or inspecting these valves the roller gate shall be lowered.
- (b) When filling the space between the roller gate and the valve, great care shall be taken just to break the seal of the gate with the valve open.

3.5.6 Where dangerous fumes or substances are liable to be present in a confined space which cannot be effectively isolated and adequately ventilated the following measures shall be taken before any person is permitted to enter the space:-

- (a) All practical steps must be taken to prevent the ingress of dangerous fumes or substances.

- (b) Every person who is to enter the confined space shall wear an approved breathing apparatus.
- (c) Every person who is to enter the confined space shall, where practicable, wear a safety harness to which a rescue line is attached.
- (d) An additional person shall be kept on duty outside the confined space and this person shall keep in touch with those inside the confined space. This person shall control the rescue line(s) attached to the safety harness(es) and shall be capable of pulling the worker(s) out of the confined space. Where safety harness is not practicable, a second set of breathing apparatus shall be available for the use of this person.
- (e) A **Permit-to-Work Certificate (Mechanical)** shall then be issued.
- (f) Adequate steps shall be taken to ensure that all persons wearing breathing apparatus shall be withdrawn from the confined space before the end of the prescribed working duration of the apparatus.

3.5.7 Where a confined space can be adequately ventilated and effective measures taken to prevent the ingress of dangerous fumes or substances, this shall be done before any person is permitted to enter the space and before exposed flames or smoking are permitted therein. In addition the following shall be done:

- (a) Adequate ventilation shall be maintained while persons remain in the space.
- (b) If doubt exists as to the adequacy of the ventilation, air in this confined space shall be tested for dangerous fumes or substances by an approved detector.
- (c) **Danger Notices** shall be attached at all points of isolation, and the keys used for locking off purposes shall be placed in the appropriate **Key Safe**.
- (d) A **Permit-to-Work Certificate (Mechanical)** shall then be issued.

3.5.8 Vessels which have contained Oil, Gas or other Flammable Substances.

Smoking and exposed flames are **PROHIBITED** in the vicinity of open vessels containing, or which have contained, oil, gas or any flammable substance. Work on the vessels

involving the application of heat is FORBIDDEN until an **Authorised Person** has taken all practicable steps to prevent fire or explosion either by removal of the flammable substance and any fumes, or by rendering them non-explosive and non-flammable.

Before any person is allowed to commence work in a vessel which has contained oil, gas or any other flammable substance, the following shall be done:-

- (a) An **Authorised Person** shall satisfy himself that all dangerous vapours and substances have been expelled, that the vessel is adequately ventilated and that adequate ventilation will be maintained whilst work is in progress.
- (b) All possible sources to the tank shall be isolated and locked off and the keys used for locking off purposes shall be placed in a **Key Safe**.
- (c) **Danger Notices** shall be attached at all points of isolation.
- (d) A **Permit-to-Work Certificate (Mechanical)** shall then be issued.

6 . 4

S E S S I 4

RECOMMENDATIONS

- (1) Emergency showers with foot operated spring board incorporating eye wash facilities, shall be made available near the vicinity of chemical handling, using and storing areas.
- (2) Colour coding of gas cylinders shall be displayed.
- (3) Left hand threaded cylinder shall be labelled.

3.6 HANDLING, STORING AND USING OF CHEMICALS

3.6.1 General Precautions And Personal Hygiene.

3.6.1.1 All chemicals must be handled in accordance with the instructions written on their respective containers. Time and opportunities shall be given to employees to become familiar with the said instruction indicated in labels, the chemical characteristics and their purpose. Safety precautions such as being careful, shall be observed in the handling of toxic, corrosive, volatile and flammable chemicals.

3.6.1.2 Wherever and whenever there is danger of contact with chemicals, personnel shall;

- (a) Be warned of the nature of the potential hazards and the necessary precautions to be taken and be instructed in the use of protective clothing and equipment.
- (b) Observe a high standard of personal hygiene and cleanliness
- (c) Drinking, eating and smoking in these area is prohibited.
- (d) Wiping of nose, eyes or face shall only be with a clean tissue paper.
- (e) Place all debris and chemical residues in polythene or other suitable bags for subsequent appropriate disposal.
- (f) Wash yourself thoroughly as soon as possible after leaving work area.

3.6.1.3 When handling chemicals, appropriate safety attire such as chemical goggles, face shields, rubber gloves, rubber boots, chemical resistant clothing shall be worn. Handling of chemicals that involve gases or dust, needs adequate ventilation respiratory equipment and chemical resistant clothing.

3.6.2 Safety In The Chemical Laboratory

3.6.2.1 Safety of the Personnel in Laboratory

- (a) Unauthorized experiments with chemicals or equipment are prohibited.
- (b) Drinking, eating and smoking in any chemical laboratory prohibited.
- (c) Beakers shall not be used for drinking or for keeping food.

- (k) Fill bench reagents in bottles to not more than three-fourth (3/4) of their capacity to allow for expansion at room temperature.
- (l) Cover all beaker containing liquid chemicals when heating on a hot plate to prevent splattering. Splatterings from the liquid chemical shall be flushed with plenty of water. Use boiling chips where possible.
- (m) Never pipette the chemicals with the mouth. A pipette filler shall be used.

3.6.3.2 Inflammable and Combustible Liquids

- (a) Inflammable liquids shall be identified and containers of same checked to ensure that they are properly labeled.
- (b) Smoking and other spark-producing devices shall be prohibited in areas where flammable liquids are stored, handled or used. A "NO SMOKING" sign shall be displayed prominently.
- (c) Mixing of flammable liquids shall be avoided because the flash point of the mixture is lowered. Do not mix acetone with kerosene as it lowers the flash point of the mixture and may cause fire hazard.
- (d) Inflammable liquids which are not miscible with water and are likely to give off toxic vapours shall not be poured into the sink.
- (e) The storing inflammable liquids in glass or other open containers shall be prohibited except in a laboratory or when obtaining samples for laboratory use, or for testing for operating units. They shall be stored in closed metal containers.
- (f) Adequate ventilation system shall be provided for flammable liquid storerooms.
- (g) Portable fire extinguishers shall be available in the vicinity of the store room.

3.6.3.3 Combustible Gases

- (a) Store all cylinders containing combustible gases in a well-ventilated place and in an upright position. Cylinders shall be properly labelled.
- (b) Do not store reserve stock of cylinders containing combustible gases with cylinders containing oxygen. They shall be stored separately.

- (c) Colour coding of gases shall be displayed.
- (d) Keep naked flame or spark away from cylinders.
- (e) Never interchange combustible gas regulators, hoses, or other appliances with similar equipment intended for use with other gases.
- (f) Cylinders in use must be properly secured in an upright position.
- (g) Do not use a cylinder of compressed gas without the pressure reducing regulator attached to the cylinder valve, and use cylinders only when the regulators are attached to the manifold header.
- (h) Always check that all connections to piping, regulators and other appliances, are kept tight to prevent leakage. Any hose used shall be in good condition.
- (i) After attaching the regulator and before opening the cylinder valve ensure that the adjusting screw of the regulator is released.
- (k) Do not permit the gas to enter the regulator abruptly. The cylinder valve must be opened slowly.
- (l) Use gas detector or soapy water to detect combustible gas leak.
- (m) If the valve is difficult to open, point the valve opening away from you and use greater force. Do not use a wrench on valves equipped with hand wheels to operate the valves. If further difficulty is encountered in opening the valve, return the cylinder to the supplier for replacement.
- (n) To remove the regulator from a cylinder, be sure to close the cylinder valve first and then release all gas from regulator before removing the regulator.
- (o) Cylinders shall be transported in a safe manner, for example on a suitable trolley.
- (p) Left hand threaded cylinder shall carry caution notices with appropriate labels.

3.6.3.4 Storage of Laboratory Chemicals

- (a) A cool dry and well ventilated storeroom is the primary requirement to store chemicals. Storage of hazardous chemicals needs careful planning. Separate shelves and compartments shall be considered depending on the properties of the chemicals and not in any other form of arrays. Danger Notices shall be displayed.

- (b) Water-sensitive materials/chemicals such as sodium, anhydride, concentrated acid and alkali shall be stored in a dry place.
- (c) Oxidising agents must be stored in a cool dry condition and kept separately from inflammable liquids or low flash point liquids.
- (d) Corrosive and volatile materials which are toxic to personnel shall be kept in a well-ventilated room.
- (e) A register of hazardous chemicals shall be kept. The shelf life shall be noted.
- (f) Volatile chemicals which could react with each other shall be kept in separate places and disposed separately to avoid hazardous reactions.

3.6.4 Handling Of Bulk Chemical

3.6.4.1 General

- (a) Work areas, equipment and machinery shall be frequently and properly cleaned.
- (b) Ensure that labels on containers and bags of chemicals are always intact. Highly poisonous chemicals shall carry the standard poison label. See Appendix 4 for standard signs.
- (c) Bulk chemicals such as sodium carbonate, aluminium sulphate, sodium hydroxide, ferrous sulphate, sodium triphosphate and sodium chloride shall primarily be stored in a clean, dry and well-ventilated section of the chemical storage area.
- (d) Safety attire such as protective clothing etc. shall be provided and worn when preparing bulk chemical solutions.
- (e) Spillage shall be avoided and any chemicals spilled on the floor shall be removed and not swept.
- (f) Always check the condition of the bags or containers of chemicals. Chemicals in damaged bags or containers shall be used first.
- (g) Emergency showers and eye wash facilities shall be provided at appropriate locations.

3.6.4.2 Handling of Hydrazine

- (a) Avoid direct contact with the skin and inhalation of the vapour.

- (b) Goggles and rubber gloves shall be worn when handling hydrazine.
- (c) Under no condition shall hydrazine be handled in open glasses for fear of breakage. It shall be transported in screw capped plastic bottles.
- (d) Accidental spillage of hydrazine shall be promptly washed off with plenty of water. Do not wipe with rag or paper.
- (e) Hydrazine shall be kept away from sunlight.
- (f) A 35% hydrazine solution must be kept away from oxidizing agents.
- (g) Hydrazine vapours or residues in contact with organic materials such as oil can ignite spontaneously. Hydrazine vapours possess 35% of the explosive strength of TNT.

3.6.4.3 Handling of Ammonia

The following precautions shall be taken:-

- (a) Personnel shall be provided with ammonia respiratory equipment when handling the chemical.
- (b) Keep away containers of ammonia from high temperature (above ambient temp.). Store in a cool dry place and away from sources of heat to avoid raising the pressure of the gas.
- (c) In case of an ammonia leak, spray the spills from the leaks with plenty of water.

3.6.4.4 Handling of Hydrochloric Acid

- (a) When handling the acid do not allow the acid to come in contact with skin, as it can cause injuries. Proper protective gloves and shield, shall be worn.
- (b) The acid container shall be handled in a proper manner.
- (c) Hydrochloric acid shall be stored in a place where there are no metal equipment. The fumes will corrode the metal in contact.

3.6.4.5 Handling of Sulphuric Acid

- (a) Always add acid to water.
- (b) Any spilt acid shall be washed with plenty of water, then followed by neutralization with soda ash before

discharging. Do not neutralize the acid directly.

- (c) Personnel who handle sulphuric acid, shall be provided with, and wear suitable personal protective equipment to prevent the acid solution from contacting the skin.
- (d) Acid splashed onto the skin or eyes shall be washed immediately with plenty of water. Do not try to neutralize the splashed acid directly.
- (e) Regular checks shall be carried out to ensure that the ventilation pipeline and the overflow pipe of the acid storage tank is free from blockage.
- (f) Sulphuric acid storage tanks shall be placed in a well ventilated space to allow dilution of acid fumes should there be a leakage in the acid storage system.
- (g) No smoking shall be allowed in an acid storage area, due to the probability of hydrogen explosions due to acid fumes reacting with metal.
- (h) Welding on a sulphuric acid drum or tank (full or empty) shall be prohibited unless the following precautions have been taken:
 - (i) Empty the acid in the drum or tank.
 - (ii) Clean drum with large volumes of water.
 - (iii) Leave the drum/tank in a position with the plug opening or cover vertically upward so that all hydrogen can diffuse out.
 - (iv) As an alternative to (iii), the drum/tank shall be purged with nitrogen or filled with water to displace all hydrogen inside.
 - (v) All plugs and covers are removed.

3.6.4.6 Handling of Caustic Soda (sodium hydroxide)

- (a) Solid caustic soda is hygroscopic. Its storage requires water tight containers and a cool dry place.
- (b) When handling the "flake" form of caustic soda, precautions shall be taken as the flakes tend to breakdown to troublesome dust and become air borne.
- (c) Always add solid caustic soda to water when mixing caustic soda with water.
- (d) Personnel who frequently handle caustic soda shall wear proper safety attire to safeguard against skin contact with caustic soda dust.

- (e) Solidified caustic soda needs to be broken into pieces and shall be contained in or covered with a soft material to prevent chips from flying.
- (f) Never wipe spilt caustic soda liquor. Spilt caustic soda shall be washed away with water. Do not sweep spilt solid caustic to prevent caustic soda dust from flying.
- (g) Do not neutralize spilt liquid caustic soda with sulphuric acid directly. Flush with plenty of water.
- (h) When caustic soda gets into the eyes or on the skin, immediately flush the eyes or skin with plenty of clean water and refer to a doctor.
- (i) Any leakage found in caustic soda system shall never be collected in an aluminium or zinc container as it reacts and emits hydrogen gas.
- (j) Regularly check that the ventilation pipe line and the overflow pipe of any liquid caustic soda storage tank is clear from blockage.

3.6.4.7 Handling of Hypochlorite

- (a) Personnel who handle hypochlorite shall be provided with and wear appropriate protective equipment.
- (b) Any splashed chemical onto the skin or eyes, shall be flushed with water for at least 10 minutes before applying medication.
- (c) Do not inhale hypochlorite dust.

3.6.4.8 Electrochlorination

- (a) Avoid direct contact with sodium hypochlorite solution. Wear rubber gloves and goggles.
- (b) When in the vicinity of the electrolytic cells, shoes with rubber soles shall be worn.
- (c) Avoid sparks or smoking in the vicinity of the electrolytic cells and dehydrogen drums.
- (d) When the electrolytic cells are supplied with power, only qualified personnel shall be permitted to enter the electrolyser area.
- (e) The supply of power to the electrolytic cells must be isolated before any kind of maintenance work can commence. A Permit-to-Work shall be issued.

3.6.5 Handling Of Chlorine

3.6.5.1 General

- (a) Avoid exposure to chlorine gas. Continuous exposure to 1 ppm of chlorine shall not exceed 8 hours. Do not be exposed to any chlorine that is more than 10 ppm in concentration as it can cause serious injuries.
- (b) Respirator, or breathing apparatus shall be made available near any chlorination plant and chlorine drum storeroom. The respirator shall only be used for escape purposes, while a self-contained breathing apparatus shall be worn when dealing with a chlorine leak. Regular inspection of the equipment shall be carried out to ensure that they are in good working condition.
- (c) All persons who have been gassed with chlorine shall be examined by a doctor as serious symptoms may develop at a later stage. Until a doctor arrives, first aid treatment shall be administered. (For First Aid Treatment, see Appendix 8).
- (d) "Poison" warning signs shall be prominently displayed in the vicinity of the chlorine house.
- (e) Two persons shall always be present when work has to be done in the drum storage house or chlorination plant.
- (f) All pipelines carrying chlorine shall be purged before the start of any maintenance work.
- (g) Gas masks shall be worn when connections are made or broken.
- (h) Chlorine leak detectors with audible alarms shall be installed in the drum storage house and chlorination plant. The alarms shall be located in the control room.
- (i) The drum storage house and chlorination plant room shall be provided with adequate ventilation, preferably forced ventilation with extraction at floor level and discharge above roof level. Fan capacity shall be adequately for a minimum of 12 changes of air/hour.
- (j) All pipelines and connections carrying chlorine shall be inspected regularly.
- (k) Pressure gauges shall be fitted to the chlorine pipe line.
- (l) Only one drum shall be put on load for liquid discharge of chlorine.

- (m) Operate two or more drums in parallel for gaseous discharge.

3.6.5.2 Chlorine Containers

- (a) Slings alone shall not be used to lift chlorine drums. Sling chains with hooks or a lifting bar shall be used.
- (b) Chlorine drums shall be arranged in a single tier and placed on rollers.
- (c) Drums shall be positioned so that the two discharge valves lie in a vertical plane.
- (d) A chlorine drum shall not be exposed to excessively high ambient temperature. It shall be stored away from combustible materials and risk of fire.
- (e) It shall be stored in a dry place.
- (f) Drums shall not be left connected for long periods to equipment that is not in use.
- (g) Heat must never be applied directly to chlorine drums.
- (h) The layout of the drum house shall allow easy escape of personnel in the event of a chlorine leak.
- (i) Drum storehouse shall not contain any equipment, such as switchgear, that might be corroded by chlorine.
- (j) Drums shall not be stored below ground level.
- (k) During the operation of changing drums, the following standard procedure shall be followed:-
 - i) Two men shall always be present in the drum house (See 3.6.5.1.e).
 - ii) Gas masks shall be provided and worn when connections are made or broken.
 - iii) The drum house door must be left open and the ventilation fan shall be working.

3.6.5.3 Handling Chlorine Leak

- (a) Even the smallest chlorine leak shall be treated as an emergency and dealt with promptly.
- (b) Use ammonia blow-bottle to detect leak.

- (c) Respiration or breathing apparatus shall be used when dealing with liquid leak. A self-contained breathing apparatus shall be worn.
- (d) Avoid inhaling the chlorine gas.
- (e) Ensure that the ventilation system is on.
- (f) Allow only experienced personnel to investigate the leak.
- (g) Use fire-fighting foam produced from a protein based compound to contain major liquid chlorine spillages. Consult chlorine supplier for the appropriate type. Apply foam to a depth of 6 inches over the surface.
- (h) Avoid using water in dealing with liquid chlorine spillages.

3.6.6 Chemical Cleaning of Power Plant Internals

3.6.6.1 General Safety Precautions

- (a) The safety precautions contained herein shall be read in conjunction with the other safety instructions for the handling, storing and using of chemicals.
- (b) The safety instructions described shall be applied to the chemical cleaning of all power station plants.
- (c) The officer responsible for the overall safety aspects of chemical cleaning shall be the supervising officer or an authorised person. The supervising officer/-authorised person shall ensure that all safety precautions are observed and that suitable hygiene and first aid facilities are available.

The supervising officer or his deputy shall be present at the scene of operations whenever chemicals are being received or are in the cleaning system or during subsequent inspections.

- (d) Statutory requirements covering effluent disposal shall be followed.
- (e) The integrity of the circuit to be cleaned shall be tested by filling with water (hydrostatically for boilers) before introducing chemicals.
- (f) All temporary connections shall be made in rigid pipework, except in cases where it is not practicable and flexible pipework has to be used. If flexible pipework is used, suitably placed valves must be provide for isolation in case of failure. All pipework, flexible or rigid, must be sufficiently reliable for

the whole of the operation.

- (g) Whilst chemical cleaning operations are in progress, venting of the boiler, including the vent from the constant head overflow, shall be to the outside of the building into areas in accessible to personnel.
- (h) Special storage precautions must be taken when storing some of the hazardous chemicals required for the chemical cleaning process; these are given in Appendix 6. If any chemical not covered is to be used, advice shall be sought from the Safety Committee.
- (i) Stock control shall be implemented so that there is a sequential turnover of chemicals.
- (j) An adequate water supply shall be available to deal with any leakage or spillage of chemicals.
- (k) Suitable equipment or means shall be provided to deal with spillage or personnel contamination.
- (l) Manual handling of chemicals shall be avoided as far as practicable. Wherever possible, mechanical aids shall be used for transporting chemicals and for dispersing and transferring chemicals from containers.
- (m) Spillage, splashing or the creation of dust or accumulation of vapours shall be avoided as far as is reasonably practicable.
- (n) Disposal of all surplus solutions and chemical waste shall be by an approved route. Reference shall be made to the appropriate Control of Pollution Act.

3.6.6.2 Precautions During the Cleaning Process

- (a) The chemical handling, mixing and temporary hazardous areas shall be cordoned, cleared of extraneous matter, and **Danger Notice** shall be displayed. Persons not concerned with the cleaning exercise shall be prohibited from the area.
- (b) Whenever chemical solutions are in the plant, the entire circuit both temporary and permanent shall be periodically examined for leaks. Any leakage shall be arrested as quickly as possible and the contaminated area thoroughly flushed down.
- (c) If the supervising officer deems the leakage to be dangerous to personnel or plant, the process shall be suspended and the affected circuit drained and flushed prior to repair.
- (d) Appropriate protective equipment shall be worn while examining for and dealing with leaks.

- (e) Entry into any confined space into which solutions or vapour can leak from the cleaning process during the process shall be avoided as far as is reasonably practicable. If entry into such spaces must be made, the precautions given in Section D shall be observed.

3.6.6.3 Approach To The Plant (Excluding Bodily Entry)
After Any Stage Of The Cleaning Process

When the plant is to be opened up after the passivation stage or after any acid stage the following precautions shall be observed:-

- (a) The chemical cleaning circuits shall be drained taking care to minimize spillage, splashing of solutions or accumulation of vapour.
- (b) If chemicals are drained into a holding vessel care shall be taken that mixing of chemicals from different stages does not occur in the vessel. It is particularly important to avoid acidifying solutions containing nitrite or bromate or mixing strong acids and alkalis, or mixing strong oxidising and reducing agents.
- (c) Vapours issuing from plant openings shall be dispersed by using good ventilation.
- (d) The breaking open of access points shall be carried out by personnel wearing protective attire. Contact with surfaces which are or have been wetted by chemicals shall be avoided as far as is reasonably practicable.
- (e) Components which are contaminated with chemicals shall be placed on impervious sheets for cleaning prior to replacement.
- (f) Personnel shall not put themselves to risk when making a quick observation of the plant interior (without bodily entry) when the access points are first opened.

3.6.6.4 Entry Of Personnel Into Plant Which Has Been Chemically Cleaned

If entry is to be made into plant after the passivation stage or after any acid stage during the process, the following precautions shall be observed:-

- (a) The supervising officer shall ensure that entry to the plant is restricted to the minimum number of people necessary.
- (b) During the time that personnel are inside the plant a standby man shall be positioned at the point of entry.
- (c) Before entering plant there shall be an absolute

minimum delay of three hours after opening all entry points. During this period ventilation of the plant shall be carried out at a rate of at least ten air changes per hour using a filtered air supply. It is essential that this three hours delay period is observed even if a higher ventilation rate is adopted. Ventilation of the plant at a rate of at least ten air changes per hour shall be continued whilst personnel are in the plant.

- (d) Before personnel enter plant the temperature shall be below 30 Degree C.
- (e) Where practicable, personnel entering the plant shall wear an overall, gloves and eye-goggles.
- (f) Debris and chemical wastes shall be removed from the plant in impervious containers.
- (g) For disposal, debris and chemical residues shall be washed into a system where considerable dilution can be achieved.
- (h) All protective gear and clothing and equipment used for handling chemicals and inhibitors shall be thoroughly cleaned at the end of the work period.

- (d) Do not run inside a laboratory, except for an emergency.
- (e) Regular inspections shall be carried out on gas lines used on burners to detect leaks.
- (f) Burners and water taps that are not in immediate use shall be turned off.
- (g) Wash bottles containing chemicals/solvents such as acetone, distilled water shall be labelled.
- (h) A person working alone in the laboratory shall ensure that another person is informed or within call.
- (i) Corrosive and toxic chemical wastes and oily wastes shall not be disposed down the sink.

3.6.2.2 Housekeeping

The laboratory shall be kept clean and maintained in proper working order. Passageways leading to building exits must be kept clear from obstructions.

3.6.2.3 Ventilation

The laboratory shall be adequately ventilated to ensure a clean laboratory atmosphere. An extraction fan with shutter frame shall be installed in every laboratory, preferably with ducting.

3.6.2.4 Fire Fighting Equipment

Portable fire extinguishers shall be available in the laboratory and immediately outside the laboratory.

3.6.2.5 First Aid Facilities

The first-aid box must be stocked adequately and be kept inside the laboratory at an easily accessible place.

3.6.2.6 Emergency Showers

Emergency showers incorporating eye wash facilities shall be located within reach of the employees and be operated by a spring loaded platform.

3.6.2.7 Fume Cupboards

- (a) A good ventilation system shall be installed in the fume cupboard.

- (b) Volatile and inflammable chemicals shall be handled in the fume cupboard with no naked flame around.
- (c) Experiments that give off fumes and require heating with naked flame shall be done in the fume cupboards.
- (d) Regular maintenance of fume cupboards shall be carried out.

3.6.3 Handling And Storing Of Laboratory Chemicals And Glassware

3.6.3.1 General

- (a) Always read labels and directions on bottles or containers of chemicals before handling.
- (b) Know the properties of chemicals that the personnel are dealing with in order to proceed with necessary caution and care.
- (c) Containers and bottles containing prepared chemicals shall be properly labelled. All poisonous chemicals shall carry the standard poison labels.
- (d) Carry beakers, bottles and flasks with the fingers around the body of the vessel. Do not hold glasses by the neck or lip. A pair of tongs shall be used to handle a hot flask.
- (e) Never open bottles or containers of highly volatile and/or flammable chemicals, liquids or gases, in a room where there are naked flames.
- (f) Always place or pour a chemical into a clean container before proceeding with the experiment. Do not use contaminated containers.
- (g) Position the bottle with the label facing upwards when pouring the liquid chemical.
- (h) After opening the acid bottle, do not place the stopper down on the table or bench where a next person may rest his hand or arm. Acid bottles must be stoppered tightly and flushed and dried on the outside before replacing them on the reagent shelf.
- (i) Do not taste any chemicals. Do not smell a chemical directly. When necessary, wave a small amount of vapour with the hand towards the nose at a distance.
- (j) Pour acid into water - Do not pour water into acid.

First Aid Treatment for Person Gassed by Chlorine

All persons who have been gassed with chlorine shall be examined by a doctor as serious symptoms may develop at a later stage.

Until a doctor arrives, the following treatment shall be administered:

- a. Immediately remove any clothing which has been contaminated with chlorine.
- b. Carry the patient into a pure, warm atmosphere free from draughts and loosen clothing at neck and waist.
- c. Keep the patient at rest remembering that an occasional change of position from lying down to sitting up may be beneficial. Reassure the patient and encourage him to suppress the desire to cough.
- d. Relief will be obtain by inhalation of a steamy atmosphere from a bronchitis kettle or from a vessel containing two teaspoonful of friar balsam in a quart of hot water. Either method shall be used under a tent.
- e. Any difficulty of breathing or cyanosis shall be relieved by the direct administration of oxygen through a face mask.

6.5

SESSI 5

RECOMMENDATIONS

- (1) The Chief Engineer (Generation Operation) shall issue a circular to all stations/departments instructing that all workshops be clearly marked with safety passage ways using yellow lines. Personnel not working in the workshop shall not cross the passage way and no object shall be left lying within the safety passages.
- (2) The Task Force shall study the inclusion of a "Hot Work Permit" for welding in flame proof areas.

GROUP/PANEL DISCUSSION

3.4 WORK ON MECHANICAL PLANT

3.4.1 Tools And Equipment

3.4.1.1 General Rules

- (a) Select the right tools for the job.
- (b) Regularly inspect tools, and use only those that are in good condition. Never use tools with loosely fitted handles.
- (c) Tools shall be stored properly.
- (d) Never place or leave tools where they might fall on persons or property, trip or otherwise cause injuries to personnel. Tools must be secured when working at heights.
- (e) Exercise care when handling or transporting tools, particularly pointed or sharp-edged ones, in order to prevent injuries to persons and damage to tools and other properties.
- (f) Use protective equipment as required.
- (g) Never use worn, blunt or damaged tool bits.
- (h) Never interfere with or distract another person who is operating a tool.
- (i) All defective tools and equipment shall be removed from service for repairs. Suitable signs/tags shall be posted and not removed until repairs have been completed.
- (j) Good house-keeping shall be maintained in work areas around machine tools.
- (k) All safety passage ways shall be clearly marked by a yellow line in all workshop layouts and personnel not working in the workshop shall not cross the passage demarkation line. No object shall be kept lying within the safety passage.

3.4.1.2 Hand Tools

- (a) Keep keen-edged blades sharp; store them safely when not in use.
- (b) Use wrenches of the right size for the job. Adjustable

wrenches shall only be used when absolutely necessary.

- (c) Never use a hand tool on or very close to any moving part of a machine. Stop the machine first, and remove all the tools before re-starting.
- (d) Never use a file without a handle.
- (e) Hammers or chisel with well worn mushroomed head shall not be used.

3.4.1.3 Portable Power Tools

(A) **ELECTRIC**

- (a) Before using a portable electric tool check to see that it is properly earthed, unless it is an approved type which does not require earthing.
- (b) Do not use electric tools with damaged casing.
- (c) All cables, plugs and connectors shall be inspected physically and wired up in accordance with BS.
- (d) Connect tools only to the correct power supply as instructed on the maker's name plate.
- (e) Make sure that the power cable is long enough to reach your working place without straining it. Ensure that the leads are not twisted or kinked.
- (f) Keep long power cables off the floor where practicable as they may get damaged or trip somebody.
- (g) Never stand on a damp or wet surface when using electrical equipment.
- (h) Disconnect tools from the power supply when not in use.
- (i) All dangerous moving and electrically live parts of the tool shall be adequately enclosed.
- (j) Do not oil the tool when it is in operation.
- (k) Do not attempt to stop any moving parts of the tool.
- (l) Do not leave a power tool unattended until it has stopped.
- (m) If the tool bit sticks, do not try to forcibly pull it out; loosen it out by steady rocking movement of the tool.
- (n) When laying the electric tool down, it shall always be placed in a position such that it can do no harm in

case the tool is accidentally started.

(B) PNEUMATIC

- (a) Disconnect tools from the air supply when not in use.
- (b) All dangerous moving parts of the tool shall be adequately enclosed.
- (c) Do not oil the tool when it is in operation.
- (d) Do not attempt to stop any moving parts of the tool.
- (e) Do not leave a power tool unattended until it has stopped.
- (f) If the tool bit sticks, do not try to forcibly pull it out; loosen it out by steady rocking movement of the tool.
- (g) When laying the tool down, it shall always be placed in a position such that it can do no harm in case the tool is accidentally started.
- (h) Make sure that the air hose is properly connected to the tool before opening the supply valve. Connectors shall be properly secured when air hoses of more than one length are used.
- (i) Grip the handle firmly with both hands when operating the tool. Never lean your body against it. When using a heavy pneumatic tool (such as jack hammer, clay digger, etc.) in a horizontal position, the tool shall be supported by vertically suspended ropes.
- (j) If the tool is accidentally detached from the air hose under pressure, turn off the air by closing the base control valve; never by kinking the hose.
- (k) Compressed air when misused can be extremely dangerous. Under no circumstances shall a worker aim an air hose at anyone, nor use it for cleaning his clothing or cool himself.

(C) HYDRAULIC

- (a) Disconnect tools from the hydraulic power source when not in use.
- (b) All dangerous moving parts of the tool shall be adequately enclosed.
- (c) Do not oil the tool when it is in operation.
- (d) Do not attempt to stop any moving parts of the tool.

- (e) Do not leave a power tool unattended until it has stopped.
- (f) If the tool bit sticks, do not try to forcibly pull it out; loosen it out by steady rocking movement of the tool.
- (g) When laying the tool down, it shall always be placed in a position such that it can do no harm in case the tool is accidentally started.
- (h) Be sure all hydraulic hoses, fittings, etc. are of the proper pressure rating, and that their connections are fully tightened.
- (i) Do not drop heavy objects on the hydraulic hose.
- (j) Avoid sharp curves and kinks in the air hose. Straighten the hose as much as possible before pressurising. Never apply pressure when hose is in kinked.
- (k) Keep hydraulic tools away from excessive heat, as heat tends to soften packing and cause leakage.
- (l) All hydraulic couplers shall be properly tightened. Loose coupler connections will cause complete or partial leakage of oil flow from the pump to the cylinder.
- (m) Do not over-tighten connections. Connections shall only be snug and leak free. Over-tightening can cause premature thread failure and may cause high pressure fittings or casting to fail.
- (n) Be sure all hydraulic hoses and fittings are connected to the proper inlet and outlet ports of the pumps and cylinders.
- (o) Never attempt to use the tool in such a way that its rated capacity is exceeded. Overloading causes cracked cylinders, blown cups and bent plungers.
- (p) Always screw dust caps on when coupler halves are disconnected. Use every precaution to guard unit against ingress of dirt because dirt and foreign matter may cause pump failure.

3.4.1.4 Machine Tools

- (a) Disconnect machine tools from the power supply when not in use.
- (b) All dangerous moving parts of the machine tool shall be adequately enclosed.

- (c) Do not oil the machine tool when it is in operation.
- (d) Do not attempt to stop any moving parts of the tool.
- (e) Do not leave a power tool unattended until it has stopped.
- (f) If the tool bit sticks, do not try to forcibly pull it out; loosen it out by steady rocking movement of the tool.
- (g) Do not use a machine unless you are authorised to operate it. The emergency stop control must be located before operating the machine.
- (h) Loose clothing, gloves and flapping sleeves shall not be worn near moving machinery.
- (i) Chips and swarfs arising from machining, etc must always be removed with a brush or stick, never with hands or rags. This shall be done only when the machine is stationary.
- (j) Always see that guards are in position before operating the machine. Guards shall not be removed when the machines are running.
- (k) Before using a grinding wheel, you must make sure that guards and tool rests are in the correct position. For all grinding machine operations, goggles must be worn to protect the eyes from flying particles.

6.6

SESSI 6

RECOMMENDATIONS

(1) Non-Destructive Testing by Radiography

The Task Force shall study safety measures involving work using radiography and consider incorporating them as addendum to the Instructions.

(2) The Task Force shall study and include other aspects of Safety requirements, for example Boiler Manufacturer's recommendations and related Statutory Acts on the following sections.

3.4.4, 3.4.5, 3.4.6, 3.4.7, 3.4.8 and 3.4.9

(3) Coal, Coke and Ash Handling

The Task Force shall includes safety Instructions on above topic.

(4) Operation and Maintenance of Gas Turbine.

The Task Force shall look into Safety Instructions required in the operation and maintenance of generating units using gas as fuel.

GROUP PANEL DISCUSSION

3.4.2 Welding And Welding Equipment

3.4.2.1 General

- (a) Always be aware of the risk before welding. Make sure that adequate fire extinguishers are readily available. Good house keeping shall be maintained at all times.
- (b) Only qualified or suitably trained personnel shall carry out welding. Welder under training shall be supervised closely by a qualified welder.
- (c) Welders and their assistants must wear welding goggles or use appropriate protective sheild when welding is being carried out.
- (d) Welders and assistants are responsible for the safe use of the welding equipment. Care must be taken in laying out the equipment before welding to ensure that there is no damage to regulators, nozzles, hoses etc.
- (e) Bottled gases must be turned off at the cylinder and welding transformers switched "off" when not in use.
- (f) Do not use oil or grease where it will come into contact with oxygen for risk of explosion.
- (g) Portable screen must be erected wherever possible to prevent flashing and flying particles. Danger Notices must be displayed to warn passers-by.
- (h) When welding above ground, precautions shall be taken to prevent weld spatter from falling on to personnel or plant below the welding area. Danger notices shall be displayed appropriately.
- (i) Any defect in the equipment must be reported to the supervisor.
- (j) Always read and understand the manufacturer's instructions on safe practices for the materials and equipment being used before commencing work.
- (k) Ensure that there is adequate ventilation when welding in confined areas. Welders shall keep their heads away from fumes and the work shall be positioned to achieve this.
- (l) Never strip to the waist during welding work, even if it is warm. Proper apparel shall be worn at all times.

- (m) Do not wear synthetic fibre clothing as weld splatter is sufficient to set these on fire.
- (n) Never hold the electrode holder under your arm during off-times in view of risk of electric shock.
- (o) Welding near flammable materials is PROHIBITED.
- (p) Never weld enclosed vessels, drums or tanks which have contained flammable materials unless they have been purged by steaming or boiling, or filled with inert gas, and tested and certified safe to work on by a Competent Person.
- (q) Do not weld inside enclosed vessels unless all safety precautions have been taken.
- (r) Appropriate Safety precautions are to be observed where site radiography is conducted on welds. (refer to 3.4.2.4).

3.4.2.2 Compressed Gas Cylinders

- (a) Treat every cylinder as 'full' and handle it with care.
- (b) Always use a carrier and secure the cylinders into it.
- (c) Welders shall be thoroughly familiar with the colour-code for gas cylinders.
- (d) Always secure acetylene cylinders in an upright position both in use and in storage.
- (e) Store all cylinders such that they cannot fall or roll. Gas cylinders shall be separately stored according to type of gas in separate compartments. All empty cylinders shall be stored separately.
- (f) Adequate ventilation shall be provided in all storage areas.
- (g) Keep cylinders away from sun, artificial heat, flammable materials, corrosive chemicals and fumes.
- (h) Avoid damage to valves and fittings ; do not use them as hooks for lifting or carrying purposes.
- (i) Keep valves and fittings of oxygen cylinders free from oil and grease.
- (j) Do not use cylinders as rollers for shifting equipment, even if they are empty.
- (k) Always lift cylinders from truck - do not drop or slide them.

- (l) In the event of fire, all gas cylinder valves shall be shut off and the cylinders removed to a safer place.
- (m) Welding torches shall not be ignited by naked flame. Spark guns shall be used at all times.
- (n) Nozzles shall be properly maintained and checked for wear and chokage before use. No repair shall be carried out on nozzles of cutting and welding torches other than cleaning of nozzle holes using nozzle files. Repair shall only be carried out by authorised agents.
- (o) Flashback arrestors shall be installed before the acetylene bottle regulators.
- (p) The instructions in Section 3.4.9 are also to be strictly followed.

3.4.2.3 Electric Arc Welding

- (a) Make sure that helmets and goggles are fitted with the correct filter glass.
- (b) Wear adequate protective clothing including appropriate gloves and clear goggles for heavy chipping.
- (c) Ensure that cables and connections are in good condition and firmly attached. Proper earthing leads shall be used.
- (d) Make certain that the welding equipment, bench or work-piece is properly earthed.
- (e) When carrying out electric arc welding, ensure that the return lead makes good contact with the work being welded and not clamped indirectly to other structures.
- (f) When carrying out electric arc welding on vehicles, ensure that the vehicle battery terminals are disconnected before commencing work.
- (g) Check that the electrode holder is in good condition and is fully insulated and always place it on an earthed surface when not in use.
- (h) Always stand on an insulated mat even when the ground is dry. Wearing of welding safety shoes is compulsory.
- (i) Keep trailing welding cables clear of roads and walkways. Secure overhead fixtures where possible.
- (j) Never wear wet clothing, gloves, shoes or any other wet apparel during electric arc welding operation.

3.4.2.4 Non-Destructive Testing By Radiography

TO BE ADDED

3.4.3. **Pressure Vessels And Associated Pipework**

3.4.3.1 All safety valves and pressure gauges shall be checked, tested and recalibrated at the time of the Statutory Inspection and results recorded. On completion of overhauls on safety valve, security locks and valves easing handles are to be reinstated and the keys handed back to the Shift Charge Engineer.

3.4.3.2 All water level indicators shall be checked and tested weekly. High and low water alarms shall be tested weekly by raising and lowering the water level. The results of these tests shall be recorded.

3.4.3.3 Should it be necessary to shut off or gag any water alarm, a **Danger Notice** warning operators about same shall be attached to the boiler operating panel and a note carried forward on the boiler log sheet.

3.4.3.4 Defects and status of plant shall be noted down on consecutive log sheets (every shift) until defect is cleared.

3.4.3.5 (a) No maintenance work other than floating of safety valves, or testing of water level indicators or alarms shall be carried out in or on the above plant or equipment until a **Permit-to-Work Certificate (Mechanical)** has been issued by an **Authorised Person**. No maintenance work shall be carried out without informing the **Shift Charge Engineer** on duty. All Furmanite repairs shall be clearly identified and labelled "Furmanite Repair. Do Not Operate."

(b) The **Permit-to-Work Certificate (Mechanical)** shall not be issued until the equipment has been isolated from all possible sources of supply, including blowdown, and brought to atmospheric pressure and if necessary the equipment drained. In cases where the **Authorised Person** is convinced that isolation is not possible or required, (eg. for Furmanite process), the **Competent Person** shall be warned of the dangers which shall be clearly stated in the **Permit-To-Work Certificate (Mechanical)**

(c) Wherever there is provision, a double shut-off shall be carried out. A non-return valve shall not be considered as a shut-off valve unless it is capable of being locked shut.

(d) The controlling valves shall be locked shut and **Danger Notices** posted where necessary and the keys placed in the appropriate **Key Safe** (refer to Section 3.1.2) before issuing **Permit-to-Work Certificate (Mechanical)**.

3.4.4 Oil, Gas And Pulverised Fuel Fired Furnaces And Ancillary Equipment

3.4.4.1 All equipment shall be maintained to prevent leakage and kept in a clean condition.

3.4.4.2 All explosion doors shall be kept free from obstruction and in good working order and shall be periodically eased during outages of the boiler.

3.4.4.3 Suitable fire protection systems shall be installed and fire extinguishing equipment shall be kept within reasonable distance from all firing plant.

3.4.4.4 No person shall enter a vessel which has recently been emptied of oil or of any other flammable substance until an **Authorised Person** is satisfied that all dangerous vapours have been expelled. Oxygen level shall be monitored to ensure minimum level adequate to sustain life.

3.4.4.5 Smoking and exposed flames are prohibited in the vicinity of open vessels containing or which have contained oil or any other flammable substance.

3.4.4.6 Work on vessels involving the application of heat is forbidden until all practicable steps have been taken to prevent fire or explosion either by removal of the flammable substance and any fumes or by rendering them non-explosive and non-flammable. A **Permit-To-Work Certificate (Mechanical)** is to be issued only after such steps have been taken.

3.4.4.7 No internal work shall be carried out in the combustion chamber or boiler passes until the firing equipment has been isolated and locked off from all possible sources of supply. Oil and gas fired combustion chambers or boiler passes shall be ventilated and tested for freedom from dangerous fumes. A **Permit-To-Work Certificate (Mechanical)** is to be issued only after above steps have been taken.

3.4.4.8 When a plant is shut down precautions shall be taken to prevent leakage of fuel into the combustion chamber.

3.4.4.9 Before any attempt is made to light up a boiler, the appropriate fans shall be used to clear the combustion chamber, boiler passes and flues of flammable gas and dust and all flame monitoring devices shall be ensured

to be in good working order.

3.4.4.10 As a precaution against possible explosion, no accumulation of coal dust shall be permitted in the vicinity of the plant.

3.4.4.11 No person shall enter a pulverised fuel bunker until the bunker has been emptied of fuel, ventilated, cleared of dangerous gas and fumes and the associated milling plant and the upstream coal conveying system isolated. Breathing apparatus, safety belt and life-lines shall be maintained in good order and kept available for immediate use.

3.4.3.12 No internal maintenance work on any item of pulverised fuel equipment on a steaming boiler shall commence until the equipment has been completely cleared of pulverised fuel and isolated by efficient dampers or blanks from the furnace, flue gas and hot air systems.

3.4.3.13 Before admitting pulverised fuel to the furnace the operators shall make certain that all torches or auxiliary oil burners are properly ignited and, should these fail before ignition of pulverised fuel takes place, the fuel supply shall be stopped immediately and all fuel cleared from the furnace and boiler passes before any attempt is made to relight.

3.4.4.14 Ash or grit removal from boiler furnaces shall not commence without a Permit-To-Work Certificate (Mechanical) from the Shift Charge Engineer.

3.4.5 Access To Bunkers And Similar Situations

3.4.5.1 Entry to bunkers for the purpose of manual trimming of coal or ash is forbidden.

3.4.5.2 Entry for the purpose of maintenance or final cleaning out shall be carried out only after a Permit-to-Work Certificate (Mechanical) has been issued.

3.4.5.3 For such approved entry the following provisions shall apply unless the bunker is empty of coal or ash:-

(a) The person entering the bunker shall wear a safety belt, the line or lines of which shall be properly secured and kept taut during the whole of the time he is in the bunker by one or more other person(s) who shall remain outside the bunker.

(b) He and every other person working with him shall be fully conversant with the manner in which the work is to be carried out and with the manner in which the safety belt and lines shall be used so as to secure his safety.

3.4.5.4 Entry to pulverised fuel bunkers shall only be after adequate precautions have been taken to prevent approach to coal, coke and ash piles where there is risk of collapse.

3.4.5.5 No naked lights or smoking shall be permitted where explosive mixtures may be present.

3.4.6 Coal, Coke And Ash Handling

TASK FORCE TO SUBMIT AS AN ADDENDUM

3.4.7 Hydrogen Cooled Generator

3.4.7.1 No person shall smoke or use any exposed flame or welding equipment or carry out operations which can produce sparks at any time within the vicinity of a hydrogen-cooled plant and its associated auxiliaries.

3.4.7.2 Before commencing work which involves the opening up of any part of a casing which normally contains hydrogen, the hydrogen supply shall be disconnected from the hydrogen system and the casing shall be cleared of hydrogen and completely scavenged by CO₂ or other inert gas which shall in turn be replaced by air. A Permit-to-Work Certificate (Mechanical) which shall certify that the casing is free of all hydrogen and scavenging gas shall then be issued.

3.4.7.3 Tests, including Orsat test, shall be carried out to confirm absence of hydrogen and scavenging gas in the casing and proper ventilation ensured before a Permit-To-Work Certificate (Mechanical) as described in 3.4.7.2 is issued.

3.4.7.4 When external work on a hydrogen cooled machine, such as the external maintenance of hydrogen seals or grinding of slip-ring has to be carried out, the casing shall be cleared of hydrogen and replaced by CO₂ or other inert gas, provided the following conditions are observed:-

(a) No part of the casing is dismantled, and

(b) The pressure in the system is maintained above atmospheric pressure at all times.

3.4.7.5 Before work is commenced on any other part of the equipment which contains hydrogen, that part shall be isolated from all sources of hydrogen, and the valves locked. Enclosures containing hydrogen gas shall, wherever practicable, be opened to atmosphere and thoroughly ventilated. A Permit-to-Work Certificate (Mechanical) which states the precautions taken to clear that part of the plant of hydrogen, shall then be

issued. The charging and purging of hydrogen gas of the generator shall be carried out in the presence of the Shift Charge Engineer.

3.4.8 Internal Combustion Engines And Gas Turbines

3.4.8.1 All fuel equipment shall be maintained to prevent leakage and kept in a clean condition. Fuel inlet lines shall be shut off before any maintenance on the engine commences. Suitable fire extinguishing equipment shall be kept adjacent to all fuel handling plant.

3.4.8.2 Before work is commenced on any engine:

- (a) A Permit-To-Work Certificate (Mechanical) shall be obtained from the Authorised Person, the starting equipment shall be locked off, isolators of any associated generator and auxiliaries shall be opened and locked off, the keys locked in a Key Safe and Danger Notices attached.
- (b) Where batteries are used for starting, they shall be disconnected at the battery terminal.
- (c) Where compressed air is used for starting, the air supply to the engine shall be isolated and locked.
- (d) All cooling water input to the Engine shall be isolated and locked off.
- (e) Anti condensation heaters in generators may be left on if work is only confined to the engine and Danger Notices to this effect shall be displayed.
- (f) Automatic fire fighting system shall be changed over to manual mode.

NOTE:

TASK FORCE TO LOOK INTO SAFETY INSTRUCTIONS IN THE OPERATION AND MAINTENANCE OF TURBINES USING GAS AS FUEL.

3.4.9 Compressed Air And Gases

3.4.9.1 General

- (a) Always close a hose by the valve. Never kink the hose.
- (b) Do not leave hoses lying around for others to trip over. Hoses shall be stored in a safe place after use.
- (c) Do not use a cylinder of compressed gas without the pressure reducing regulator attached to the cylinder valve, except when cylinders are

attached to a manifold, in which case, a regulator must be attached to the manifold header.

- (d) Do not use a wrench on valves equipped with hand wheels nor hammer the valve wheel in attempting to open or close the valve.
- (e) Never permit the gas to enter the regulator suddenly. Open the cylinder valve slowly.
- (f) Store all cylinders such that they cannot fall or roll.

3.4.9.2 Compressed Air

- (a) Do not use compressed air for any other purpose than that for which it is intended.
- (b) Never direct compressed air at yourself to blow dust off clothes or hair.
- (c) Do not clean down machines and benches with compressed air. Use a brush or special vacuum cleaner.
- (d) Horseplay with compressed air is PROHIBITED. This can cause serious injury or death.
- (e) Make sure that your compressed air tool, hose and fittings are in good working condition. If not, report the fault to your supervisor.
- (f) When connecting a tool to the air line, keep a firm hold on the tool in case it whips.
- (g) Before changing tools make sure that the supply line is closed or has an automatic shut-off valve.

3.4.9.3 Combustible Gases

- (a) Keep sparks and flame away from cylinders.
- (b) Connections to pipings, regulators, and other appliances shall always be kept tight to prevent leakage. Where hose is used, it shall be kept in good condition.
- (c) Never use an open flame to detect combustible gas leaks. Instead, use soapy water.
- (d) When cylinders are not in use, keep valves tightly closed.
- (e) Before regulator is removed from a cylinder, close the cylinder valve and release all gas from regulator. Do not test cylinders by opening the

cylinder valves without the proper regulator.

- (f) Never interchange combustible gas regulators, hoses or other appliances with similar equipment intended for use with other gases.
- (g) Store all cylinders containing combustible gases in a well-ventilated place and in an upright position.

3.4.9.4 Preparation For Work On Equipment Containing Or Operated By Compressed Air Or Gas

The following precautions shall be taken before any work, other than operating adjustments are carried out on equipment operated by or containing compressed air or gas:-

- (a) All valves controlling the supply of air or gas to equipment shall be closed, and compressed air or gas removed from the associated receivers and pipework, which shall be left open to the atmosphere.
- (b) The valves in (a) above shall be locked in the safe position by locks and keys shall be placed in the appropriate **Key Safe**.
- (c) **Danger Notices** shall be attached to the valves.
- (d) A **Permit-to-Work Certificate (Mechanical)** shall then be issued.

6.7

SESSI 7

RECOMMENDATIONS

- (1) All Heads of Departments shall draw up contingency plans to handle major fires and emergencies.

GROUP/PANEL DISCUSSIONS

3.7 FIRE PREVENTION AND CONTROL

3.7.1 Fire Prevention

The best time to stop a fire is before it starts.

3.7.1.1 The elimination of one of the three elements in the "triangle of fire" vis-a-vis heat, oxygen and fuel material will put out the fire.

3.7.1.2 Electrical equipment, machinery and processing equipment, housekeeping conditions and other sources of fire shall be checked for fire hazards at regular intervals.

3.7.1.3 Fire fighting equipment shall be checked regularly to be sure that they are ready for any emergency. Each designated employee must become proficient in the method of handling fire fighting equipment installed at the area or station where he works.

3.7.1.4 All Heads of Department shall arrange inspections of all fire fighting equipment by Jabatan Bomba from time to time.

3.7.1.5 Petroleum oil, gases and other volatile liquids (low flash point) shall be handled with great care. Open flames, lighted cigars, cigarettes, or pipes shall be kept away from them.

3.7.1.6 Employees shall eliminate or report to their immediate supervisor, fire hazards, particularly in their work area .

3.7.1.7 All fires shall be reported and investigated.

3.7.1.8 Fire drills and fire-fighting drills shall be carried out regularly. Fire fighting teams shall be properly instructed and trained.

3.7.1.9 Fire fighting procedures, safety measures and contingency plans for fire fighting shall be established and displayed in strategic locations.

3.7.1.10 Pillar hydrants shall clearly be identified and shall not be obstructed. They shall be regularly tested for operation.

3.7.1.11 Fire doors shall remain shut at all times.

3.7.1.12 Fire exit doors shall be clearly indicated by "EXIT/"

KELUAR" signs. All escape passages shall be kept clear of obstructions at all times.

3.7.2 Housekeeping

3.7.2.1 Oil-soaked and paint-saturated rags, papers, waste and other combustible refuse shall be deposited in non-combustible, covered receptacles, and removed daily from the work areas for proper disposal.

3.7.2.2 A procedure on safe collection and disposal of all combustible waste and rubbish shall be a part of the fire prevention program.

3.7.2.3 Accumulation of all types of dust shall be cleaned at regular intervals from overhead pipes, beams and machines, particularly from bearing and other heated surfaces.

3.7.2.4 Roofs shall be kept free of all combustible refuse. No such materials shall be stored or allowed to accumulate in air shafts, or elevator and stair shafts, tunnels, out-of-the-way corners near electric motors or machinery, against steam pipes, or within 3 metres of any stove, furnace, or boiler.

3.7.2.5 All passageways leading to portable fire extinguishers, fire hose cabinets and fire exits shall be kept free from obstructions at all times. Portable fire extinguishers shall not be relocated from their officially designated places without previous clearance from the responsible Safety Officer.

3.7.3 Rubbish Disposal

3.7.3.1 Combustible rubbish, weeds and grass shall not be allowed to accumulate in substation yards, in or around pole yards, or near buildings, other combustible materials, or storage drums/tanks of flammable liquids.

3.7.3.2 Rubbish shall be burned only in incinerators or designated areas away from buildings, sheds, lumber piles, fences and grass or other combustible materials.

3.7.3.3 Wind and weather conditions shall be considered before fires are lit. Only a controllable amount of materials shall be burned at one time and a fire hose or other suitable fire fighting equipment shall be on hand. In no case shall a fire be started on a windy day where there is any possibility of the fire getting out of control.

3.7.3.4 Weeds, grass and other growths within designated areas and along perimeter fencing shall be kept trim.

3.7.4 Electrical Equipment Fires

- 3.7.4.1 Only approved electrical equipment shall be used in areas where flammable gases or vapors may be present.
- 3.7.4.2 Portable electrical tools and extension cords shall be inspected by the competent person at frequent intervals and repaired or replaced promptly when found defective. User shall also visually check same before use.
- 3.7.4.3 Waterproof cords and sockets shall be used in damp places, and explosion-proof fixtures and lamps shall be used in the presence of highly flammable gases and vapors.
- 3.7.4.4 Portable lamp bulbs shall be protected by heavy lamp guards or by adequately sealed transparent enclosure and kept away from sharp objects and from falling. Bare bulbs shall never be used when exposed to flammable dusts or vapors. Lamp bulbs must be considered as potential hazards in areas where flammable dusts or vapors exist; they must be safeguarded accordingly.

3.7.5 Smoking

- 3.7.5.1 In areas, where smoking is prohibited, the no-smoking sign shall be posted conspicuously.
- 3.7.5.2 Where flammable and combustible liquids, vapors, chemicals, gases and the like are stored or handled, personnel shall be prohibited from carrying matches, lighters and other spark-producing devices.

3.7.6 Open Flames

- 3.7.6.1 If petrol gasoline, kerosenes, LPG (Liquefied Petroleum Gas), LNG (Liquefied Natural Gas), acetylene or alcohol torches are used, they shall be placed so that the flames are at least 50cm from wood surfaces. They shall not be used in proximity with flammable materials.
- 3.7.6.2 When portable furnaces, blow torches and the like are used, there shall be a safe overhead clearance of at least 1.5 metres. Combustible materials shall be removed or protected by non-combustible insulating board or sheet metal and preferably by a natural draft hood and flue of non-combustible material.

3.7.7 Fire Protection Equipment

3.7.7.1 General

- (a) All fire fighting installations shall be regularly tested. Any defect shall be immediately attended to.

- (b) Contact with some chemicals used in fire protection equipment may be dangerous and in such cases **Danger Notices** to this effect shall be displayed adjacent to the equipment.
- (c) Portable Carbon-dioxide, BCF and dry chemical extinguishers may be used in the vicinity of live electrical apparatus provided that in the handling of the extinguishers, safety clearances are maintained. After the discharge of portable carbon-dioxide, halon or BCF extinguishers in a confined space, the operator shall leave the space until the precautions set out in (d) have been taken. Other portable fire fighting equipment shall not be used on electrical apparatus unless such apparatus has been disconnected from the supply.
- (d) After any fire, or after the discharge of extinguishers using carbon-dioxide, halon or BCF in an enclosed space, the space shall be thoroughly ventilated before entry, or, suitable breathing apparatus shall be worn if entry is necessary before the gases have been cleared.

3.7.7.2 Automatic Control

- (a) Before work or inspections are carried out in any enclosure protected by automatic carbon-dioxide, halon, BCF or other chemical extinguishing agents, the automatic control shall be rendered inoperative, the fire fighting equipment left on manual control and a notice to this effect shall be attached. This procedure shall not apply to continuously manned areas (such as Control Rooms) protected by carbon-dioxide, halon, BCF or other chemical extinguishing agents where a time-delay has been incorporated. In such cases, emergency safety procedures for evacuation shall be prominently displayed.
- (b) The automatic control shall be restored immediately after the persons engaged on the work or inspections have withdrawn from the protected enclosure.
- (c) Precautions taken to render the automatic control inoperative shall be noted on any Permit-to-Work issued for work in the protected enclosure.

3.7.8 **Portable And Manual Fire Control Equipment**

3.7.8.1 Inspection And Maintenance

- (a) Extinguishers shall be maintained in a fully charged and operable condition and kept in their designated places at all times, except when being used, tested, repaired or replaced.

- (b) Extinguishers removed from their designated places for recharging or repair shall be temporarily replaced by spare extinguishers of the same type and capacity.
- (c) Extinguishers shall be inspected monthly to ensure they are in their designated places, that they have not been tampered with and are fully charged and pressurized, and to detect any physical damage, corrossions or other impairments. Extinguishers or parts thereof which are not in good operating condition shall be immediately recharged, repaired or replaced. Servicing and repairing shall be carried out by authorised personnel.
- (d) Each extinguisher shall have a durable tag securely attached to show the maintenance or recharge date and the initials or signature and name of the person who performs this service.
- (e) Fire fighting equipment shall not be tampered with.
- (f) Extinguishers installed in corrosive environment shall be placed in suitable transparent covers.

3.7.8.2 Installation

- (a) Extinguishers shall not be obstructed or obscured from view. In large rooms and in certain locations where visual obstruction cannot be completely avoided, the location and intended use of extinguishers shall be indicated conspicuously.
- (b) In situations where extinguishers must be temporarily provided, unless they are of the wheel type, they shall be installed on standard portable stands or set on shelves.
- (c) Extinguishers shall be conspicuously located in strategic positions with the operating instructions facing outward.

3.7.9 Care Of Fire Hose

- 3.7.9.1 Fire hoses shall always be in good order and cared for properly. They shall not be used except for the purpose it is intended. Regular testing of hoses shall be carried out at least once in three months.
- 3.7.9.2 Fire hoses provided for yard hydrants shall be kept in well-ventilated hose house with sufficient space to hold the hose and equipment. Hot locations shall be avoided, if possible. Hoses shall be so stored that they may be unrolled easily when required.
- 3.7.9.3 Care shall be taken so that gasoline, grease, harmful chemicals and acids do not come in contact with hoses.

Where such exposure is likely to occur, hoses resistant to these agents shall be employed. If a hose does come in contact with any of the above materials, it shall be washed with soap and thoroughly rinsed with water. After use, hoses shall be drained, shall be cleaned and dried before it is placed in storage.

3.7.9.4 Do not store hoses until thoroughly dry. Drying shall be done carefully by hanging hoses or placing them on a rack.

3.7.9.5 Hoses shall not be dried in the sun on concrete roadways or sidewalks. Just as soon as the hose is thoroughly dry, it shall be removed from exposure to the weather. Over-exposure, especially in or by the sun can be damaging. Hoses shall not be left in hot drying towers or cabinets after drying has been completed. Polythene coated hoses may be rolled and stored without drying.

3.7.9.6 If the hose appears to be defective, it shall be tested hydrostatically and replaced if necessary. If the hose has had prolonged or severe use at a fire, it shall be inspected and tested.

3.7.9.7 Nozzles

- (a) All nozzles shall be checked periodically and immediately after use.
- (b) If there is an obstruction that cannot be removed by fully opening the nozzle, the nozzle shall be taken from the hose line and the obstruction removed through the coupling end, since any further attempt to force it out through the tip may damage the nozzle.
- (c) Care shall be taken to avoid dents or nicks in nozzle tips, as this can seriously affect the reach of the stream. Nozzles shall not be dropped or thrown aside.
- (d) When using a nozzle, care shall be taken not to twist or bend the handle of the shut off valve.
- (e) During inspection, check that nozzle valves work freely. Otherwise, they shall be immediately taken out of service, temporarily replaced and repaired.

3.7.9.8 Couplings

- (a) Couplings shall be kept in good operating condition, and after each time the hose is used, the coupling threads and mating faces shall be examined. Any length of hose with defective or damaged couplings shall be removed from service and repaired. Couplings shall be adjusted so that they would function easily by hand.

- (b) Couplings shall not be greased or oiled if found to be stuck. Ordinarily, they can be freed satisfactorily by immersion in warm soapy water.
- (c) When disconnecting the line after use, care shall be taken not to drop couplings on pavement or other hard surfaces.
- (d) Inspection shall be made to see that the hose is firmly attached to the coupling, so that the coupling and the hose do not come apart.

3.7.9.9 Gaskets

- (a) When couplings are inspected, the gasket in the swivel shall be checked. Rubber gaskets deteriorate with age and will break away from the washer or gasket seat.
- (b) Care shall be taken to ensure that the gasket does not protrude into the waterways, particularly at the nozzle coupling, as this can cause a ragged stream, thus reducing the effective reach of the nozzle.

3.7.10 Procedures For Control Of Fire At Power Stations

3.7.10.1 Any person, upon discovery of any fire, shall raise the alarm immediately and inform the Electrical Control Room, and the **Shift Charge Engineer** on duty giving details and the location of the fire.

3.7.10.2 The Control Assistant on receiving the information of any fire shall immediately sound the fire alarm. He shall also ring for the Fire Brigade for assistance if a big fire is reported. The **Shift Charge Engineer** shall confirm that this is carried out.

3.7.10.3

- (a) On hearing the fire alarm raised, all office, workshop, stores and maintenance staff shall evacuate the premises immediately and proceed to the nearest designated safety areas.
- (b) The **Shift Charge Engineer** shall report (or directing the Control Assistant if he's too busy to do so) to the Station Superintendent and his deputies any fire outbreak.
- (c) All operational staff on duty shall remain at their normal place of work and await instructions from the **Shift Charge Engineer** unless the fire is in their immediate vicinity and (except those who are members of the fire fighting team).
- (d) The fire fighting team shall first be directed by the Fire Fighting Officer to proceed to the fire site with

the necessary equipment and commence fighting the fire.

(e) The **Shift Charge Engineer** shall not hesitate in deciding to take off the plant as appropriate before evacuation of the operation personnel.

3.7.10.4 When the Fire Brigade arrives on the scene, the Fire Fighting Officer and his team shall will give every assistance to the Fire Brigade team who will then take charge. The **Shift Charge Engineer** present is to liase to this effect.

3.7.10.5 The Fire Fighting Officer shall be an officer appointed by the Head of Department. After normal working hours, the **Shift Charge Engineer** on duty shall be the Fire Fighting Officer.

7.0 UPACARA PENUTUPAN BENGKEL

The Workshop 'Panduan Keselamatan (Mekanikal)' was closed by Mr. D.K. Jesuthesan, Chief Engineer (Generation Operations) with the presence of Mr. Misron bin Yusof, Pengarah ILSAS as a guest. He expressed his pleasure and appreciation for being asked to make the closing address and mentioned that as Chief Engineer and member of the Standards Technical Advisory and Work Safety Committee, he was personally responsible for the issuing of the Safety Regulations (Mechanical) and ensuring its implementation. He lauded the efforts of all those have made the Workshop possible and mentioned in particular the Research and Development Department.

With the realisation of the three day Worksyop Mr. Jesuthesan expressed his relief and joy and said that Puan Hajjah Maimunah would share this feeling too if she had been present. He admitted that the Worksyop had exceeded his expectations and attributed this to the presence of Mr. P.V.Lingham as Workshop Chairman and active participation of experienced Senior Officers from various stations.

He was impressed with the full participation of external bodies like Factories and Machinery Department, SIRIM, BOMBA, IEM and others and pointed out that their contribution is essential in finalising the draft. He stressed that the Workshop had only made recommendations on the existing draft regulations and he expressed hope that immediate feedback would be forthcoming once the regulations are out. He explained on the role of

participants in disseminating the deliberations of the Workshop to others, including their superiors at their respective stations. He urged the participants to conduct their own Workshops and Seminars to familiarise other Station staff with the Safety Instructions to prepare for smooth implementation. Mr. Jesuthesan acknowledged the difficulties faced by the Task Force in producing the final document and commented that the infrequent meetings of the Standards, Technical Advisory and Work Safety Committee may contribute to the delay in formalising the Safety Instructions. In view of this he gave his full backing for the Task Force to proceed with the final version of the document and to distribute them to the Stations immediately. He was confident that once the Safety Instructions are issued the Power Station staff would have a document to work on and would endeavour to implement them. He explained that in enhancing the safety of plant and personnel, it would ultimately lead to improvement in efficiency. He remarked that the Factories and Machinery Department have vested the LLN with some powers to act as their representative in the implementation of certain safety requirements. This he said was partly due to the high work load of the Factories and Machinery Department and partly because they recognised the LLN as a capable body with good safety records.

Mr. Jesuthesan stressed to all participants to act with responsibility and to ensure that no risk to life and plant is taken whenever exemptions are given with regards to statutory requirements. He appealed to all participants to ensure that the Safety Instructions are finalised and implemented as early as

possible and trusted that these will eventually become so familiar that reference to the document may no longer be necessary.

He thanked the Workshop Chairman and the Organising Committee for affording him the opportunity to close the Workshop.

8.0 PENGHARGAAN

Jawatankuasa Pengelola Bengkel Keselamatan (Mekanikal) mengucapkan setinggi-tinggi penghargaan kepada mereka yang telah menjayakan bengkel ini secara langsung atau tidak. Senarai penghargaan adalah seperti berikut:-

- o Y.B. Dato' Mohd. Jalaluddin bin Zainuddin, Pengurus Besar LLN.
- o Ketua Pengarah Jabatan Kilang dan Jentera .
- o Pengarah Jabatan Kilang dan Jentera (Bhg. Sel/W.P.)
- o Ketua Pengarah Jabatan Perkhidmatan Bomba
- o Pengarah Jemaah Pemeriksaan Elektrik
- o Pengawal SIRIM
- o Yang Dipertua Institut Jurutera-Jurutera Malaysia
- o Yang Dipertua Persatuan Keselamatan Perusahaan Malaysia
- o Encik D.K Jesuthasan, K.J. Kendalian Penjanaan Kuasa
- o Encik P.V.Lingham, T.K.J. Kendalian Penjanaan Kuasa
- o Pengarah ILSAS dan kakitangannya
- o Pegawai Pelajaran dan Latihan Kanan
- o Semua Peserta
- o Jawatankuasa Petugas
- o Rapporteur Bengkel
- o Kakitangan Urusetia
- o Semua yang telah menyumbangkan kepada penyempurnaan Bengkel

LAMPIRAN

LAMPIRAN A

ATURCARA BENGKEL

Isnin 10 Mac 1986

<u>Masa</u>	<u>Acara</u>	<u>Tempat</u>
0800 - 0830	Pendaftaran Peserta-Peserta Bengkel	Theatrette
0830 - 0900	Pembukaan Rasmi Oleh Y.B Dato' Jalaluddin bin Zainuddin Pengurus Besar L.L.N	Theatrette
0900 - 0930	Jamuan Ringan	
0930 - 1000	Penerangan Ringkas Penjalanan Bengkel Olih Pengerusi Jawatankuasa Petugas	Theatrette
1000 - 1245	Perbincangan Kumpulan - Sessi I	Bilik Sindiket
1245 - 1400	Makan Tengahari	Dewan Makan
1400 - 1545	Perbincangan Kumpulan - Sessi II	Bilik Sindiket
1545 - 1600	Jamuan Ringan	
1600 - 1645	Perbincangan Panel (Lain-Lain Peserta Akan Mengikuti Pertunjukan Filem Keselamatan)	Bilik Persidangan Theatrette
1645 - 1700	Kesimpulan Perbincangan Sessi I & II Oleh Pengerusi Bengkel	Bilik Persidangan

Selasa 11 Mac 1986

<u>Masa</u>	<u>Acara</u>	<u>Tempat</u>
0800 - 1000	Perbincangan Kumpulan - Sessi III	Bilik Sindiket
1000 - 1015	Jamuan Ringan	
1015 - 1245	Perbincangan Kumpulan - Sessi IV	Bilik Sindiket
1245 - 1400	Makan Tengahari	Dewan Makan
1400 - 1500	Perbincangan Kumpulan - Sessi V	Bilik Sindiket
1500 - 1615	Jamuan Ringan	
1515 - 1515	Perbincangan Panel (Lain-Lain Peserta Akan Mengikuti Pertunjukan Filem Keselamatan)	Bilik Persidangan Theatrette
1615 - 1700	Kesimpulan Perbincangan Sessi III, IV dan V oleh Pengerusi Bengkel	Bilik Persidangan

Rabu 12 Mac 1986

<u>Masa</u>	<u>Acara</u>	<u>Tempat</u>
0800 - 0930	Perbincangan Kumpulan - Sessi VI	Bilik Sindiket
0930 - 0945	Jamuan Ringan	
0945 - 1115	Perbincangan Kumpulan - Sessi VII	Bilik Sindiket
1115 - 1200	Perbincangan Panel (Lain-Lain Peserta Akan Mengikuti Pertunjukan Filem Keselamatan)	Bilik Persidangan Theatrette
1200 - 1245	Kesimpulan Perbincangan Sessi VI Dan VII Oleh Pengerusi Bengkel	Bilik Persidangan
1245 - 1400	Makan Tengahari	
1400 - 1500	Dailog Am Amalan Keselamatan Distesen- Stesen Janaletrik Dipengerusikan Oleh En. D.K Jesuthasan K.J Kendalian Penjanaan Kuasa	Theatrette
1500 - 1515	Jamuan Ringan	
1515 - 1615	Upacara Penutup Dan Bersurai. Oleh K.J Kendalian Penjanaan Kuasa	Theatrette

LAMPIRAN B

SENARAI - SENARAI PESERTA

B.1 PESERTA BENGKEL

<u>Nama</u>	<u>Stesen/Jabatan</u>	<u>Jawatan</u>
1. En.Tan Teong Ho	Woksyop Bangsar	Pengurus Woksyop
2. En.Nadzimuddin Pitt	S.J.Tuanku Jaafar (P.D)	Timbalan Penguasa Stesen (S)
3. En.Hashim . Hamid	"	
4. En.Wan Kamaruddin Wan Abdullah	"	Jur. Ketua Gil. Kerja
5. En.Sia Cheng Kek	"	Ahli Kimia Kanan
6. En.Othman Hj. Mahmood	S.J.Kenyir	Timbalan Penguasa Stesen
7. En.Vincent Tan Soo Hin	S.J.Sultan Iskandar (Pasir Gudang)	Timbalan Penguasa Stesen
8. En.Tan Cheng Kheng	"	Ahli Kimia Kanan
9. En.Ishak Zakaria	S.J.Temenggor	Timbalan Penguasa Stesen
10. En.K.Arunaselem	S.J.Sultan Ismail (J.B)	Timbalan Penguasa Stesen
11. En.Zulkifli Mohd. Noor	S.J.Prai	Jur.Mekanikal Kanan
12. En.Mohd.Yunus Yaakob	"	Jur. Ketua Gil. Kerja Kanan
13. En.Zahidi Ismail	"	Jur. Mekanikal(D)
14. En.Henry Loong	Jab. Projek Penjanaaan Kuasa	Pemangku Ahli Kimia
15. En.Mohd.Ridzuan Abu Bakar	S.J.Gelugor	Timbalan Penguasa Stesen
16. En.Ibrahim Pawanteh	"	Jurutera Mekanikal
17. En.A.Rahman Marhaban	S.J.Pelabuhan Klang	Pen. Jur. Projek Kanan

<u>Nama</u>	<u>Stesen/Jabatan</u>	<u>Jawatan</u>
18. En.A.Rahim Noh	S.J Pelabuhan Klang	Pen. Jur. Projek Kanan
19. En.Vivekananda	"	"
20. Tuan Hj.A.Hadi Mohd.Deros	"	"
21. En. Choi Kam Cheong	"	Ahli Kimia
22. En.Prabakaran Nair	S.J. Melaka	Timbalan Penguasa Stesen
23. En. Bunny Khoo Ban Hai	S.J. Malim Nawar	Timbalan Penguasa Stesen
24. En. Geoffrey Nasrul Haq	ILSAS	Jurutera Latihan (Mekanikal & Loji)
25. En. Khamis Mohd. Yassin	S.J. Jambatan Connaught	Jurutera Mekanikal
26. En. Mohd.Redzuan Yahaya	S.J.Paka	Jurutera Kendalian
27. En. Asok Raghavan	"	Jurutera Projek
28. En. Zainuddin Ibrahim	"	Jurutera Ketua Giliran Kerja
29. En. Mohd. Mokhtar Ahmad	"	Ahli Kimia Stesen
30. En. Harminder Singh	Jabatan Kilang Dan Jentera	
31. En. Zakaria Nayan	"	
32. En. Leong Chiew Kum	"	
33. En. Mohd. Saifullah Idris	"	
34. En. Lam Peng Chee	SIRIM	
35. Encik Abdul Ghani Bin Daud	Jabatan Perkhidmatan Bomba	
36. Encik Yahya Salleh	Jemaah Pemeriksa Elektrik	
37. En. K.S.Kannan	Institut Jurutera-Jurutera Malaysia	

B.2 SENARAI KUMPULAN

Kumpulan A

- | | | |
|--------------------------------|---|-----------|
| 1. Tan Teong Ho | - | Pengerusi |
| 2. Wan Kamaruddin Wan Abdullah | | |
| 3. Mohd. Mokhtar Ahmad | | |
| 4. Geoffry Nasrul Haq | | |
| 5. Mohd Yunus Yaakub | | |
| 6. Zakaria Nayan | | |
| 7. Yahaya Salleh | | |

Kumpulan B

- | | | |
|--------------------------|---|-----------|
| 1. Nadzimuddin Pitt | - | Pengerusi |
| 2. Prabakaran Nair | | |
| 3. Hj. Hadi Deros | | |
| 4. Abd. Rahman Marhaban | | |
| 5. Ibrahim Pawanteh | | |
| 6. Tan Cheng Kheng | | |
| 7. Mohd. Saifullah Idris | | |

Kumpulan C

- | | | |
|------------------------|---|-----------|
| 1. Othman Hj. Mahamood | - | Pengerusi |
| 2. Hashim Hamid | | |
| 3. Ashok Raghavan | | |
| 4. Vivekananda | | |
| 5. Zulkifli Mohd. Noor | | |
| 6. Choi Kam Cheong | | |
| 7. Leong Chiew Kum | | |
| 8. Abdul Ghani Daud | | |

Kumpulan D

- | | | |
|----------------------------|---|-----------|
| 1. Vincent Tan Soo Hin | - | Pengerusi |
| 2. Mohd. Ridzuan Abu Bakar | | |
| 3. K. Arrnaselem | | |
| 4. Khamis Mohd. Yassin | | |
| 5. Mohd Radzuan Yahaya | | |
| 6. Hendry Loong | | |
| 7. Lam Peng Chee | | |

Kumpulan E

- | | | |
|-----------------------|---|-----------|
| 1. Ishak Zakaria | - | Pengerusi |
| 2. Bunny Khoo Ban Hai | | |
| 3. Abd Rahim Noh | | |
| 4. Zainuddin Ibrahim | | |
| 5. Zahidi Ismail | | |
| 6. Sia Cheng Kek | | |
| 7. Harminder Singh | | |
| 8. K.S.Kannan | | |

B.3 Pengerusi Bengkel

Encik P.V Lingham - Timbalan Ketua Jurutera
Kendalian Penjanaan Kuasa

B.4 Rapporteur Bengkel

Dr. Salim Sairan
Encik Abd. Rahman Hussain

B.5 Jawatankuasa Petugas

Encik Ammil Mahamud - Pengerusi
Encik R. Jayasekar
Encik Khairuddin Mohd. Yunus
Encik Kamarruzzaman Jusoh
Encik Abd. Rahman Hussain
Puan Mariam Hj. Othman

B.6 Jawatan Kuasa Pengelola

Encik Ammil Mahamud - Pengerusi
Encik R. Jayasekar
Encik Khairuddin Mohd. Yunus
Encik Kamarruzzaman Jusoh
Encik Yussof Ahmad
Encik Abd. Rahman Hussain
Encik V.R Menon
Puan Norsiah Abd. Wahab
Puan Mariam Hj. Othman

B.7 Senarai Jemputan Hari Pembukaan

1. Y.B. Pengurus Besar
2. Timbalan Pengurus Besar
(Kendalian)
3. Timbalan Pengurus Besar
(Projek Utama)
4. Timbalan Pengurus Besar
(Pentadbiran)
5. Timbalan Pengurus Besar
(Perancang Pembangunan)
6. Pengarah Perkhidmatan Khas
7. Ketua Akauntan
8. Ketua Jurutera (Kendalian)
9. Pengarah ILSAS
10. Timbalan Pengarah ILSAS I
11. Timbalan Pengarah ILSAS II
12. Pegawai Pelajaran dan Latihan Kanan

LAMPIRAN C

TUGAS DAN TANGGUNGJAWAB

C.1 Pengerusi Bengkel

1. To chair the opening and closing ceremonies.
2. To chair the panel discussions.
 - 2.1 Outline the subject.
 - 2.2 Direct the discussions.
 - 2.3 Crystallize the discussions.
3. To present resolutions to the workshop.

C.2 Rapporteur Bengkel

1. To record the salient points of the opening and closing ceremonies.
2. To gather the findings of the group discussions after each session for panel discussion.
3. To record the resolutions of panel discussion.
4. To provide draft of the panel resolutions to the participants
5. To assist the secretariat in compiling the proceedings.

C.3 Pengerusi Kumpulan

1. To appoint Rapporteur kumpulan.
2. To chair the group discussion.
 - 2.1 Outline the subject.
 - 2.2 Direct the discussion.
 - 2.3 Crystallize the discussions.
3. To participate and present the group findings to the panel.

C.4 Rapporteur Kumpulan

1. To record summaries of points agreed on by the group during group discussion.
2. To submit the group findings to the Rapporteur Bengkel immediately after each session.
3. To participate in the panel discussion.