

**AERB SAFETY GUIDELINES NO. AERB/SG/IS-2**

**PREPARATION OF SAFETY REPORT  
OF INDUSTRIAL PLANTS  
OTHER THAN NUCLEAR POWER PLANTS  
IN THE DEPARTMENT OF ATOMIC ENERGY**

**Issued in December, 2001**

**This document is subject to review, after a period of one  
year from the date of issue, based on the feedback received.**

**Atomic Energy Regulatory Board  
Mumbai 400 094**

**Price:**

**Orders for this Guide should be addressed to:**

**Administrative Officer  
Atomic Energy Regulatory Board  
Niyamak Bhavan  
Anushaktinagar  
Mumbai - 400 094.**

## FOREWORD

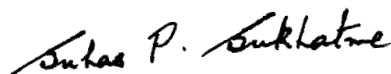
The Atomic Energy Regulatory Board (AERB) constituted by the Government of India vide S.O. 4772 dated November 15, 1983 was entrusted with the responsibility of enforcing safety and regulatory functions envisaged under the Atomic Energy Act, 1962. AERB is responsible for enforcing safety in all atomic energy related activities within India as well as for enforcing the provisions of the Factories Act, 1948 in all units of the Department of Atomic Energy (DAE). In discharging these responsibilities, AERB has been drawing up codes, guides, standards and manuals to facilitate the concerned organisations in implementing the necessary safety regulations.

DAE establishments viz. the Heavy Water Plants, the Nuclear Fuel Complex, the Indian Rare Earths Limited, the Uranium Corporation of India Limited, the Electronics Corporation of India Limited, the Atomic Minerals Division etc. all over India handle various chemicals in their plants. These establishments come under the purview of the "Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989". These rules, inter alia, call for preparation of a Safety Report if some chemicals exceed a threshold quantity. These chemicals are potentially hazardous and need special precautions for storing and handling. The rules, in addition, address problems such as mitigation of major accidents for plant personnel as well as personnel outside the premises likely to be affected. The rules also specify a format for preparation of the safety report. A need was felt in AERB for making suitable guidelines, which will enable the industrial plants, other than nuclear power plants, in the Department of Atomic Energy to prepare safety reports, commensurate with the format specified in the rules.

Guidelines earlier prepared by the Industrial Safety Division of AERB in 1990 needed to be updated in view of a change in environmental statutes, and the experience gained since then for safety review of such industrial plants.

This document has been prepared initially by the staff of Industrial Plants Safety Division of AERB and subsequently reviewed by other professionals. AERB thanks all individuals who helped in its drafting and finalisation.

The list of persons who participated in the committee meetings for preparing this document, along with their affiliations, is included for information.



(Suhas P. Sukhatme)  
Chairman AERB

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# 1. INTRODUCTION

## 1.1 General

The first and mandatory requirement to authorise regular operation of any industrial plant of the Department of Atomic Energy is a safety report to be prepared and submitted by the unit to the Atomic Energy Regulatory Board seeking authorisation. The appropriate Project Safety Review Committee (PSRC) and the Advisory Committee for Project Safety Review (ACPSR) constituted for the purpose by AERB then carry out a safety review of the project. AERB considers the proposal for authorisation after the review is complete and the project authorities implement the recommendations of these committees. Therefore a need was felt for preparing a safety report in standardised format applicable for all projects. In 1990, AERB prepared a standard format for the first time viz. 'Safety Report Format for Industrial Plants other than Nuclear Power Plants' (AERB/M/ISD-1). Since then all new projects adhere to this format for their Safety Reports. Over the years considerable experience has been gained in authorising nuclear fuel facilities. The time is now appropriate to update the guide/format for safety reports in the light of experience gained. This revised guide/format should be followed in the preparation of safety reports in future.

The Ministry of Environment and Forest has formulated rules for handling and storage of hazardous chemicals likely to affect the environment around such activities. These rules are called "Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989". These were last amended in 2000 and apply to an industrial activity or storage involving hazardous chemicals. The chemicals are classified into three categories. Correspondingly, three levels of controls are prescribed. These are termed as:

- (a) low level requirements,
- (b) medium level requirements, and
- (c) high level requirements.

Under high level requirements, 27 chemicals and 3 classes of compounds are included. They are potentially more hazardous and the threshold limits are specified. High level requirements also call for the preparation of a safety report. While preparing the report it is to be ensured that the requirement of stipulations in any other relevant codes/standards of statutory nature shall also be satisfied.

## **1.2 Objectives**

Safety report is a document prepared by project authorities (applicant) and submitted to AERB. These guidelines aim at apprising the project authorities, the detail, furnished in the safety report. This information will enable AERB and its committees to assess whether adequate arrangements have been made for safe operation and whether control measures are in place to mitigate the consequences of major accidents. The safety report should identify the type, the relative likelihood and the consequences of major accidents. The safety report will demonstrate that accident potentials of activities have been identified and control measures incorporated.

## **1.3 Scope**

These guidelines are applicable to all industrial plants in the Department of Atomic Energy other than nuclear power plants for assessment of proposal for siting, commissioning and operation. The topics required to be covered are site conditions, process details, quality assurance, hazardous chemicals involved, hazard control mechanism, radiation hazard control, waste management, safety system, safety and operational analysis, organisational system, inclusion of safety training and crisis management, mitigation of accident and medical facilities etc. In view of wide variation in both the size and type of plants, applicability of various aspects brought out in this document should be checked before preparation of the safety report.

Sections 2 to 15 discuss these topics in a broad and general manner. The details to be furnished in the safety report are covered in Appendix-I.

## **2. SITE CONDITIONS**

Siting of a plant requires careful evaluation of various factors such as raw material availability, source of water, power, effect on human settlement, meteorological conditions, environmental impacts (i.e. effects on flora and fauna) etc.. Information on topographical and geological aspects is also needed prior to installing the plant, as it will help in designing the plant from safety viewpoint. Information on roadways, the nearest railhead, and airport helps in assessing plant accessibility. The land acquired shall be adequate for storing/treatment of wastes generated from plant operation.

## **3. PROCESS**

Process description including type of reactions, critical process parameters relevant to safe operation, energy, material and water balance are to be given in the report. Details on layout of the equipment, and power supply systems should also be given. The layout of equipment containing hazardous chemicals and power supply system is critical and needs to be designed from the stand point of hazards arising out of any unusual occurrences.

## **4. QUALITY ASSURANCE**

Quality assurance programme at each stage starting from design, fabrication till the product/waste is to be brought out, the standard used and the deviation from standard, need to be mentioned.



## **5. HAZARDOUS CHEMICALS**

Handling of hazardous chemicals requires special precautions. Storage of hazardous chemicals is required to be designed strictly as per the relevant code allowing adequate margin for safety. The quantity of hazardous chemicals to be stored at a time and the distance to be maintained between two storage tanks should be taken into consideration. Pressure relief system, draining arrangement, spare storage capacity and alarm system are to be provided. Statutory provisions under the Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989 should be followed and the license for storing and using should be obtained from the competent authority.

## **6. HAZARD CONTROL MECHANISM**

The hazards of chemicals generated and present in a working environment in the form of dust, fumes, vapours and sprays and the engineering measures taken to control them need to be described. Preventive measures to avoid contamination of working personnel by ingestion, inhalation or by skin contact are to be mentioned. Mechanical means for spillage control of hazardous chemicals need to be provided.

## **7. RADIATION HAZARD CONTROL**

The hazards of ionising radiation from radioactive substances are to be described and the radiation hazard control should conform to the Radiation Protection Rules, 1971. Zoning system for contamination control, access control for radiation exposure of personnel, radiation levels, shielding provided for areas of continuous or limited occupancy, if any, are to be mentioned. Design of ventilation system involving number of air changes per hour to control airborne contamination should be indicated. Provisions for decontamination of equipment/areas are to be included. Handling of radioactive materials is to be covered. Safety codes/guides published in this regard by AERB should be referred for radiological protection during handling of radioactive material.

## **8. WASTE MANAGEMENT**

The acts and rules applicable to management of waste are:

The Water (Prevention and Control of Pollution) Act, 1974,

The Air (Prevention and Control of Pollution) Act, 1981,

The Atomic Energy (Safe Disposal of Radioactive Wastes) Rules, 1987 and

The Hazardous Waste (Management and Handling) Rules, 1989.

The waste management system shall conform to these acts and rules.

Three classes of waste according to their physical states are:

### **8.1 Liquid Effluents**

- (i) Soil permeability should be studied before discharging the effluents into holding tanks or impoundment and steps taken to prevent percolation and ground water contamination;
- (ii) Deep well burial of toxic effluents/radioactive components can result in resurfacing and ground water contamination;
- (iii) In all cases efforts should be made for reuse of water; and
- (iv) Components, either radioactive or toxic or harmful to plant, animal or ecosystem, should be measured as mentioned in the above rules before discharging to public domain.

### **8.2 Gaseous Emissions**

- (i) Emission levels of chemical/radioactive pollutants from different stacks should conform to pollution control standards; and
- (ii) Proper stack height should be provided for appropriate level of dispersion of pollutants over a wider area to minimise the effect of pollution.

### **8.3 Solid Wastes**

- (i) The site for waste disposal should be evaluated to verify permeability to avoid contaminants percolating to ground water or river/lake; and
- (ii) Containment in which radioactive/toxic wastes are disposed off should be appropriate as per the Atomic Energy (Safe Disposal of Radioactive Wastes) Rules, 1987/Hazardous Wastes (Management and Handling) Rules, 1989 respectively.

## **9. DECOMMISSIONING**

Design should ensure that plant and equipment are amenable for easy decontamination. The site for disposal of waste generated after decommissioning should be planned during installation considering the life of the plant and the maximum amount of waste expected. The civil structural arrangement for constructing the site should ensure avoidance of (a) contamination of nearby water source, and (b) permeability of the radioactive substance to soil affecting nearby vegetation (Ref: AERB/SM/Decom - Safety Manual for Decommissioning of Nuclear Facilities).

## **10. SAFETY SYSTEM**

The primary objective of safety system is to ensure safe operation of the equipment, within designed parameters like pressure, temperature, gas/liquid flow etc. and hence of preventing fire, explosion, release of toxic/radioactive materials or criticality which may lead to loss of material and property. This is achieved by a built-in safety system incorporated in the design to ensure that operating parameters are not exceeded beyond safety limits through interlocks which control process parameters and alert operating staff by audio-visual signals. Action such as switching off power supply, cutting off feed and starting of water sprinkler system etc. should be described.

## **11. SAFETY ANALYSIS**

Safety of the proposed plant needs to be analysed at the design stage itself and the major steps involve the qualitative identification of hazards in the plants and consequence analysis risk, the details of which are to be furnished.

## **12. SAFETY ORGANISATION**

To ensure better health and safety in an organisation, safety consciousness and the priority for safety should be activated by the senior most executive and the first step to achieve this is the formation of a structured safety organisation and various safety committees. The head of the safety organisation should report to the senior-most executive of the organisation and his duties will be to advise and assist the head of the organisation in the fulfilment of his safety obligations. The main functions of safety officer and safety committees are identifying unsafe conditions and practices and initiating action to rectify them, and ensuring adherence to safe practices.

## **13. STATUTORY REQUIREMENTS IN THE PLANT**

Under various sections of the Factories Act, 1948 and the Atomic Energy (Factories) Rules, 1996 competent persons and safety officers respectively are required to be appointed to carry out certain specific tasks and duties as mentioned in the above statutes. The Radiation Protection Rules, 1971 also call for the appointment of a Radiological Safety Officer in plants where radioactive materials or radiation generating equipment are stored, handled and used.

## **14. MITIGATION OF MAJOR ACCIDENT**

Plans for on-site emergency and off-site emergency need to be prepared to tackle any unusual situation in an organised/systematic way. The responsibility for preparation of site emergency plan rests with the occupier and it is to be prepared in accordance with the AERB safety guidelines, AERB/SG/EP-3 and AERB/SG/EP-4.

Reportable accidents and unusual occurrences are to be investigated for remedial measures to avoid recurrence and should be reported to the appropriate authorities in prescribed forms designated for the purpose.

Fire-fighting capability is one of the key factors for tackling fire emergency in a plant and this requires adequate manpower and the necessary fire-fighting equipment.

Depending on potential hazards in the plant, fire detection and fire suppression systems are to be installed.

## **15. MEDICAL FACILITIES**

One of the requirements for ensuring safety is to provide medical facilities for employees in case of an accident or accidental release of toxic chemicals. There should be provision to extend preliminary treatment, including antidotes to affected persons. It is desirable that information on services of first-aid centres, hospitals (within 5 km radius) with special facilities to treat injured persons is readily available. This information should be available and maintained properly in the control room. Provision of well-equipped ambulance and its proper maintenance will avoid delay in transferring patients/injured to the place of treatment. Training and refresher training in first-aid should be imparted on a regular basis to plant employees to avail the first-aid service in an emergency. Periodic medical examination to the occupational workers as per the Radiation Protection Rules, 1971, the Atomic Energy (Working of Mines, Minerals & Handling of Prescribed Substance) Rules, 1984 and the Atomic Energy (Factories) Rules, 1996 needs to be arranged.

## **APPENDIX-I**

### **DETAILS OF TOPICS TO BE FURNISHED IN A SAFETY REPORT**

This Appendix provides guidance to project authorities to prepare a safety evaluation report such that the information to be provided on each of the topics listed in these guidelines is sufficiently detailed and brings out hazards and measures that need to be taken for their control. Queries are not to be dismissed with short answers. Where any item of the guidelines is not applicable to a particular project, the same should be stated in the report, along with reasons as to why it is inapplicable. While every topic listed in the guidelines is to be covered in the report any item not listed but important to fully explain the safety implications is required to be included in the safety report. For a plant consisting of a number of systems, where the nature of the hazards is different, the report should contain separate discussions on each.

#### **I.1 Site Conditions**

- (a) Site description, land use and population density around the plant:  
(Attach a map showing locations and surrounding areas up to 5 km radius)
  - (i) names of villages, population data, educational institutions, hospitals, police station and primary health centres within 1 km, 2 km and 5 km radii of the plant.
  - (ii) major industries/storage within 5 km radius:

| <b>Name</b> | <b>Location</b> | <b>Raw Material(s)</b> | <b>Intermediates</b> | <b>Final Product</b> | <b>Wastes</b> | <b>Likely Nature of Hazards Associated (e.g. Fire, Explosion and Toxicity)</b> |
|-------------|-----------------|------------------------|----------------------|----------------------|---------------|--|
|             |                 |                        |                      |                      |               |  |

- (iii) sources of water, power,
- (iv) airport nearby, if any, and
- (v) site map indicating railway station, highway and district level roads, approaches and district headquarters.

(b) Geological, topographical and meteorological aspects:

- (i) water table, existence of river, sea, lake - with distance from the site,
- (ii) geological conditions,
- (iii) ground water sources, and
- (iv) temperature (maximum and minimum), temperature inversions, humidity, rainfall (maximum and minimum), maximum flood levels and frequency of occurrence for a period of at least last five years.

(c) Wind speed, direction and wind rose.

(d) Seismic conditions:

- (i) details of all earthquakes in the area:

| Date and Time of Occurrence | Duration | Magnitude and Epicentre | Damage Caused, if any |
|-----------------------------|----------|-------------------------|-----------------------|
|                             |          |                         |                       |

- (ii) zones as per Indian Standard (IS: 1893)  
“g” factor taken for seismic design,
- (iii) active fault line, if any, within the vicinity, and
- (iv) type of soil, liquefaction potential.

(e) Manpower availability at site:

| Man Power Deployment/<br>No. of Persons              |                       | Regular                                |                            | Casual Labourers<br>and Contractor<br>Personnel | Security<br>Personnel |
|--|-----------------------|--|----------------------------|---|-----------------------|
|  |                       | Technical &<br>Scientific<br>Employees | Non-technical<br>Employees |   |                       |
| During construction                                  |                       |  |                            |   |                       |
| Minimum staff requirement for operating plant safely |                       |  |                            |   |                       |
| Normal Operation                                     | General shift         |  |                            |   |                       |
|  | Round the clock shift |  |                            |   |                       |
|  | Total                 |  |                            |   |                       |

## I.2 Process

- (a) Basic principle of the process.
- (b) Process description with energy, material and water balance, highlighting hazardous reactions and chemicals involved, if any: description of the process with a flow chart/P&I diagram, codes/standards used for plant design including material selection criteria, critical process parameters relevant to safety and safety features incorporated, and details of instrumentation and control system.



- (c) Layout:
- plant layout, equipment layout with brief description of safety features (attach a plot plan),
- location of control room,
- escape routes (evacuation routes under emergency),
- routes for emergency services, and
- zoning in plant and zoning criteria based on flammability and radiation.
- Ref: (IS-5572-1994 Classification of hazardous area) and (Para 4.3 of AERB Safety Manual "Radiation Protection For Nuclear Facilities." Revision 3)
- (d) Utilities:
- supplies and facilities (steam, compressed air, chilled water, cooling water etc.),
- different utilities used in the process/specification of each utility item/quantity of each utility required (per hour),
- quantity of supplies such as  $LN_2$  or  $N_2$  gas required, and
- consequences of failure of supply of utility and corrective action to be taken indicating minimum quantities to be conserved for continued operation/safe shutdown.
- (e) Power supply:
- maximum power requirement,
- types of power supply provided in the plant, and
- analysis or consequences of failure of power supply.

### **I.3 Quality Assurance**

- (a) Quality assurance programme adopted.
- (b) Various stages of quality assurance: fabrication of equipment from the raw material stage (composition) to the finished stage (radiography on welds, calibration tests, etc.) with appropriate documentation.

- (c) Material selection criteria.
- (d) Bought-out items, mechanical, electrical, instrumentation etc.,
- (e) Standards used: deviations from standards if any.

**I.4 Hazardous Chemicals**

- (a) Safety data sheets should be filled for all chemicals as given in the Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989 as amended up to 2000.
- (b) Physical and chemical changes in hazardous chemicals:

| Sr. No. | Name of the hazardous chemical | Physical state in which the hazardous chemical is likely to be stored in the plant/storage | Physical and chemical changes likely to take place when the hazardous chemical(s) is/are exposed to |     |
|---------|--------------------------------|--|---|-----|
|         |                                |  | Water   | Air |
|         |                                |  |   |     |

(c) Storage of hazardous chemicals:

**Storage Vessels Data Sheet:\***

- |         |  |
|---------|--|
| (i)     | Vessel designation numbers or name :   |
| (ii)    | Design application code :  |
| (iii)   | IP and API code :  |
| (iv)    | Contents :   |
| (v)     | Vessel size (capacity in tonnes):  |
| (vi)    | Vessel dimensions (in metre):  |
| (vii)   | Vessel orientation : Horizontal/Vertical   |
| (viii)  | Material : _____ steel, _____ s/steel or _____ other.  |
| (ix)    | Storage temperature : _____ °C   |
| (x)     | Storage pressure : _____ kg/sq.cm.   |
| (xi)    | Vessel locations : (please indicate on-site plan or plot plan)   |
| (xii)   | Vessel location : aboveground/on ground/underground.   |
| (xiii)  | If above ground, indicate, how far above ground : _____ m.   |
| (xiv)   | Vessel inside building/outside/in tank farm  |
| (xv)    | Is vessel within 20 m of other listed vessels: Yes/No  |
| (xvi)   | On-site boundary : Yes/No  |
| (xvii)  | Is vessel bunded : Yes/No  |
| (xviii) | If yes, what is nature and size of bund?   |
| (xix)   | How is bund emptied (in the event of spill or rain)?   |
| (xx)    | How is vessel isolated in the event of mishap?   |
| (xxi)   | Is the vessel fitted with remotely controlled instruments?   |
| (xxii)  | Isolation valves : Yes/No  |
| (xxiii) | Is vessel provided with : vent/emergency vent/relief valve/bursting disc/<br>other vent/relief device/level indicator/pressure gauge/drain valve/overflow<br>line etc. |
| (xxiv)  | Where do such vents discharge?   |
| (xxv)   | Is vessel provided with alarms for high level, high temperature and high<br>pressure? Yes/No   |
| (xxvi)  | Is standby empty tank provided for emptying in case of emergency?<br>Yes/No  |

\* For storage capacity exceeding the threshold quantity specified in column 3 of schedule 3 of the Manufacture, Storage and Import of Hazardous Chemical Rules, 1989 as amended up to 2000.

- (d) Process equipment details for vessel holding more than 5 Te of chemical specified in schedule 1 of the Manufacture, Storage and Import of Hazardous Chemical Rules, 1989 as amended up to 2000:

| Equipment |     | P   |     | T   |     | MOC | H | BH | L/D | Det/Alarm |     | Relief Device |     |
|-----------|-----|-----|-----|-----|-----|-----|---|----|-----|-----------|-----|---------------|-----|
| Name      | No. | Max | Min | Max | Min |     |   |    |     | Ptr       | Spt | Ptr           | Spt |
|           |     |     |     |     |     |     |   |    |     |           |     |               |     |

P = pressure  
 L = length  
 D = diameter  
 RD = relief device  
 BH = height of the bottom most nozzle from the ground  
 MOC = material of construction  
 Ptr = parameter (e.g. pressure, temperature, smoke, toxic concentration etc.)

T = temperature  
 H = height  
 Det = detector  
 Spt = set point

- (e) Transportation of hazardous chemicals:
- precautions to be observed during transportation of chemicals,  
 details of hazardous chemicals to be transported through pipeline,  
 details of hazardous chemicals to be transported by road/railway/  
 ship/air,  
 precautions to be observed during loading/unloading of chemicals,  
 availability of transport emergency card (TREM card), and  
 labelling system including HAZCHEM code, emergency information  
 panel, and training of drivers,

## **I.5 Hazard Control Mechanism**

- (a) Identification of hazards such as dust, mist, vapour, spray, skin contact/clothing contact of toxic/harmful chemicals and other process streams.
- (b) Any engineered system to be provided to control such hazards or other measures to be taken for control.
- (c) Likely spillage/leakage of process streams/process chemicals in the working areas and measures of control.
- (d) Housekeeping system that will be followed, to keep working areas clean and free of any leakage/spillage, for example, use of vacuum cleaning equipment, system of sumping and pumping to process. etc..
- (e) Fire hazard control - solvents, volatiles, flammables.

## **I.6 Radiation Hazard Control**

(Ref: The Radiation Protection Rules, 1971)

- (a) Radioactive material handled: Forms (sealed or unsealed), quantities, activity and nature of radiation.
- (b) Zoning system for contamination control, access control for limiting radiation exposure of personnel, radiation levels, shielding provided for areas of continuous or limited occupancy, if any.
- (c) Design of ventilation system including number of air changes per hour to control airborne contamination for active and inactive areas.
- (d) Design provisions for decontamination of equipment, areas and personnel.
- (e) Design provisions for safe handling of radioactive materials transport.
- (f) Health Physics Instrumentation:
  - (i) installed monitors and alarm systems,
  - (ii) portable radiation survey instruments, and
  - (iii) health physics laboratory instruments,

- (g) Provisions made for area and air monitoring and personnel monitoring – external and internal and maintaining records.
- (h) Radiation protection standards and procedures.
- (i) Health Physics Unit – staff strength and training in radiation safety.
- (j) Radiation emergency action measures taken for control of criticality.

## **I.7 Waste Management**

### **I.7.1 Gaseous (Conventional Chemical and/or Radiological):**

composition and quantities (cubic meters/day and activity) of gaseous effluents generated before treatment,

design provisions for treatment of gaseous effluents (filters, scrubbers etc.) to meet the authorised limits,

whether treatment of gaseous emission leads to other forms of wastes, and

height at which quantity of gas effluent will be released per hour and temperature of gaseous effluent.

Note: Gaseous emissions such as exhausts from dust extraction systems, vessel ventilation, general ventilation (mechanical), waste incinerators, vacuum pumps, diesel engines and such others, although not related directly to the process, do constitute “gaseous waste”. Therefore description of their treatment, control and final disposal should be given.

### **I.7.2 Liquid:**

composition and quantities (cubic metres/day and activity) of liquid effluents generated before treatment,

(Non-process liquid stream such as spillage/leakage, spillage washing effluent, mines water should also be considered as liquid waste).

design provisions to treat liquid effluents, segregation of liquid effluents depending on type of design of storage tanks, pipes for collection of liquid effluents and dykes to contain accidental leakage,

composition and quantities of liquid effluents after treatment,

design provisions to discharge treated liquid effluents meeting the standard before discharge to environment,

provisions for treatment of gaseous product, residues generated if any, and

point of effluent discharge and monitoring system batch/continuous. Release limits: concentration, quality and quantity.

**I.7.3 Solid:**

quantity of solid waste (tones/annum),

segregation of solid wastes,

category of hazardous waste generated and quantity,

method of treatment, conditioning of hazardous waste,

disposal of solid wastes,

whether treatment/disposal method give rise to other forms of pollution (gaseous, liquid),

location of waste disposal, and

surveillance to assure integrity of waste packages disposal.

**I.8 Safety Systems**

(a) Special safety features in design:

Safety limits and limits on operating conditions.

(b) Controls and alarms:

safety interlocks provided,

provision of facilities for tripping the plant,

redundancy of the system, and

action to be taken in case of actuation of some of the major safety related alarms involving safety of operating personnel and protection of the members of public and environment.

(c) Monitoring equipment:

details of provision of monitoring equipment (static as well as mobile), and

measurement of flammable, explosive or toxic gases.

(d) Relief systems:

relief devices (safety relief valves, rupture discs, control relief valves) provided in the plant (with location and setting),

basis of their selection,

periodical testing to ensure their operability, and

special features, if any, provided for relief such as dump valves, (collecting tanks, dump tanks etc.).

(e) Quick acting valves:

details of provision of quick acting valves, and

air-operated or electrically operated valves.

(f) Flare:

details of flare system, if any,

basis for determining height of flare,

design used for preventing back flash,

exit velocity when blow-out will occur, and

method of igniting the flared substance.

(g) Scrubber:

details of design of scrubbing systems employed to meet standards,

composition of fresh scrubber solutions,

limiting concentrations of scrubber for use,



surveillance measures to ensure efficiency of scrubbers,  
type of tower (packed, sieve trays, bubble caps, etc.), and  
basis for selecting particular type of tower.

- (h) Ventilation:  
details of ventilation system employed, and  
basis for choosing the same.
- (i) Sprinkler system:  
details of water sprinklers, deluge system, etc.,  
method of operation, and  
surveillance measures/periodic testing.
- (j) Safety-related components for prevention of accidents:  
safety-related components installed,  
consideration of engineered safety features,  
reliability of safety-related components. Redundancy where required,  
and
- (k) Identification of engineered and other systems, which can control  
potential occupational hazards or hazards to nearby population,  
arising out of chronic exposure of lower concentrations.

## **I.9 Safety Analysis**

### **I.9.1 Hazard Identification**

- (a) Types of likely accident:  
identification of the types of accidents - chemical and radioactive,  
classification of accidents - fire, explosion, releases of toxic material  
and radioactivity etc.,  
major areas of hazard potential, and  
major consequences that could occur.

- (b) Events that can lead to an accident:
  - identification of systems that could malfunction,
  - listing of initiating events,
  - sequence of events culminating in an accident situation, and
  - possible operator error that could initiate an event.

#### I.9.2 Risk Assessment

- (a) Assessment of major hazards according to their frequency of occurrence and consequences (to the extent information can be provided). In respect of these give the following:
  - probability of failure of components/equipment,
  - human failures.
  - role of protective devices, and
  - effect of failure of protective functions, engineered safety features.
- (b) Consequences of above mentioned accidents:
  - methods, assumptions and conditions used in estimating the consequences,
  - consequences of such release including dispersion calculations, and
  - effect criteria and affected zone. (Distances for three effect concentrations are to be considered namely IDLH values, LCL0 and LC50 values.) ,
- (c) Safety systems for prevention/mitigation of above mentioned accidents.
  - additional safety systems provided based on risk assessment study.
- (d) Known accident history.

## **I.10 Safety Organisation**

- (a) Organisational chart:
  - in-house organisational relationships established for design and construction, review and quality assurance functions,
  - safety organisation at the corporate level and plant level,
  - technical staff for operation and maintenance of the plant, and
  - working inter-relationships with suppliers, contractors and statutory/regulatory bodies.
  
- (b) Implementation of plant safety as mentioned in relevant Acts and Rules:
  - corporate functions,
  - responsibilities and authorities,
  - adequacy in plant engineering and design, quality assurance, testing, operation and other applicable activities,
  - safety review and assessment process - safety committees, and
  - authorisation of Competent Persons.
  
- (c) Implementation of safety procedures:
  - preparing, reviewing, approving and executing all procedures,
  - safety work permit procedure, and
  - procurement of personnel protective equipment and maintaining stock.
  
- (d) Maintenance and inspection schedules:
  - preventive maintenance for equipment – load testing of cranes, hydrotest,
  - inspection of equipment (inspection of pressure vessels) etc., and
  - maintenance of document regarding inspection.

(e) Training of personnel:

training programme including scope of training in plant operations, safety procedures (chemical and radiological) and industrial safety, methods of dealing with process malfunctions, safety systems, emergency procedures, etc.,

retraining of personnel and identification of organisation responsible for training and retraining, and

procedures for qualification of operating and maintenance staff.

**L11 Statutory Requirements in the plant**

(a) Competent Persons:

Depending on various activities involved in the plant e.g. civil construction, operation and testing of lifts and hoists, pressure plants, handling of hazardous chemicals etc. as indicated in Appendix-II, staff with desired qualifications are to be designated as competent persons.

The relevant inspection, testing, examination reports, records as per statutory requirements are to be maintained.

(b) Safety Officers:

Staff strength of the plant determines the number of Safety Officers under the Atomic Energy (Factories) Rules, 1996-Section 43(5) and the qualifications detailed in Appendix-II give the guidelines for designating the Safety Officer.

(c) Radiological Safety Officer:

Another requirement of plant involving radiation hazards is the nomination of Radiological Safety Officer with the desired qualification and experience mentioned in Appendix-II.

**I.12 Mitigation of Major Accidents/Emergency Plans**

(a) Fire Brigade:

| <b>Staff</b>                   | <b>Number</b> |
|--------------------------------|---------------|
| Chief fire officer             |               |
| Deputy chief fire officer      |               |
| Station officer                |               |
| Sub-officer                    |               |
| Leading fireman                |               |
| Driver-cum-operator            |               |
| Fireman                        |               |
| Total strength of fire station |               |

Strength of fire crew in each shift.

Fire-fighting provisions.

No. of fire tenders available.

No. of trailer pumps available.

Details of fire hydrant system with number of hydrant posts and provision of isolation valves for isolating a section on the ring main for carrying out maintenance.

No. of fire hose boxes with location.

No. of water monitors both fixed type and portable type.

Details of water reservoir with capacity and source of water supply.

- (i) Specify whether two separate reliable water sources are available.
- (ii) If only one large enough water source (lake, pond or river etc) is provided, then at least two independent intakes are ensured.

- (iii) Specify whether water supply system has been designed based on largest flow rate at required pressure for a period of two hours.

No. of pumps available at firewater pump house with capacity and head.

Details of hydro-pneumatic tank (if available).

Control for maintaining constant pressure in the fire-hydrant system.

Frequency of testing of fire-hydrant system.

Provision of emergency power at firewater pump house and fire station.

No. of portable type of extinguishers available with location.

Mutual aid for using fire-fighting arrangement of nearby industries in case of larger fire (which cannot be controlled by plant fire-fighting arrangement) is to be agreed upon in advance.

(b) Alarm System:

| Type of field mounted Sensor                      | Locations | Location of Control Panel | Location at which alarm will be communicated | Frequency of checking |
|---|-----------|---------------------------|--|-----------------------|
| For detection of release of toxic/flammable gases |           |                           |  |                       |
| For detection of fire/smoke                       |           |                           |  |                       |

(c) Emergency plans:

Details to be provided as per schedules 11 and 12 of the Manufacture, Storage and Import of Hazardous Chemicals Rules, 2000

(d) Antidotes:

names of Antidotes to be administered in the event of inhalation/ingestion of toxic chemicals, and

method of administering antidotes.

(e) Notification of an Accident:

procedure to be followed during an accident, and

list of authorities to be informed e.g., SARCOP, Assessment Committee of Fatal Accidents (in case of fatality), Crisis Management Group, DAE and District Authorities in case of an off-site emergency.

**I.13 Medical Facilities**

(a) First-aid centre:

no. of qualified doctors available in round-the-clock shift and in general shift,

no. of other qualified staff available at first-aid centre in round-the-clock shift and in general shift, and

emergency equipment available at first-aid centre.

(b) Ambulance:

no. of ambulances available,

equipment available in the ambulance, and

checking of ambulance: every shift/every day/once a week.

(c) First-aid boxes:

total number of available first-aid boxes with their locations,

content of each first-aid box, and

checking of first-aid boxes and replenishment of content.

(d) Hospitals (in the 5 km. radius):

| <b>Name of the Hospital</b> | <b>No. of beds</b> | <b>No. of Qualified Doctors</b> | <b>Special Facilities available</b> | <b>Distance from Site</b> |
|-----------------------------|--------------------|---------------------------------|-------------------------------------|---------------------------|
|                             |                    |                                 |                                     |                           |

(e) First-aid training programme:

authorities imparting training in first-aid,  
details of theoretical and practical training to be imparted, and  
number of personnel trained in first-aid in each shift etc.

(f) Occupational workers and periodic medical examination:

identifying the occupational workers for periodic medical examination as per the Radiation Protection Rules, 1971 the Atomic Energy (Working of Mines, Minerals & Handling of Prescribed Substance) Rules, 1984 and the Atomic Energy (Factories) Rules, 1996,  
arrangement of periodic medical examination and keeping record, and  
reporting systems for occupational disease.



## APPENDIX-II

### TYPICAL REQUIREMENT OF STATUTORY PERSONNEL IN A PLANT

#### II.1 Competent Persons under the Atomic Energy (Factories) Rules, 1996 and various sections of Factories Act, 1948:

The competent person is one who has a degree in the discipline mentioned or equivalent followed by experience as specified in responsible position in the field and designated by the Competent Authority.

| Sl. No. | Rules under section requiring competency | Type of Work                            | Discipline   | Experience   |
|---------|--|---|--|--|
| 1       | 2  | 3                                       | 4  | 5  |
| 1.      | Section 6                                | Civil construction and structural work. | Civil or structural engineering.   | Minimum 10 yrs in design, construction testing or repairs of structures knowledge of various codes pertaining to the non-destructive testing methods.  |
| 2.      | Section 21(2)                            | Operation of dangerous machines.        | Electrical or mechanical engineering or equivalent.                            | Minimum 7 yrs in design, operation, maintenance, testing of relevant machinery, guards, safety devices, etc.   |
| 3.      | Section 28                               | Lifts and Hoists                        | -do-   | Minimum 7 yrs in design, erection, maintenance, inspection and test procedures of hoist and lifts.   |
| 4.      | Section 29                               | Lifting machinery, lifting tackles      | Electrical, mechanical or metallurgical  | Minimum 7 yrs in design, erection maintenance, inspection, testing of lifting machinery or lifting tackle.   |
| 5.      | Section 31                               | Pressure Plant                          | Chemical, Electrical or Mechanical or Metallurgical Engineering or equivalent. | Minimum 10 yrs in design erection, maintenance testing, examination, inspection of pressure plants and knowledge of non-destructive testing and codes of safety requirement of pressure vessels. |

| Sl. Rules under<br>No. section<br>requiring<br>competency |                 | Type of<br>Work                                  | Discipline  | Experience  |
|---|-----------------|--|---|---|
| 1   | 2               | 3  | 4   | 5   |
| 6.  | Section 36      | Dangerous fumes                                  | Chemical engineering or masters degree in chemistry | Minimum 7 yrs. in collection and analysis of environmental samples and calibration of monitoring equipment.               |
| 7.  | Section 41-C(b) | Supervision of handling of hazardous substances. | Chemical Engineering or master degree in chemistry  | Minimum 7 yrs. on the shop floor in handling and disposal of hazardous chemicals.   |
| 8.  | Section 87      | Ventilation system                               | Electrical or mechanical engineering                | Minimum 7 yrs in design, fabrication, installation, testing of ventilation system used for collection of dust, fumes etc. |

## **II.2 Safety Officer under the Atomic Energy (Factories) Rules, 1996-Section 43(5)**

### Qualification

- (a) A person shall not be eligible for appointment as a safety officer unless he:
- (i) possesses
- a recognised degree or equivalent in any branch of engineering or technology and has had practical experience of working in a factory in a supervisory capacity for a period not less than two years; or
  - a recognised degree in physics or chemistry and has had practical experience of working in a factory in a supervisory capacity for a period not less than five years; or
  - a recognised diploma or equivalent in any branch of engineering or technology and has had practical experience of working in a factory in a supervisory capacity for a period not less than five years;

- (ii) possesses a degree or diploma in industrial safety recognised by Central/State Government in this behalf; and
  - (iii) has adequate knowledge of the language spoken by a majority of the workers in the region where the factory in which he is to be appointed is situated.
- (b) Notwithstanding the provisions contained in clause (a) any person who:
- (i) possesses a recognised degree or diploma in engineering or technology and has had experience of not less than five years in a department of Central or State Government which deals with administration of the Factories Act, 1948 or the Dock Workers (Safety Health and Welfare) Act, 1986 (54 of 1986) or
  - (ii) possesses a recognised degree or diploma in engineering or technology and has had experience of not less than five years, full time, on training, education, consultancy, or research in the field of accident prevention in industry or in any institution;
- shall also be eligible for appointment as a Safety Officer:

Provided that the competent authority may, subject to such conditions as it may specify, grant exemption from the requirements of this sub-rule, if in its opinion, a suitable person possessing the necessary qualifications and experience is not available for the appointment:

Provided further that, in the case of a person who has been working as a Safety Officer for a period not less than three years on the date of commencement of this rule, the competent authority may, subject to such condition as it may specify, relax all or any of the above said qualifications.

**II-3. Radiation Safety Officer under the Radiation Protection Rules, 1971**

- (a) Should be a science graduate with physics as one of the subjects.
- (b) Should have also successfully undergone instructions specified for the training of the Radiological Safety Officer. Should have also successfully undergone instructions specified for the training of the Radiological Safety Officer level III as prescribed by the Atomic Energy Regulatory Board and should possess a valid certificate to that effect. The subjects for instructions should include fundamentals of radiation and radiation protection, concept of dose limit, use of instruments and survey technique in radiation detection; and knowledge of personnel monitoring equipment inspection and maintenance of safety interlocks and operation of emergency procedures.

## ANNEXURE-I

### MATERIAL SAFETY DATA SHEET

#### 1. Chemical identity:

|                               |                               |         |
|-------------------------------|-------------------------------|---------|
| Chemical Name                 | Chemical classification       |         |
| Synonyms                      | Trade Name                    |         |
| Formula                       | CAS No.                       | UN No.: |
|                               | Shipping name<br>Codes/ Label |         |
| HAZCHEM No.:                  | Regulated identification_____ |         |
|                               | Hazardous Waste<br>ID No.:    |         |
| Hazardous ingredients CAS No. |                               |         |
| 1.                            | 2.                            |         |

#### 2. Physical and chemical data

|                              |                     |                                       |            |
|------------------------------|---------------------|---------------------------------------|------------|
| Boiling range/Point          | _____ °C            | Physical state                        | Appearance |
| Melting/Freezing point       | _____ °C            | Vapour pressure<br>@ 35 °C _____mm Hg | Odour      |
| Vapour density<br>(Air = 1)  | Solubility in water | @ 30 °C                               | Others     |
| Specific gravity (water = 1) | pH                  |                                       |            |

---

**3. Fire and explosion hazard data**

---

Flammability(Y/N): LEL \_\_ %, Flash point \_\_°C, Autoignition temperature \_\_ °C

---

TDG flammability                      UEL \_\_\_ %      Flash point \_\_\_°C

---

|  |  |                        |
|--|--|------------------------|
| Hazardous<br>Explosion sensitivity to impact | Explosion sensitivity<br>to static electricity | Combustion<br>products |
|--|--|------------------------|

---

Hazardous polymerisation

---

|                    |                    |                    |
|--------------------|--------------------|--------------------|
| Combustible liquid | Explosive material | Corrosive material |
|--------------------|--------------------|--------------------|

---

|                    |          |        |
|--------------------|----------|--------|
| Flammable Material | Oxidiser | Others |
|--------------------|----------|--------|

---

|                     |                  |
|---------------------|------------------|
| Pyrophoric Material | Organic peroxide |
|---------------------|------------------|

---

**4. Reactivity data**

---

Chemical stability

---

Incompatibility with other material

---

Reactivity

---

Hazardous reaction products

---

**5. Health hazard data**

---

Routes of entry

---

Effects of exposure/symptom

---

Emergency treatment

---

TLV (ACGIH) : \_\_\_ppm, \_\_\_mg/m<sup>3</sup>. STEL: \_\_\_ppm, \_\_\_mg/m<sup>3</sup>.

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Exposure Limit (IDLH)\_\_\_ ppm, \_\_\_mg/m<sup>3</sup>; Odour threshold \_\_\_ ppm, \_\_\_mg/m<sup>3</sup>

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NEPA Hazard signals      Health Flammability      Stability

---

**6. Preventive measures**

---

Personal protective equipment

---

Handling storage precautions

---

**7. Emergency and First-aid measures**

---

Fire      Fire extinguishing media

---

Fire      Special procedures      Unusual hazards

---

Exposure      First-aid measures  
                         Antidotes/dosages

---

SPILLS      Steps to be taken

---

Waste disposal method

---

**8. Additional information/references**

---

**9. Manufacturer/Suppliers data**

---

**10. Contact persons in emergency**

Name of the Firm \_\_\_\_\_

Mailing address \_\_\_\_\_

Telephone/Telex No. \_\_\_\_\_

TREM card details/Ref.

## ANNEXURE-II

### THRESHOLD QUANTITIES OF CHEMICALS

(As given in the Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989 amended up to 2000)

| <b>Chemical</b>   | <b>Threshold Quantities<br/>(tonne)</b> |
|-------------------|---|
| Ammonia           | 500                                     |
| Chlorine          | 25                                      |
| Hydrogen fluoride | 50                                      |
| Hydrogen sulphide | 50                                      |
| Hydrogen          | 50                                      |
| Liquefied oxygen  | 200                                     |

Note: Substances most commonly used in DAE installations are given above. For other substances not listed here, refer the Manufacture, Storage and Import of Hazardous Chemicals (Amendment) Rules, 2000.



## **ANNEXURE-III**

### **TYPICAL DETAILS TO BE FURNISHED IN THE ON-SITE EMERGENCY PLAN**

(Ref.: Schedule 11 of the MSIHC Rule 1994 and AERB Safety Guidelines: Preparation of Site Emergency Preparedness Plans for Non Nuclear Installations- AERB/SG/EP-3)

1. Name and address of the person furnishing the information.
2. Key personnel of the organisation and responsibilities assigned to them in case of an emergency.
3. Outside organisations if involved in assisting during on-site emergency:
  - (a) type of accidents, and
  - (b) responsibility assigned.
4. Details of liaison arrangement between the organisations.
5. Information on the preliminary hazard analysis:
  - (a) type of accidents,
  - (b) system elements or events that can lead to a major accident,
  - (c) hazards, and
  - (d) safety-related components.
6. Details about the site:
  - (a) location of dangerous substances,
  - (b) seat of key personnel, and
  - (c) emergency control room.
7. Description of hazardous chemicals at plant site:
  - (a) chemicals (Quantities and toxicological data),
  - (b) transformation, if any, which could occur, and
  - (c) purity of hazardous chemicals.

8. Likely dangers to the plant.
9. Enumerate effects of fire and explosion inside the plant and effect if any of fire and explosion outside.
10. Details regarding:
  - (i) warning, alarm and safety and security systems,
  - (ii) alarm and hazard control plans in line with disaster control and hazard control planning, ensuring necessary technical and organisational precautions,
  - (iii) reliable measuring instruments, control units and servicing of such equipment,
  - (iv) precautions in designing the foundations and load bearing parts of the building,
  - (v) continuous surveillance of operations, and
  - (vi) maintenance and repair work according to generally recognised rules of good engineering practices.
11. Details of communication facilities available during emergency and those required for an off-site emergency.
12. Details of fire-fighting and other facilities available and those required for an off-site emergency.
13. Details of first-aid and hospital services available and adequacy.

## **ANNEXURE-IV**

### **TYPICAL DETAILS TO BE FURNISHED IN THE OFF-SITE EMERGENCY PLAN**

(Ref.: Schedule 12 of the MSIHC Rules 1989 and AERB Safety Guidelines: Preparation of Off-site Emergency Preparedness Plans for Non-Nuclear Installations- AERB/SG/EP-4)

1. Types of accidents and releases to be taken into account.
2. Organisation involved including key personnel and responsibilities and liaison arrangements between them.
3. Information about the site including likely locations of dangerous substances, personnel and emergency control rooms.
4. Technical information such as chemical and physical characteristics and dangers of the substances and plant.
5. Identify the facilities and transport routes.
6. Contact for further advice e.g. meteorological information, transport, temporary food and accommodation, first aid and hospital services, water and agricultural authorities.
7. Communication links including telephones, radios and standby methods.
8. Special equipment including fire fighting materials, damage control and repair items.
9. Details of emergency response procedures.
10. Notify the public.
11. Evacuation arrangements.
12. Arrangements for dealing with press and other media interests.
13. Longer term clean up.
14. Mutual aid.

## REFERENCES

1. The Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989
2. The Water (Prevention and Control of Pollution) Act, 1974
3. The Air (Prevention and Control of Pollution) Act, 1981
4. The Atomic Energy (Safe Disposal of Radioactive Wastes) Rules, 1987
5. The Hazardous Waste (Management and Handling) Rules, 1989
6. The Radiation Protection Rules, 1971
7. The Atomic Energy (Working of Mines Minerals and Handling of Prescribed Substances) Rules, 1984
8. The Factories Act, 1948
9. The Atomic Energy (Factories) Rules, 1996
10. ATOMIC ENERGY REGULATORY BOARD, Safety Manual, "Radiation Protection for Nuclear Facilities"- Revision 3, 1996
11. ATOMIC ENERGY REGULATORY BOARD, Safety Manual, "Decommissioning of Nuclear Facilities" AERB/SM/Decom, 1998
12. BUREAU OF INDIAN STANDARDS, "Classification of Hazardous Area", IS 5572-1994
13. BUREAU OF INDIAN STANDARDS, "Earthquake Resistance Design of Structures", IS 1893-Second Reprint, 1983
14. ATOMIC ENERGY REGULATORY BOARD, Safety Guidelines, "Preparation of On-site Emergency Preparedness Plans for Non-Nuclear Installations", AERB/SG/EP-3, 2000
15. ATOMIC ENERGY REGULATORY BOARD, Safety Guidelines, "Preparation of Off-site Emergency Preparedness Plans for Non-Nuclear Installations", AERB/SG/EP-4, 2000
16. THE AMERICAN CONFERENCE ON GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH), "Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices", 2000

## **LIST OF PARTICIPANTS**

### **TEAM OF SPECIALISTS FOR PREPARING AND REVIEWING THE DRAFT**

|                            |   |                      |
|----------------------------|---|----------------------|
| Shri R.K. Garg             | : | CMD, IREL (Formerly) |
| Shri M.K.T. Nair           | : | BARC (Formerly)      |
| Shri S. Varadarajan (Late) | : | BARC (Formerly)      |
| Shri V.S. Keni             | : | BARC (Formerly)      |
| Dr. K.C. Pillai            | : | BARC (Formerly)      |
| Shri P.K. Ghosh            | : | AERB                 |
| Shri J. Prasad             | : | AERB                 |
| Smt S. Bhattacharya        | : | AERB                 |

## **ADVISORY COMMITTEE ON NUCLEAR SAFETY (ACNS)**

Dates of Meeting : May 29, 1999  
June 3, 2000

### **Participant Members and Invitees of the meeting:**

Shri S.K. Mehta (Chairman) : Director, Reactor Group,  
BARC (Formerly)

Shri S.M.C. Pillai : Nagarjuna Power Corporation Ltd.,  
Hyderabad

Prof. U.N. Gaitonde : IIT, Bombay

Shri S.K. Goyal : BHEL

Shri Ch. Surendar : NPCIL (Formerly)

Shri S.K. Sharma : BARC

Dr. U.C. Mishra : BARC (Formerly)

Dr. V. Venkat Raj : BARC

Shri S.P. Singh : AERB (Formerly)

Shri G.K. De : AERB (Formerly)

Shri K. Srivasista (Member-Secretary) : AERB

Shri P.K. Ghosh (invitee) : AERB

Shri R.K. Garg (invitee) : IREL (Formerly)

Shri V.S. Keni (invitee) : BARC (Formerly)

Dr. K.C. Pillai (invitee) : BARC (Formerly)

## RELEVANT AERB DOCUMENTS PUBLISHED TILL DATE

| Reference Number | Title  | Year of Publication |
|------------------|--|---------------------|
|                  | Atomic Energy (Factories) Rules, 1996  | 1996                |
| AERB/S/IRSD-1    | Standards for Fire Protection Systems of Nuclear Facilities  | 1996                |
| AERB/SS-4        | Standard Specifications for Radiological Safety in the Design and Manufacture of Consumer Products Containing Radioactive Substances.                      | 1991                |
| AERB/SG/EP-1     | Preparation of Site Emergency Plans for Nuclear Facilities   | 1999                |
| AERB/SG/EP-2     | Preparation of Off-site Emergency Plans for Nuclear Facilities   | 1999                |
| AERB/SG/IS-1     | Safety Guide for Works Contract Safety   | 1992                |
| AERB/SG/HS-1     | Safety Guide for Intervention Levels and Derived Intervention Levels for Off-Site Radiation Emergency  | 1993                |
| AERB/SG/MED-1    | Safety Guide on Medical Management of Persons Exposed in Radiation Accidents   | 1990                |
| AERB/SM/         | Radiation Protection for Nuclear Facilities (Revision 3)   | 1996                |
| AERB/SM/Decom    | Safety Manual for Decommissioning of Nuclear Facilities  | 1998                |
| AERB/SM/IS-1     | Safety Manual on Data Base Management for Accidents/Diseases Happening due to Occupation and Implementation of the same in the Department of Atomic Energy | 1991                |

**RELEVANT AERB DOCUMENTS PUBLISHED TILL DATE**  
(Contd.)

| <b>Reference Number</b> | <b>Title</b>   | <b>Year of Publication</b> |
|-------------------------|--|----------------------------|
| PPE-1                   | Personal Protective Equipment: Helmets   | 1992                       |
| PPE-2                   | Personal Protective Equipment: Safety Footwear   | 1992                       |
| PPE-3                   | Personal Protective Equipment: Respiratory Protective Equipment  | 1992                       |
| PPE-4                   | Personal Protective Equipment: Arm and Hand Protection   | 1992                       |
| PPE-5                   | Personal Protective Equipment: Eye and Face Protection   | 1992                       |
| PPE-6                   | Personal Protective Equipment: Protective clothing and coverall  | 1992                       |
| PPE-7                   | Personal Protective Equipment: Ear protection  | 1992                       |
| PPE-8                   | Personal Protective Equipment: Safety Belts  | 1992                       |
| AERB/SG/EP-3            | AERB Safety Guidelines: Preparation of On-site Emergency Preparedness Plans for Non Nuclear Installations  | 2000                       |
| AERB/SG/EP-4            | AERB Safety Guidelines: Preparation of Off-site Emergency Preparedness Plans for Non Nuclear Installations | 2000                       |



## NOTES

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