

## APPENDIX-3B-II

(Refer section 3.3.1)

### FORMAT OF THE PRELIMINARY SAFETY ANALYSIS REPORT FOR PARTICLE RESEARCH ACCELERATOR FACILITIES (PARF) < 10MeV

[ PSAR should be submitted to AERB in this format, duly signed by  
Head of the organisation (employer) ]

1. Name and address of the applicant :
2. Details of supplier :  
Name and address of the applicant/local  
supplier with PIN code (in block letters)
3. Details of system parameters :  
Model/type designation :  
Year and country of manufacture :  
Maximum voltage - MV  
Maximum beam current - mA  
Vacuum - Torr  
  
Maximum beam dimensions - mm  
Scan amplitude/scan angle -  
  
Particles to be accelerated and purpose :  
Operational life of the device (in hours) :  
  
Leakage radiation levels at a distance  
of one metre from the source  
when radiation beam is 'ON' (specify for  
maximum energy and mode) : .....mGy/h.....MV/  
MeV/Photon/Electron  
  
Built-in safety features/operation :  
procedures to prevent any radiologically  
unsafe malfunction of the equipment  
(Please attach relevant documents such  
as installation manual, operation/servicing  
manual)  
  
Standards to which the  
accelerator comply :

Details of beam energy and  
current calibration facility :

4. Documentation Detail

Design Detail : Summary of accelerator design and general working principles, specifications and physical parameters of the system and user objectives.

Design manual of the accelerating device which includes

- (a) Drawing of the accelerator, beam transportlines and target showing the radiation shielding and materials of construction
- (b) Drawings along with the functional description of safety related control systems and devices
- (c) National standards to which the equipment conforms (English translation of the standard is to be provided)
- (d) Test report on the performance of the accelerator demonstrating the compliance with the National Standard or IEC 601-1 and IEC 601-2-1
- (e) Certificate from the competent authority of country of design/manufacture to the effect that the equipment is approved for industrial use.
- (f) Beam injection and transport system detailing their design, construction and testing.

Site characteristics : Location, occupancy in site area as well as surrounding population up to 1000 meters radius, load bearing capacity of soil and rock, structural design criteria, foundation, meteorology, seismology etc.

Accelerator facility : Description of general layout, details of buildings, equipment, pressure vessels, vacuum system, beam injection and transport system, details of control console facility to view active and passive engineered controls, Fail safe (any defect or component failure prevent accelerator operation) and operational independent mechanism etc.

Biological shield - Final sketch giving details of shielding wall surrounding the source, wall thickness, roof thickness, labyrinth access, openings, voids, reinforcements, embedment etc. in the biological shield.

- Shield material, density, and quality assurance during construction
- Dose rate profiles anticipated at various locations: (maximum and minimum values). Indicate them on a sketch of the facility - control room, roof, access doors, openings and where personnel are expected to be stationed for work or otherwise.
- Maximum dose rate anticipated

Lay out of the enclosure along with the location of the Accelerator device

- (a) Shielding design detail and drawing of the accelerator enclosure, which includes :
  - (i) Radiation shielding: concrete blocks, lead bricks, iron plates etc.
  - (ii) Barriers: fences, locked gates, doors etc.
- (b) Area radiation monitors
- (c) Ventilation facility details
- (d) Access sensors or interlocks : magnetic and mechanical
- (e) ‘Crash’ or ‘scram’ buttons either mounted on walls or at doors and gates
- (f) Search and rescue control
- (g) Warning indicators (status lights, alarms, posted procedures)
- (h) Inventory and labeling of control devices

5. Documentation Detail of Services

- (a) Electrical power and power supply systems (including emergency power supply) major electrical equipment, illumination, lift, hoist, cranes etc.
- (b) Air conditioning and ventilation system
- (c) Cooling water supply system
- (d) Compressed air system
- (e) Insulating gas supply system
- (f) Communication system
- (g) Injector gas handling system-system description, characteristics of the gas (properties, specifications, purification etc.)

- (h) Laboratory, workshops, stores etc.
- (i) Other services - please specify
- (j) Control of various subsystems, description, operation etc.

Summary list of potential hazards and safety measures to be taken

- (a) During precommissioning trials of all systems and subsystems
- (b) During commissioning
- (c) During operation and maintenance

6. Safety Features including Hazard Evaluation

- (a) Design safety of buildings and equipment
- (b) Accelerator facility
- (c) Electrical system and equipment
  - (i) Power and control cables-specifications
  - (ii) Cable ducting
  - (iii) Safety fencing of high voltage locations
  - (iv) Earthing
  - (v) Electromagnetic interference and suppression
- (d) Air conditioning and ventilation
- (e) Vacuum system
- (f) Cooling water supply system
- (g) Compressed air system
- (h) Insulating gas supply system
- (i) Communication system
- (j) Control system
- (k) Production and removal of noxious gases
- (l) Pressure vessels
- (m) Others, (if any)

7. Radiation Safety

- (a) Radiation safety policy
- (b) Dose limits
- (c) Planned exposure (operational hours/week)
- (d) Planned special exposure

- (e) Design features - shielding etc.
  - (f) Radiation monitoring and alarm system (including interlocks)
  - (g) Induced activity estimation - radiation levels due to induced activity, induced gaseous airborne activity (if applicable)
  - (h) Other radiation safety considerations - radioactive waste, postulation of radiation accident, analysis and action, administrative considerations (if applicable)
  - (f) Analysis of potential radiation exposure scenarios
8. Chemical Safety
- List of chemicals used with quantities, their toxicity and hazards, safety considerations, analysis of potential release scenarios and preventive and other action to be taken [e.g. ozone production and ozone depleting substance, flammable gases, liquids, oxygen deficiency hazard (SF<sub>6</sub>), biologically hazardous material, cryogenic fluids, etc.]
9. Fire Safety
- Fire and explosion hazards, means of escape, access, fire detection and alarm system, fire fighting system- fire hydrants, dry risers, fire extinguishers etc.
10. Personnel Safety
- Safety policy, organisation, functions of safety personnel, responsibilities, general safety rules, accident prevention program, safety equipment and procurement, safety inspection, housekeeping, accident reporting, investigation, preventive measures, training, medical facilities including first aid.
11. Normal and emergency operation procedures of the accelerating device
12. Safety in Operation and Maintenance
- (i) Startup procedure
  - (ii) Shutdown procedure
  - (iii) Emergency shutdown procedure
  - (iv) Search and secure
  - (v) Entry into beam hall during beam - ON condition
  - (vi) Others (eg. gas handling procedure) please specify.
- Emergency planning and procedures
- (types of emergencies envisaged, preventive measures handling of emergencies, investigation etc.)

- (i) During major leaks in the pressure vessel
  - (ii) During explosion and fire
  - (iii) During general fires
  - (iv) During beam loss/ window foil puncture/target rupture etc.
  - (v) During radiation emergency such as overexposure/activation etc.
  - (vi) Crisis management in case of major emergency
13. Pre-operational Radiation Survey Report (background radiation in and vicinity of the enclosure)
14. Details of Quality Assurance Program during Design and Construction of the Facility
15. Details of Disposal Procedures (if applicable)
- (a) Storage/Shielding or activated materials for reuse or disposal
  - (b) Storing facility for radioactive waste and disposal procedure (waste is segregated into appropriate containers, inventory cards with radioactivity symbol)
  - (c) Activity in cooling water
16. Details Regarding the Decommissioning of the Facility (if applicable)

We certify that all the information provided by us is true and correct to the best of our knowledge and belief.

Place:

Signature:

Date:

Name:

Designation:

Documents to be attached

- (i) Lay out of the enclosure along with the location of the accelerator device
- (ii) Shielding design details and drawing of the accelerator facility setup
- (iii) Other supportive documents mentioned in the application above.