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## PERFORMANCE OF NUCLEAR POWER STATIONS

**April-September 2013**  
Operated by Nuclear Power Corporation of India Limited (NPCIL)

<table>
<thead>
<tr>
<th>Station</th>
<th>Unit</th>
<th>Availability Factor (%)</th>
<th>Capacity Factor (%)</th>
<th>Generation Million Units</th>
</tr>
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</table>
| Tarapur Atomic Power Station  
(2 x 160 MWe + 2 x 540 MWe)  
*TAPS 2,3&4 were under maintenance for part of the period* | 1    | 97                      | 95                  | 684                      |
|                                              | 2    | 39                      | 35                  | 245                      |
|                                              | 3    | 65                      | 63                  | 1482                     |
|                                              | 4    | 83                      | 80                  | 1907                     |
| Rajasthan Atomic Power Station  
(1 x 200 MWe + 4 x 220 MWe) | 2    | 90                      | 90                  | 754                      |
|                                              | 3    | 99                      | 99                  | 954                      |
|                                              | 4    | 83                      | 83                  | 804                      |
|                                              | 5    | 100                     | 104                 | 1014                     |
|                                              | 6    | 76                      | 79                  | 761                      |
| Madras Atomic Power Station  
(2 x 220 MWe)  
*MAPS-2 was shutdown for maintenance from 15th March to 29th September 2013* | 1    | 100                     | 77                  | 739                      |
|                                              | 2    | 1.63                    | 0.8                 | 7                        |
| Narora Atomic Power Station  
(2 x 220 MWe)  
*Both Units were shutdown for part of the period due to grid disturbance* | 1    | 95                      | 78                  | 748                      |
|                                              | 2    | 76                      | 53                  | 514                      |
| Kakrapar Atomic Power Station  
(2 x 220 MWe) | 1    | 92                      | 94                  | 905                      |
|                                              | 2    | 99                      | 97                  | 941                      |
| Kaiga Atomic Power Station  
(4 x 220 MWe) | 1    | 100                     | 95                  | 913                      |
|                                              | 2    | 99                      | 92                  | 890                      |
|                                              | 3    | 99                      | 96                  | 923                      |
|                                              | 4    | 88                      | 80                  | 774                      |
| **Total** (Capacity 4680 MWe) |      |                         |                     | **15959**                |

NPCIL recorded an estimated operating profit of Rs. 848 Crore during the first half of 2013-14.
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<th>Title</th>
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<td>Statement by Dr. Ratan Kumar Sinha, Chairman of the Atomic Energy Commission and Leader of the Indian Delegation at 57th General Conference of the International Atomic Energy Agency, Vienna</td>
<td>1</td>
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<td>Homi Bhabha National Institute (HBNI)- Linking Research and Education</td>
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<td>An institution of excellence is born- National Institute of Science Education and Research (NISER)</td>
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<td>11</td>
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</table>
Mr. President, Excellencies, Ladies and Gentlemen,

It gives me great pleasure to congratulate you, Mr. President, on your election as the President of the 57th General Conference. Under your able leadership, I am sure the current General Conference will accomplish all the tasks before it.

India congratulates His Excellency Mr. Yukia Amano on his unanimous election for a second term as Director General of the IAEA. I am sure that the Agency and the international community will benefit from his experience and foresight.

India welcomes the new Members to the IAEA and I take this opportunity to congratulate Brunei Darussalam and the Commonwealth of the Bahamas on the occasion of their joining the IAEA family.

Mr. President,

We are meeting now after two important meetings related to nuclear energy, namely, the Fukushima Ministerial Conference in Japan during December 15-17, 2012, and the IAEA International Ministerial Conference on Nuclear Power in the 21st Century in the Russian Federation during June 27-29, 2013. Both these meetings have underscored the role that nuclear energy continues to play in the energy mix of various countries for achieving energy security and sustainable development goals in the 21st century for their respective populations. The international community has learned its lessons from the Fukushima Daiichi accident and come out with new guidelines for further enhanced levels of safety of nuclear reactors against beyond-design-basis accident scenarios.

India is committed to implement the highest standards for the safety of Indian nuclear power plants and the associated fuel cycle facilities.

IAEA Operational Safety Review Team (OSART) mission to India for Rajasthan Atomic Power Station (RAPS) units - 3&4, took place during October 29 to November 14, 2012. A follow-up OSART mission is planned in 2014. Preparation and planning for inviting IAEA’s Integrated Regulatory Review Service (IRRS) for peer review of our regulatory system is also in progress, and India will approach the Agency in due course with a request to undertake this mission.

Further, as I had informed last year, India, along with the IAEA, organised an International Workshop on “Safety of Multi-Unit Nuclear Power Plant Sites against External Natural Hazards” at Mumbai, during October 17-19 2012. The Workshop addressed the complex task of safety evaluation of a multi-unit site with respect to multiple hazards, such as earthquake, tsunami and fire. The Workshop was attended by experts from regulatory authorities and plant operators from different countries as well as the IAEA. Actions taken by Member States and International Organisations following Fukushima Accident were also discussed.

Mr. President,

I now turn to updating on India’s progress in the three-stage nuclear power programme, formulated under the visionary leadership of Dr. Homi Jehangir Bhabha. India has adopted the policy of a closed nuclear fuel cycle in order to extract the maximum energy from the limited uranium resources, to ensure sustainable nuclear waste
management, and above all, to achieve sustainable, long-term energy security through utilisation of thorium.

The performance of the Indian Nuclear Power Plants [NPPs], as well as of the several fuel cycle facilities, reached their highest levels last year. This includes NPPs registering 80% capacity factor, PHWR fuel production of 812 MT [an increase of 8% over the previous year], and the highest ever production of heavy water with the lowest specific energy consumption.

The average annual availability of the Indian NPPs has remained at 90%. Six of the nineteen reactors, currently under operation in the country, have logged continuous operation of more than 300 days during the year. The Indian nuclear power sector has registered over 379 reactor years of safe operation. In this connection, I would like to once again reiterate that the Indian Pressurised Heavy Water Reactors (PHWRs) offer a highly competitive capital cost per MWe and a low unit energy cost.

I am happy to inform you that the first unit of the Kudankulam Nuclear Power Plant achieved its first criticality on July 13, 2013, and is expected to begin commercial operation shortly. This plant has been built in cooperation with the Russian Federation. The second unit is also in an advanced stage of commissioning.

The construction of four indigenously designed 700 MWe PHWRs, two each at existing sites of Kakrapar in Gujarat and Rawatbhata in Rajasthan, is progressing on schedule, and India is planning to construct sixteen more PHWRs of 700 MWe at five different inland sites.

The construction of the 500 MWe Prototype Fast Breeder Reactor (PFBR) is nearing completion at Kalpakkam. The critical erection of all permanent in-core components has been completed. Filling of sodium in the secondary sodium loop is planned shortly, and PFBR is expected to achieve first criticality in about a year from now. The construction of the 500 MWe Prototype Fast Breeder Reactor (PFBR) is nearing completion at Kalpakkam. The critical erection of all permanent in-core components has been completed. Filling of sodium in the secondary sodium loop is planned shortly, and PFBR is expected to achieve first criticality in about a year from now.

A co-located Fast Reactor Fuel Cycle Facility (FRFCF), to reprocess and re-fabricate the fuel from PFBR, is being set up at Kalpakkam. Necessary site infrastructure has already been created and preparations for launching the Project are being taken up.

The Fast Breeder Test Reactor (FBTR) fuelled with unique mixed carbide fuel, located at the Indira Gandhi Centre for Atomic Research (IGCAR) has been performing well with high availability factor, providing valuable operating experience, as well as technical inputs to India’s fast reactor programme. Irradiation of indigenously fabricated sodium bonded metallic fuel pins has been initiated in this reactor.

India continues to carry forward intense development of Thorium fuel cycle based technologies for demonstration in its AHWR programme. It is heartening to note that one of the Panel Sessions at the IAEA International Ministerial Conference on Nuclear Power in the 21st Century held at St. Petersburg was devoted to the topic ‘Drivers for deployment of sustainable and innovative technology’. In this Session, I had the opportunity to share India’s rich experience in the development and implementation of Thorium utilisation programme. Thorium-based fuel cycles and technologies present opportunities for enhanced passive safety features, utilisation of the larger natural resources of Thorium, and inherent proliferation resistance. International collaboration under the IAEA would help provide a much wider resource base for future nuclear technology development in this direction.

Mr. President,

India has continued to make good progress in finding new uranium resources in the country through extensive exploration work using multiple technologies. As a result of the use of advanced techniques, we have been able to identify new resources of Uranium. Last year, our reserves have registered an increase of about five percent.

The Nuclear Fuel Complex has developed a new process route, based on adopting radial forging for extrusion of blanks, to manufacture pressure tubes with improved metallurgical properties leading to better creep performance.

Considering India’s domestic strength in
nuclear power and non-power applications, India continues to host events in support of many programmes of the IAEA. An IAEA Technical meeting on Advanced Fuel Cycles for PHWR was held in India during April 8-11, 2013. In this Meeting, twenty one papers were presented covering the areas of new fuel cycle, fuel design, performance, post-irradiation examination and accident modeling. An IAEA Inter-regional training course on “Uranium exploration and processing techniques” was hosted by the Uranium Corporation of India Limited at Jamshedpur. Delegates from twenty three countries participated in this Course.

India, as a founder Member of IAEA’s International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO), appreciates the significant progress made by INPRO over the years. The INPRO methodology for assessment of innovative nuclear reactors and fuel cycles provides a broad framework for developing specific goals and acceptance criteria for new designs. India continues to support INPRO, and will be making a voluntary contribution of US $50,000 later this year.

Mr. President,

The impact of nuclear power in addressing climate change concerns needs to be emphasised, since nuclear power involves low greenhouse gas emissions. In this direction, the decision of the Director General to organise the Scientific Forum on the theme of Nuclear Applications for a Sustainable Marine Environment during this session of the General Conference, is quite relevant.

India is developing technologies for high temperature reactors and hydrogen production processes. The current R&D activities target technologies for high temperature nuclear reactors, capable of supplying process heat up to 1000°C, and high efficiency hydrogen production processes, such as thermo-chemical processes and high temperature steam electrolysis. In addition, India is also developing hydrogen storage materials, as well as fuel cells for applications in transport and power generation sectors. As a contribution to the IAEA activities related to nuclear hydrogen production, a software tool for Hydrogen Economic Evaluation Programme (HEEP) has been developed by an Indian team under a contract with the IAEA. This tool is being used for economic analysis of nuclear hydrogen production so as to compare various options.

Non-power applications of nuclear and radiation technologies in the area of health-care, water, industry and environmental protection are extremely important. We have been a strong supporter and contributor to the Regional Cooperation Agreement (RCA) initiatives right from its inception, and India is the RCA Lead Country in the area of industrial applications and cancer treatment for the past several years.

The Tata Memorial Centre (TMC), an autonomous institution under the Indian Department of Atomic Energy, continues to play a major role in developing cost-effective methods for cancer diagnosis and treatment. TMC has developed a low-cost screening method for cervical cancer using acetic acid. In a recently published study carried out over twelve years covering 150000 women, it has been shown that the use of this technique has resulted in reducing mortality by 31%.

The Bhabha Atomic Research Centre (BARC) has developed a Digital Radiotherapy Simulator (DRS) “Imagin” as a vital supplement to the indigenous teletherapy system, Bhavhatron. One of the three DRS Units installed at TMC was inaugurated remotely by the DG, IAEA during his visit to India in March this year. The technology of DRS has been transferred to private industry for its wider deployment.

India is highly appreciative of the IAEA’s efforts in cancer management, and in particular the Programme on Action for Cancer Therapy (PACT).

India has been offering education and training programmes for physicians and technologists in the field of nuclear medicine. The Radiation Medicine Centre (RMC) of BARC in Mumbai leads these efforts, including those under various IAEA programmes. In early September this year, the RMC completed fifty years of sustained service in the field of nuclear medicine. RMC-trained specialists are not only serving in centres all over India, but also in several other countries.
Mr. President,

In addition to the various core activities related to nuclear energy and non-power applications, India is engaged in the development of high technologies in several other areas, including nuclear fusion and particle accelerators.

India has an active programme in nuclear fusion. The Steady State Superconducting Tokamak (SST-1) at the Institute for Plasma Research (IPR) has been successfully commissioned with the first plasma obtained on June 20, 2013. With this achievement, India has joined the select group of countries where research in ‘Superconducting Tokamak’ is currently being carried out. As a partner in the ITER Project, India is also working on the development of the concepts for Test Blanket Module (TBM). The Indian Lead-Lithium Ceramic Breeder Test Blanket Module will be tested in the ITER machine. The Indian TBM team is involved in the indigenous development of tritium breeder material by solid state reaction and solution combustion methods, as well as in the characterisation of these materials.

The Indus-2 Synchrotron Radiation Source at Indore operated at an enhanced current of 158 mA at 2.5 GeV using indigenously developed solid state Radio-Frequency amplifier modules. An indigenously designed and developed Radio Frequency Quadrupole (RFQ) has been commissioned at BARC and a proton beam was successfully accelerated to 200 keV through the RFQ. This is part of the RD&D for India’s roadmap of Accelerator Driven Systems (ADS). As a part of our accelerator development programme, and also as Indian contribution under an international collaboration initiative, a prototype non-invasive Beam Position Monitor for use in GANIL accelerator facility in France, has been developed and tested in France.

Mr. President,

India actively participated in the IAEA International Conference on Nuclear Security at Vienna during July 1-5, 2013.

India has signed an Arrangement with the IAEA concerning its voluntary contribution to the Nuclear Security Fund. During the last year, we have identified activities to be taken up with the IAEA and look forward to holding the first activity, “Review of Guiding Principles on applying Computer Security Controls to Instrumentation & Control Systems at Nuclear Facilities,” during September 23-27, 2013. This activity will be held under the aegis of the Global Centre for Nuclear Energy Partnership (GCNEP), being established near Delhi. Off-campus activities of GCNEP are taking place, involving organisation of different training programmes. Recently, a National Programme on Prevention and Response to Radiological Threats was organized during August 26-30, 2013 at GCNEP. During the current year, two other programmes, one on Food Irradiation, and the second on Radiological Safety, were organised.

Mr. President,

To conclude, I would like to look ahead at the world energy scenario beyond 2050. By then the accessibility and affordability, if not the global availability, of the fossil fuels will decline. Other energy sources, including nuclear, will need to bridge this deficiency so as to ensure clean and sustainable energy supply for different sectors, and at various scales. This would, in turn, necessitate a more rational approach and strategy, seeking a well-balanced use of all the energy resources available to us. Apart from electricity, nuclear will need to address the large-scale energy needs for industrial use and transport as well. In this context, ten years ago, the IAEA Scientific Forum had discussed the rising hydrogen economy, including the fuel’s future production by advanced next generation nuclear power plants. The IAEA’s latest Nuclear Technology Review is now carrying a feature article on ‘Nuclear Hydrogen Production Technology’.

Considering the long gestation period for deployment of new technologies in the nuclear field, it is essential to further strengthen the role of the Agency for facilitating pooling of international knowledge resources, to achieve sustainable energy security at the global level, looking at the challenges of the future.

Thank you, Mr. President.
The Department of Atomic Energy (DAE), since its inception, has been pursuing basic research as well as technology development with equal rigour. Over the years, a robust institutional framework has been put in place. Today, apart from industrial units, DAE runs 4 major research centres and 7 grant-in-aid institutions. These are listed below:

**R&D Centres**

1. Bhabha Atomic Research Centre (BARC), Mumbai
2. Indira Gandhi Centre for Atomic Research (IGCAR), Kalpakkam
3. Raja Ramanna Centre for Advanced Technology (RRCAT), Indore and
4. Variable Energy Cyclotron Centre (VECC), Kolkata

**Grant-in-aid Institutions**

1. Tata Institute of Fundamental Research (TIFR), Mumbai
2. Saha Institute of Nuclear Physics (SINP), Kolkata
3. Institute of Plasma Research (IPR), Gandhinagar
4. National Institute of Science Education and Research (NISER), Bhubaneswar
5. Institute of Physics (IOP), Bhubaneswar
6. Harish-Chandra Research Institute (HRI), Allahabad
7. Tata Memorial Centre (TMC), Mumbai and
8. Institute of Mathematical Science (IMSc), Chennai
While in the research centres the focus is more on technology and product development, the grant-in-aid institutions concentrate relatively more on basic research. In the process, the research centres and the grant-in-aid institutions have together provided high calibre technologists as well as scientists to the Department but for which India’s spectacular strides in the field of nuclear sciences and their applications would not have been possible.

A key element of the success achieved in the manpower development is the visionary initiative of Dr. Homi Bhabha who set up the prestigious BARC training school in the year 1956. In addition to the training school at Trombay, training schools have been set up at other places as affiliates of BARC training school. The BARC training school and its affiliates have been running a remarkably successful Orientation Course for Engineering graduates and Science post-graduates (OCES). The grant-in-aid institutions, apart from carrying out research, have been running pre-doctoral and doctoral programmes, which have helped in producing high quality scientific research personnel. It is in this respect of an in-house human resource development programme that the DAE has been unique.

The DAE has not only trained manpower for running its own programmes, it has also made significant contributions to the National scene. It has strengthened the research programmes at Universities by providing grants for well-defined projects. All grants are channelised through the Board of Research in Nuclear Sciences (BRNS), which has the distinction of being the first agency in the country for funding extramural research. In the recent years, funding through BRNS has been significantly stepped up and the Department is planning to further expand its activities.

A new scheme called DAE Graduate Fellowship Scheme for Indian Institutes of Technology (IITs) with the twin objectives of human resource development and collaborative research through the medium of M.Tech. students was launched by the BRNS in the year 2002. The scheme envisages selection of M.Tech. students admitted to one of the 6 select IITs for working on a project of interest to DAE under the guidance of faculty from IITs and DAE. Such students receive enhanced financial support from the DAE while pursuing M.Tech. and on completion of which are ensured employment within the DAE system.

Along with massive in-house basic research and technology development programme as well as support to such programmes in academic institutions and other national laboratories, the Department has thus been exceptional in having variously contributed to human resource development. Self-reliance of our atomic energy programme and world-class excellence realized in commercial performance of our indigenously built nuclear plants testify to the soundness of the approach.

However, the demands for self-reliance on the DAE have been rendered even more arduous to fulfil because the Department is the target for technology control regimes imposed by some of the technologically advanced nations. In this scenario, the country and, in particular, the DAE have to necessarily take innovative steps to consolidate the gains achieved so far and take fresh initiatives for enhancing the capabilities to meet the imminent and future challenges.

It has, therefore, become imperative that DAE conceives novel ways through which in-depth capabilities in nuclear science and nuclear engineering are unabatedly nurtured within our institutions. It is in this context: Homi Bhabha National Institute (HBNI) with a Deemed to be University status has been established. The MHRD vide notification No. F.9-5/2004-U.3 dated June 3, 2005 as declared Homi Bhabha National Institute (HBNI) a Deemed to be University along with ten Constituent Institutions (Cl’s) (As mentioned above: 4 R&D Centres and 6 Grant-in-aid Institutions, excluding TIFR, Mumbai, which is a Deemed University on its own). It has now been declared a Grade A university.
An institution of excellence is born -
National Institute of Science Education and Research

On 28th August 2006, the Prime Minister of India Dr. Manmohan Singh announced for the establishment of the National Institute of Science Education and Research (NISER) at Bhubaneswar, under the umbrella of Department of Atomic Energy (DAE) of Govt. of India. He announced that the NISER will facilitate the synergy between research and higher education in science. The Atomic Energy Commission approved the proposal for establishment of NISER at Bhubaneswar in 2007. NISER has been functioning from the beautiful campus of the Institute of Physics (IOP), Bhubaneswar, until its own campus which is under construction gets completed in 2014. The government of Orissa agreed to give 300 acres of land to build the campus of NISER at Jatni in Khordha district, near the Barunei hills about 20kms from Bhubaneswar railway station. The Union Cabinet on 6th September 2007 gave its approval for establishment of National Institute of Science Education and Research (NISER) at Bhubaneswar at an estimated cost of Rs. 823 Crone and also creation of 761 posts in academic, scientific, technical, administrative and auxiliary categories. NISER will conduct an integrated 5 year M.Sc programme in the core and emerging branches of Basic Sciences to students after their 10+2, an integrated M.Sc followed by a Ph.D after B.Sc degree and a Ph.D programme after M.Sc. degree. Presently, NISER is conducting a 5 year - integrated M.Sc. programme in Biology, Chemistry, Mathematics and Physics. NISER organises a unique nationwide entrance test National Entrance Screening Test (NEST) in connection with University of Mumbai-DAE Centre for excellence in Basic Sciences, another Institution set up by DAE in Mumbai, to select the students for the 5 year - Integrated M.Sc. programme. The aim of this test is to find out very talented and bright students who are motivated towards science.

National Institute of Science Education and Research (NISER) is envisioned to be a unique institution of its kind in India. NISER will strive to be recognized as a Centre of Excellence in science education and research in four basic sciences (Biology, Chemistry, Mathematics and Physics) and in related areas. The aim of this special institute is to nurture world class scientists for the country who will take up challenging research and teaching assignments in universities, R & D laboratories and various industries. Presently, NISER’s degrees are awarded by Institute of Physics under Homi Bhabha National Institute (HBNI), a Grade A deemed University of DAE.

NISER’s new campus is nearing completion at Jatni and the activities will shift to its own facility by middle of 2014.
DISTRESS ALARM DEVICE

BARC has developed a compact and low cost electronic device called 'Distress Alarm Device- NIRBHAYA' to send information to near and dear ones including police in case of severe distress or fear of attack. The 3"x 1.1/2"x 1" device weighing about 100 grams can be carried in pocket or purse and requires a cell phone for its functionality. In case of need, a switch provided on the device is pressed. It automatically sends a signal on Bluetooth to the cell phone along with its GPS location. The software loaded on the cell phone sends pre-formatted message through SMS to pre-selected five cell phone numbers. These five phone numbers are user selectable. These can include phone numbers of parents, relatives, friends and police. The SMS message is also user defined and pre-formatted, which can be as follows. “I am X, female/male, aged Y years. I am in distress. I need urgent help. My location is latitude LAT and longitude LONG.” Once the switch on the device is pressed, it continues to send its GPS location to the cell phone of the person in distress every 10 minutes and the cell phone transmits SMS again to the same five cell phones. Thus if the person is being kidnapped, the latest location will be available to the police. However, if kidnapper snatches the device and or the cell phone of the person, at least last location from where he/she is kidnapped is known. The device can also be used in case a person gets heart attack and needs immediate help. The device is rugged and cannot be destroyed easily. It has chargeable battery, which like any cell phone can be charged daily. There is LED to indicate low battery voltage. The switch is located in such a way that it cannot get pressed accidentally.

SALIENT FEATURES

- Easy to use, single-button single-press operation.
- Sends SMS alerts to 5 user-selectable numbers.
- Message includes GPS location.
- Once activated, automatically sends SMS every minute.
- Re-chargeable battery.
- Low cost compact device.

**Mechanical Dimensions**

A3” X 1.5” X 1”

**Weight**

100gms

**Current Consumption**

200mA (Standby mode)

50mA (Operating mode)

**Power Input**

3.5V - 5V, 800mA Li-ion rechargeable battery

**Mobile specification**

Any mobile with Bluetooth, J2ME support and running on Symbian / Android Operating System
SPECIFICATIONS:

APPLICATIONS

• It has a societal application and assures that help is on hand when it is needed.
• It will be of great use in case of sudden attacks, accidents, kidnappings etc.

INFRASTRUCTURE

• Electronic assembly facility.
• Test equipment for measuring voltage and current and for calibration: DVM with 0.1V resolution.
• Provision to import some components if not available locally.

MANPOWER

• Man power: One experienced Electronics Engineer and one assistant / Technician required for production, testing and calibration of the instrument.

PORTABLE RADIO ISOTOPES DETECTION AND IDENTIFIER (PRID)

Introduction

The Portable Radioisotope Identification [PRID] system detects and identifies multiple radionuclides, provides quantified results using field strength analysis and stores the results & spectrum for future reference. It can be operated in various modes as Identifier mode, MCA mode, Transfer stored spectrum mode, Administrator mode and Dosimeter mode.

Salient Features

• Ability to identify up to 20 Radionuclide (easily expandable).
• Useful energy range extends from 150 KeV to 3 Mev with saturation field strength of 2000 μR/Hr for Cs-137.
• Online background cancellation and dead time correction.
• Individual cut-off for each radionuclide for identification.
• Minimum detection time of one second.
• 3.5" 320 X 240 colour TFT LCD display.
- Ability to work in Identifier, MCA and Dosimeter modes.
- RS-232 based communication for transfer of data to P.C.
- ANSI N42.34-2006 compliant features.
- Menu driven structure with seven keys for operation of instrument.
- 15 hours continuous operation battery life.

**Working Principle**

It consists of the spectrometer electronics, the gamma ray detector (attached inside the module), the HV module (installed on the rear end of the instrument), two battery pack (installed in the sides of the instrument), an AC power adapter for battery charger) and optional devices/software.

**Applications**

The Portable Radioisotope Detection and Identification (PRID) system finds applications for ascertaining radioactive contamination mainly for public safety. One of the applications in steel industry is ore and scrap handling besides other applications in various dimensions.

```
Detector & PMT assembly ➔ Analog Processing ➔ Analog to Digital conversion

HV Module & Power Supply ➔ Microcontroller (μC) ➔ Display & User Interface
```

**Space required**

The space requirement is approximately 10ft X 12ft to comfortably accommodate electronics equipments as computer, soldering/rework workstation, MSP430 hardware debugging tool, pulse generator, calibrated radioactive source, NIM bin, BNC sliding pulsar, power supply, HV multimeter, oscilloscope, logic analyser etc.

**Manpower Requirement**

One electronics engineer having 2-3 years of experience in hardware and software. One Diplomate in Electronics person with 2-3 years of experience and one experienced technician.

**For details on transfer of these technologies and other technologies available in BARC contact:**

**Head, Technology Transfer & Collaboration Division,**
**BHABHA ATOMIC RESEARCH CENTRE, TROMBAY, MUMBAI - 400 085**
Fax: 091-022-25505151 Email: headttcd@barc.gov.in
Public Awareness Activities

DAE participated in INNAVIAZONE’13 organised by the GH Patel College of Engineering and Technology (GCET), at Anand, Gujarat during August 16-17, 2013. The event was a platform for encouraging young students to solve real world challenges by applying science and technology. Students and faculty members from schools and engineering colleges in and around Anand visited the pavilion and had very fruitful interactions with DAE officials. Many of them showed keen interest in various R & D activities of DAE and expressed a desire to pursue a career in Nuclear Science and Technology.

The 17th National Exhibition with the theme, “India Advancing towards a World Power” was held at the Visvabharati University, Shantiniketan, West Bengal during September 6 – 10, 2013. DAE participated in this event and exhibited all the peaceful uses of atomic energy. The Saha Institute of Nuclear Physics (SINP), Kolkata and the Variable Energy Cyclotron Centre (VECC), Kolkata also participated and exhibited their R&D activities. Visitors to the exhibition comprised, students, general public and members from the academia.
## Status of Nuclear Power Projects under construction as on end September 2013

<table>
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<tr>
<th>Sr. No</th>
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<th>Unit</th>
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