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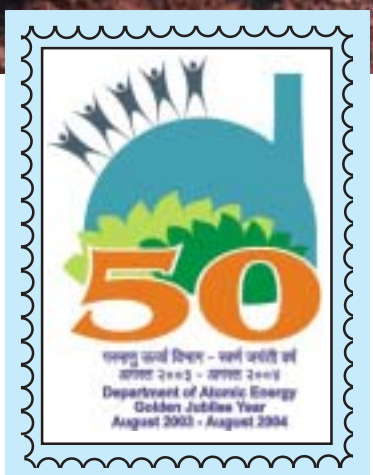
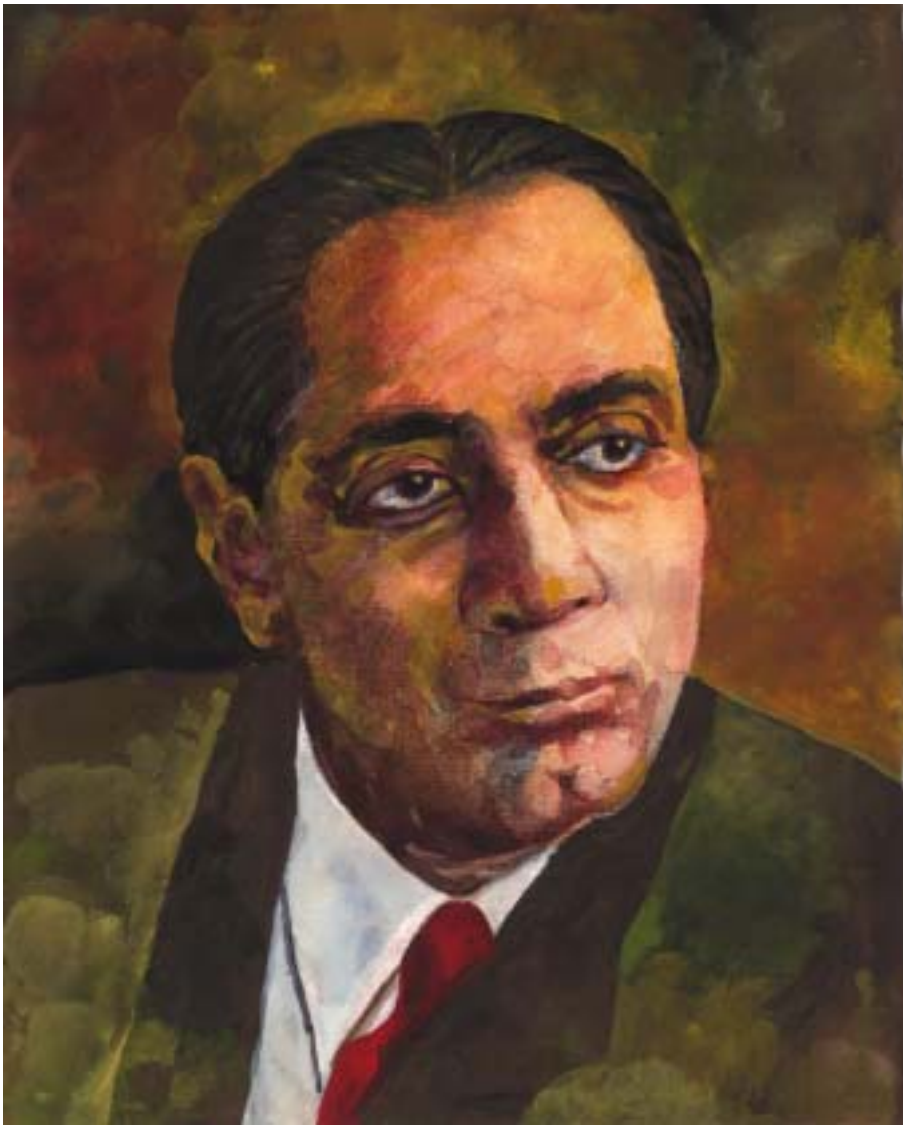
BARC DEVELOPES RADIATION INDUCED DWARF MUTANT IN SUNFLOWER

Sunflower (Helianthus annuus) has been under cultivation as an oil-seed crop since 1970. Increasing genetic variability and development of high yielding varieties/hybrids is an important objective. 'Surya' is the first high yielding variety released for cultivation. Induced mutation studies were initiated at the Nuclear Agriculture and Biotechnology Division, Bhabha Atomic Research Centre. Large spectrum of variability for morphological characters was isolated using gamma rays. Dwarf mutant of sunflower is one of them, which was observed in the $9^{th}(M_9)$ generation and in subsequent generations too indicating that the dwarf character is heritable and governed by genes.



“.....We have been able to achieve technological successes because our research base is strong. We have to ensure that we sustain and enrich the environment that nurtures research.....”*



Dear Colleagues:

On the occasion of the 94th birth anniversary of Dr.Bhabha, let us first of all rededicate ourselves to the vision of our founder. This year is particularly special because it happens to be the Golden Jubilee Year of our Department. This year is also very important because we have launched the construction of India’s first commercial fast breeder reactor, a very important milestone in the implementation of our three-stage nuclear power program.

Friends, NPCIL has now demonstrated world-class performance in operation of nuclear power reactors. Nuclear electricity generation of 19,358 million units was realized during the year 2002-03 with NPCIL reactors achieving an overall annual capacity factor of 90 percent, which is among the best in the world. The Kakrapar Atomic Power Station Unit 1 was adjudged to be the best performing PHWR worldwide during the rolling twelve-month period from October 2001 to September 2002. Shri Bhiksham, Station Director, Kakrapar Atomic Power Station was awarded the first WANO (Word Association of Nuclear Operators) Excellence Award for his contributions to excellence in nuclear industry, only a few days ago at the WANO Biennial General Body meeting held in Berlin. For the calendar year 2002, three NPCIL PHWR Units were among the five best PHWR Units in the world. Our fuel as well as Heavy Water plants have worked to near full capacity as in earlier years.

Dr. Anil Kakodkar,Chairman, Atomic Energy Commission & Secretary, Department of Atomic Energy,addressing on the occasion of Founder’s Day at BARC,Trombay

** Excerpts from the address by Dr. Anil Kakodkar,Chairman, Atomic Energy Commission & Secretary, Department of Atomic Energy, on the occasion of Founder’s Day of BARC, October 30 2003.*

Clearly, we have been very successful in taking the indigenous development of nuclear power technology to the level of world-class excellence in spite of the restrictive international regime. We have to consolidate these gains and move forward to deliver to the nation, clean and green electricity in adequate quantity and at affordable cost. As all of you are aware, nuclear power is important both from point of view of sustainability as well as from considerations of protection of global climate. A very significant role of nuclear power is inevitable if India has to realize its dream and aspirations of becoming a developed nation. The realization of this goal before it is too late, is our responsibility.

There are thus many challenges ahead of us. The first challenge is to rapidly increase the share of nuclear electricity in the overall electricity generation in our country. In this regard, we now have as many as nine nuclear power units under construction. When completed, the nuclear power generation capacity would climb to 7300 MWe from the present 2770 MWe, a jump of more than two and half times. All our construction projects are in fact moving ahead of schedule. We have also launched several initiatives to meet the fuel requirements of our power stations. In addition to the production at Jaduguda, Narwapahar, Bhatin and Turamdih mines, the Uranium Corporation of India Ltd. has taken up the work to develop mines at Banduhurang, Bagjata, Lambapur and Domiasiat. We are also working to exploit other secondary resources. The Nuclear Fuel Complex is augmenting its Zirconium production capacity through expansion of its activities including a new zirconium sponge plant being set up at Palayakayal in Tamil Nadu. It should be our endeavor to enhance fuel production capacity as early as possible to meet the requirements of our expanding program.

Bharatiya Nabhikiya Vidyut Nigam (BHAVINI) Ltd, the fifth Public Sector unit of the Department of Atomic Energy, has come into existence a few days back for commercial implementation of fast breeder reactor technology. Setting up of the 500 MWe Prototype Fast Breeder Reactor would be its first task. As you can appreciate, this technology holds the promise of around 350,000 MWe power generation capacity using the spent fuel arising from Pressurized Heavy Water Reactors which we can set up on the basis of Uranium available in the country.

The challenge now before us is to demonstrate a commercial success in this endeavour in a manner similar to what we have done with PHWR technology. Given the excellent knowledge and skill base at the Indira Gandhi Centre for Atomic Research, generated through years of comprehensive Research and Development on Fast Reactor Technology, established capabilities of Nuclear Power Corporation in project engineering and construction management and dedication of every one involved, we will no doubt be successful.

The completion of *en masse* coolant channel replacement and several upgrades at the 2nd Unit of Madras Atomic Power Station in a record time has been an important achievement. Successful incorporation of moderator spargers at this Unit has been a matter of personal satisfaction for me as this completes the planned rehabilitation to full power rating. Sustaining commercial viability in a changing environment often poses complex technological challenges. Life management activities at various plants, increasing the design output of 540 MWe PHWR Unit to 700 MWe, the new front-end under commissioning at the Baroda Heavy Water Plant and many other similar activities that have been recently completed, are further examples of such successfully met challenges.

While the mixed carbide fuel in FBTR has now reached a burn up of 1,13,000 MWD/T, the PFBR fuel pins under irradiation in FBTR have also reached 12,730 MWD/T burn up. These pins incorporate U233 to enable irradiation at required linear heat rating while keeping the chemical proportion of uranium and plutonium at the level of PFBR design value. Reprocessing trials for FBTR fuel pins have also been started. We have accumulated considerable industrial scale experience in the back end of nuclear fuel cycle. In the context of Fast Breeder Reactor Programme, we now have to quickly take recycle activities to commercial – industrial domain on one hand and develop short doubling time capability on the other.

Development of Thorium utilization technologies for energy production is our long-term goal. I am happy that the engineering peer review process of Advanced Heavy Water Reactor has been completed. We now have to take up independent safety review and detailed costing before we can launch the construction of this technology demonstrator. We have to also complete all necessary R&D activities including validation of AHWR core through critical experiments as early as possible. Thorium utilization capability along with related material development can open up not only vast potential for electricity production but also could offer superior alternatives for applications such as production of hydrogen, burning of actinides and other long lived wastes, long endurance remote power packs and many others. Coupled with accelerator driven spallation neutron sources, these applications could become even more viable making the vast thorium resource available in our country a truly primary energy source with

assured degree of sustainability and with negligible environmental impact and residual waste. As you are aware, we have launched an integrated long-term development strategy for shaping the third stage of our nuclear power programme. Let us all put our might together to realize the goals of this programme as early as possible.

We have been able to achieve technological successes because our research base is strong. We have to ensure that we sustain and enrich the environment that nurtures research. I think we are at a level where we should pick up new challenges where our research can provide possible answers to address some of the problems of national importance. Given our technological strength we are in a unique position to translate such new research output into beneficial applications. We have already done so commendably well in the field of food and agriculture, medicine and health, environment, water availability in addition to electricity production. DAE technologies can make significant difference to quality of life of our people and so special initiatives have been launched to reach them to the target beneficiaries. Facilitating this translation should be a part of endeavour of each one of us. I would urge all of you to get first hand acquaintance with these technologies from DAE website and also encourage other to do so.

While our research has to have a national focus, we must excel at the global level. Here again, the strong linkage between our research activities and our technological capability has become our strength. Our participation in the STAR experiment at the Relativistic Heavy Ion Collider in the Brookhaven National Laboratory of United States, the Large Hadron Collider and its experiments CMS and ALICE under construction at the European Centre for Nuclear Research (CERN), Geneva, participation of Indian scientists in several synchrotron and other facilities in several laboratories abroad has earned considerable respect for Indian capabilities. As you are aware, we are now among very few countries who have Observer status at CERN.

Our efforts to create world-class research facilities are also bearing fruits. The Giant Meterwave Radio Telescope (GMRT) is now a full-fledged international observational facility for radio astronomy below 1.4 GHz. Gamma ray astronomy facility at Mt. Abu is operational. INDUS-I synchrotron is working well. ECR facility at VECC has considerably enhanced the range of heavy ions available for experiments. Good progress is being made towards radioactive ion beam development. Phase-I of Superconducting LINAC Booster at Pelletron Heavy Ion Accelerator is now operational. The Advanced Centre for Training, Education and Research in Cancer (ACTREC) is now functional. The Accelerator Mass Spectrometry facility for carbon dating is now available at the Institute of Physics, Bhubaneswar. SST-1, one of the world's first Superconducting Steady State Tokamaks with elongated diverter plasmas and 1000 second operation capability is getting ready at Institute for Plasma Research. The Superconducting Cyclotron is making good progress at the Variable Energy Cyclotron Centre. INDUS-2 is getting ready at the Centre for Advanced Technology.

Colleagues, in all our work we have always placed highest priority on our safety and environment related programmes. I must add here that we are committed to not only maintaining the environment but to its further enrichment through our work. That has been our philosophy all along. We should be judged by our actual track record and not by unsubstantiated stories. All our operating power plants and Heavy Water Plants now have ISO environment certificate. Our vision on environment is not restricted to just our programme. We are perhaps the pioneers in comprehensive thermal ecology work in our country. Flue gas conditioning technology developed by Heavy Water Board is now helping reduce fly ash emission in thermal boilers. Nisarga-Runa developed here at BARC is helping convert biodegradable solid waste into useful manure and methane. The sewage sludge hygenisation plant (SHRI) at Vadodara is now providing dried hygenised sludge for use by farmers. In my view these developments are of far reaching value in value added recycle of wet solid waste in urban areas and Agricultural waste or residue in rural areas. I am confident that these technologies would grow on the strength of their viable utility not only in preventing environment degradation but to produce valuable fertilizer and energy of use in rural areas. We all should play a catalytic role to expand this application.

Finally, friends we must recognize that our human resource is our strength. Our links with academic institutions built around program oriented research and training are being further strengthened through BRNS and DAE-UGC Consortium. It should be our persistent endeavour to search talent, inspire and orient them to our national programme during their education phase, nurture and empower them to pursue innovative ideas while they pick up experimental and technological skills in the early part of their career with us and facilitate their blooming as leaders in their respective areas. We owe it to this organization that has groomed all of us so well.

Thank you.

ECIL: The Opportunities and Challenges Ahead

Organisations by very definition are organic in nature. They are required to be dynamic and adapt themselves to the ever-changing environmental scenario and redefine their goals and strategies consistent with ground realities. However they have to be firmly entrenched in their core values, plan around their core strengths and focus with unwavering intensity on their core purposes.

Same is true for ECIL. The core value cherished is **self-reliance**; the core strength is **technical excellence**; and the core purpose is **to be a valued asset to the country** in supporting the programmes envisaged in strategic sectors covering Nuclear, Defence and other domains of national importance.

ECIL pioneered the development of various complex products without any external technological help and scored several 'firsts' in the country. Though the initial thrust was on meeting the Control & Instrumentation requirements of the Nuclear Power Programme, the expanded scope of self-reliance pursued by ECIL enabled the company to develop products for diverse and demanding sectors like defence, civil aviation, telecommunications, security and others. This missionary zeal essentially directed the technology, products and processes of the company over the years that enabled it to blossom itself into a multidisciplinary and multiproduct organisation.

Doubly curved Antenna manufactured by ECIL for defence

Tracking Antenna for strategic applications

Apart from achieving several product and technological goals, ECIL has demonstrated its organisational resilience by staging a remarkable turnaround from the brink of sickness. Additionally, the post-liberalisation era characterised by global competition even on local soil has thrown up fresh opportunities and challenges for ECIL. It is expected that the company will continue to demonstrate this resilience in battling the challenges of technology, competition, the rapidly changing economic scenario and issues related to human resources.

Opportunities

Born as an offshoot of BARC, ECIL has ready access to a reservoir of state-of-art proven technology which only a select few; either in the public or private sector can boast of. This privilege should empower the company to synergise its system engineering and associated capabilities with the R&D capabilities of BARC/DAE and DRDO to offer a wide mix of world class products and services.

ECIL acquired a unique blend of

New Chairman & Managing Director of ECIL

Shri G.P. Srivastava, who has taken over as Chairman & Managing Director of ECIL on 30th June, 2003 is a brilliant Electronics Engineer. Born in 1949, he is a Post Graduate in Electronics and Radio Engineering from the University of Allahabad. He started his career as a Scientific Officer in BARC by getting selected into the prestigious BARC Training School in 1970. He rose to the position of Head, Control Instrumentation Division in BARC before joining ECIL.

He made notable contributions in the areas of Computer based Control Systems, Reactivity Control mechanisms for Light Water Reactors and Pressurised Heavy Water Reactor, Antenna Control Systems for Giant Meter Radio Telescope (GMRT), Development of Security Electronic Systems in Nuclear Power Plants in India, etc.

He has chaired a number of Design Safety Committees for the Atomic Energy Regulatory Board. He was also a member of the Physical Protection Advisory Committee – DAE, a member of the Nuclear Reactors and Fuel Cycle Committee of the Board of Research in Nuclear Sciences, and Human Resource Development Division, BARC.

Shri Srivastava is a Fellow of the National Academy of Engineering in the Electronics & Communications discipline and is a recipient of VASVIK Award 1998 in Electrical Sciences & Technology.

skills, capabilities and technologies that enabled it to convincingly demonstrate its techno-commercial competitiveness in the global market conditions prevailing within the country. The competency set required to succeed in the field of Strategic Electronics has been amply validated, giving the company a head start in its export initiatives.

The company with a nation-wide sales and service network can initiate breakthrough improvements in the fast enlarging services market. The impressive levels of customer satisfaction that the company has been recording by virtue of its customer-centric focus should help it in expanding the scope of its servicing operations beyond its own products and beyond the frontiers of the country.

ECIL established its capabilities in the area of Control & Instrumentation, and is geared up to fully utilise the opportunities being provided by the country's ambitious Nuclear Power Programmes. Time has come for the company to position itself to meet the other products and servicing/updating requirements of DAE and its constituent units.

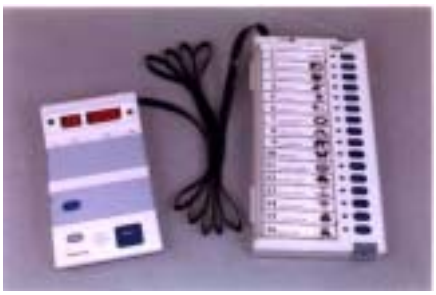
Challenges

Eventhough ECIL proved itself to be a national asset in the field of Strategic Electronics, it will have to continue its crusade against technology denials as situation arises.

ECIL will continue to face intense competition from the Multinational Corporations (MNCs) and the private sector. The company does not enjoy any captive market advantage and will have to continue to compete and survive in the open market against global benchmarks.

Today's knowledge economy is putting a premium on the human capital and its development. Owing to its original manufacturing focus, the company generated surplus manpower at various levels over a period of time.

Conveyorised Parcel Viewer for scanning powdery substances in parcels/ mail



Electronic Voting Machine

Vehicle Mounted Frequency Jammer for Strategic Application

Vigorous efforts need to be made for rightsizing the organisation through more pragmatic Human Resources Management (Reduction and Induction) and for ensuring timely and effective implementation of various plans and programmes

The vision and mission of ECIL, the policies, plans and programmes and the associated strategies, systems, procedures and processes at the corporate and strategic business unit level need to be installed and calibrated considering the above promises. These will have to cover the ambits of business philosophy, sectoral marketing goals, R&D strategies and HR practices ensuring a global presence.

Business Philosophy

The original philosophy of pioneering the technology irrespective of commercial implications underwent a drastic transformation owing to economic liberalisation and concomitant global competition. The need to survive and grow on one's own resources compelled the company to recast its business strategy based on sound business principles and prudent commercial practices.

The business strategy would necessarily have to focus on a business design that

- Can assure sizeable annual turnover by way of meeting the requirements of various units of DAE
- Can ensure a guaranteed steady state performance to sustain the current levels of operations and profitability
- Can identify and harness event driven and general purpose product mix to ensure sustainable levels of growth and contribution
- Can introduce new products based on state of the art technologies to create value inflows and ensure a safe and secure future
- Can ensure significant presence of the company in the international market

By virtue of its time-tested capabilities in Project Management and System Engineering, emphasis will continue to be on low volume and high technology operations in the chosen areas of Strategic Electronics. To consolidate its strengths and ensure a steady growth of business in this segment, the organisation needs to regain

its preeminence as a technology leader. Accordingly, scanning, selection, initiation and harnessing appropriate technologies suiting the requirements of divergent sectors of national importance will be pursued and undertaken in a focused and more vigorous manner.

ECIL was chosen by Ministry of External Affairs to execute a 7.2M Satellite Communication Earth Station Project at Mauritius enabling reception of Doodarshan signals

Breaker Electronic Panel supplied to CERN, Switzerland

R&D Strategy and Technology Goals

ECIL has to fine-tune its R&D strategy with continued emphasis on self-reliance in the relevant areas of Strategic Electronics. The emphasis of R&D at ECIL will therefore be to

- regularly introduce new products to ensure new channels of value inflows,
- optimally utilize R&D resources to give priority to those areas that facilitate self-reliance,
- focus on application-specific R&D-to directly address customer requirements,
- emphasize on optimal R&D management while exercising options to meet any customer/market requirements through investment in own R&D, taking up networked/collaborative work with other R&D Labs/ academic institutions, buying the know-how, outsourcing etc..

Sectoral emphasis

The company charted out its own niche areas in the chosen sectors of its operations. The product streams of ECIL are regrouped and a sectoral focus is consciously brought in. The strategic sectors, namely, nuclear, defence, civil aviation and security will receive special attention in terms of improvement of technology base and skill generation.

ECIL is concentrating on enhancing its areas of core competence in the field of Integrated Security Systems. It will be the endeavour of the company to revive its links and enhance its business with the Department of Space. Mutually beneficial business linkages will be established with other public sector undertakings (PSUs) and if necessary even with reputed private enterprises.

Another important sector on which ECIL would like to intensify its focus is the social sector. Eventhough a number of products were developed and supplied over the years in the areas of healthcare, agriculture and education, the company would like to serve the rural sector both from a business and national perspective. Suitable initiatives will be evolved and launched in this direction, if necessary by constructing bridges of cooperation with other concerned governmental and non-governmental agencies.

Globalisation and Exports

ECIL conclusively established that it has the capability to

- Combat technology denials during critical times
- Compete with established MNCs and private companies and face market forces successfully
- Meet global standards of performance

With these capabilities and potential coupled with world class infrastructure, the company is now contemplating a vigorous export drive for its products and services. To facilitate this, ECIL will launch necessary initiatives to

- Forge strategic alliances fostering business and technology tie-ups
- Obtain Intellectual Property Rights
- Identify and enter into MoUs with reputed international companies to function as a trusted OEM supplier

Practices and Quality Standards

In the aftermath of globalisation and its impact on the fortunes of ECIL, it has been adequately realised that the company needs to attain and maintain global standards of performance. This calls for identifying, understanding and pursuing process parameters and practices as per global benchmarks. All the business divisions of the company are already ISO 9000 certified and initiated programmes to ensure early transition to ISO 9000:2000 version of the Quality Management System, which is recognised as a TQM standard. There is also a need to inculcate a zero-defect culture across entire organisation, which

will be promoted through programmes aimed at continual improvements in quality, cost, delivery and service, leading to enhanced levels of customer satisfaction.

Human Resource Base

To face the challenges ahead, there is an urgent need to focus on attracting and retaining talent. The present human resource base reflecting an aged organisation needs to be rejuvenated by selectively injecting young blood into the system. The existing workforce needs to be retrained and deployed suitably by imparting multi-skilling and multi-tasking capabilities to ensure a flexible manufacturing culture in tune with the changing requirements of the market place. A system of continuous and actionable learning and updating merits a serious consideration in this regard. Employee satisfaction surveys have to be initiated to elicit reliable feedback for appropriate managerial interventions for galvanising the organisation for excellence in performance. All efforts will have to be made to create a congenial and productive working atmosphere at various levels so as to further consolidate ECIL's status as a valued national asset.

Conclusion

It will be the endeavour of ECIL to emerge as a technologically strong and commercially sturdy entity organised to make significant contributions to the nation by realising applications which are of both strategic and economic significance to the country in the fields of atomic energy, national defence, security systems, telecommunications, education, agriculture, water management, waste management and health care.

BOARD OF RADIATION & ISOTOPE TECHNOLOGY

Although the Board of Radiation & Isotope Technology (BRIT) was formally launched in 1989, its main activities evolved from the nucleus formed earlier in the Isotope programme of BARC and there is a strong synergy between the two units.

BRIT enjoys a unique position amongst the other constituent units of DAE and this unit acts as the bridge between the R&D activities of the Department and the society. BRIT plays the role of "Bhagirath" bringing the fruits of R&D emanating from the nuclear programme to the benefit of the common man. The four major areas in which this flow continues are health-care, industry, agriculture and research.

In its earlier avatar as Isotope Division of BARC, BRIT had midwifed the birth of state-of-the-art diagnostic methodologies and therapeutic medicines in the field of nuclear medicine and radiotherapy. From the 1960s when a few hospitals in and around Mumbai started using Iodine-131 and Phosphorus-32 labelled compounds for diagnosis and therapy, BRIT virtually grew into a supplier of sub-continental proportions catering today to more than 500 institutions within India, Nepal and Srilanka. Growth in the quantity of consignments was accompanied by the expansion in the range of products. Today BRIT supplies on a weekly basis ^{99m}Tc generators, 11 types of cold kits for formulation of ^{99m}Tc radiopharmaceuticals, Sodium Iodide (^{131}I) therapeutic capsules, ^{131}I MIBG for diagnosis of neuro-endocrine tumors, ^{32}P injections for palliation and treatment of blood cancer and ^{153}Sm EDTMB for bone palliation in bone metastasis. RIA kits for testing 8 parameters covering thyroid and fertility disorders are routinely supplied to users all over the country. BRIT is the only manufacturer of Radioimmunoassay kits in the country. In this area, BRIT has developed separation system based on magnetizable particles for which patent application has been filed with the Indian Patent Office.

Radiopharmaceutical Laboratory, Vashi, Navi Mumbai

Researchers in India had been using ^{14}C and ^{3}H labelled amino acids, carbohydrates and fatty acids for biological research. With the development of biotechnology and

molecular genetics, researchers were handicapped by the non-availability of economically priced labelled nucleotides and amino acids. BRIT stepped into this area as early as 1985 and started synthesizing four basic labelled nucleotides. With the commissioning of the production facility at the Centre for Cellular and Molecular Biology (CCMB) campus, Hyderabad, named JONAKI, the range has increased to cover 12 Phosphorus-32 labelled nucleotides, 4 Phosphorus-33 labelled nucleotides and 12 molecular biology kits. The Labelled Compounds Laboratory at Vashi, Navi Mumbai supplies 5 kinds of ^{35}S labelled amino acids. One International Patent application has been filed in the area of detection of Nucleic Acids by the JONAKI lab.

In the industrial front, the first major equipment to be developed was the gamma radiography camera incorporating ^{192}Ir sources as well as ^{60}Co sources. Today the ROLI-1 cameras with ^{192}Ir sources are the work horse of industry and a large network of radiographers around the country are using these units.

Laboratory research irradiators have also been evolving from their earlier models and the latest addition to this series, the "Blood Irradiators" are now being supplied to hospitals in different parts of the country for the benefit of immuno-deficient patients.

The major thrust given to the area

Blood Irradiators developed by BRIT

New Chief Executive of BRIT

Shri J.K. Ghosh has taken over as the new Chief Executive of BRIT. He joined the twelfth batch of BARC Training School after graduating in Metallurgical Engineering, from the Regional Engineering College, Durgapur, West Bengal. He started his career in Radiometallurgy Division of BARC. He was responsible for setting up the Inspection and Quality Control facilities for the plutonium fuel programme.

Shri Ghosh received training in plutonium metallurgy in Kemforschungszentrum Karlsruhe, Germany in the early seventies. His first major task in Radiometallurgy Division was the inspection and quality control of plutonium oxide fuel for PURNIMA reactor. This was followed by development of NDT techniques for MOX fuel quality control. He shouldered the responsibility of FBTR mixed carbide fuel quality right from specifications stage to the final delivery. He had played a key role in the quality assurance of Uranium-233 based plate type fuel for the KAMINI reactor at IGCAR.

Shri Ghosh has pioneered the use of advanced NDT techniques like Infrared Thermography and Neutron Radiography using the Apsara reactor facility for plutonium based fuel quality assurance. He has also made significant contribution in the field of quality documentation in the plutonium programme.

Shri Ghosh joined the Board of Radiation and Isotope Technology (BRIT) in March-2000 as Deputy Chief Executive and worked from Kolkata to strengthen the eastern regional activities of BRIT. He returned to Mumbai in May-2002 and has been leading the engineering programme of BRIT covering diverse activities spanning from the large scale recovery of radioactive Cobalt from irradiated adjuster rods in RAPPCOF facility Kota, to fabrication of miniature source capsules using laser welding in the Radiological laboratories of BARC and providing radiation processing services to customers from ISOMED and Radiation Processing Plant, Vashi.

Shri Ghosh has given a major thrust to the programme of setting up Radiation Processing Plants by private entrepreneurs and a number of such plants under MoU with BRIT are coming up in different locations such as Kolkata, Mumbai, Delhi, Agra, Rahuri and Hyderabad.

Shri Ghosh has over hundred and twenty technical publications in national and international journals.

The Indian Society of Non-destructive Testing, Mumbai Chapter has recently bestowed the NDT Excellence Award 2003 on him for his contribution in the field of industrial applications of NDT.

of setting up of new radiation processing plants for medical, food related and allied products has shown very encouraging results in the recent times and about eight private parties have signed MoU with BRIT for setting up new plants. The first of these (M/s.Organic Green Foods Ltd., Kolkata) is expected to be operational during the first quarter of 2004.

Organic Green Foods Ltd. Kolkata

The Sealed Sources Programme supplies cobalt source pencils to all the industrial radiation processing facilities. Apart from ISOMED and Radiation Processing Plant, Vashi, the list includes RASHMI, the irradiator operated by Kidwai Memorial Institute of Oncology, Bangalore, irradiator "RAVI" operated by Defence Laboratory, Jodhpur and the irradiator operated by M/s. Shriram Institute for Industrial Research, Delhi. It also supplies source pencils for all laboratory irradiators. Custom made sources are supplied to customers for specific use.

A very important task performed by this unit is the supply of cobalt teletherapy sources to a large number of cancer hospitals throughout the country. Hundreds of kilo curies of cobalt activity is handled by this unit. A variety of brachytherapy sources are also being supplied by this unit.

The RAPPCOF facilities located at Kota, Rajasthan is the "Gangotri" of the entire cobalt based programme of BRIT. The water pool has a capacity to hold upto three million curies of Cobalt-60. The irradiated adjuster rods are transported from power reactors to this facility and

RAPPCOF facilities located at Kota, Rajasthan

Cobalt-60 is recovered and later transported to Mumbai for further process

The impeccable record of ISOMED, the flag-ship unit of BRIT operating successfully for 30 years now and providing radiation processing service of medical products to more than 1500 clients spread all over the country, has had a catalytic effect on changing the mind-set of private entrepreneurs to go in for setting up such plants in private sector.

The Radiation Processing Plant, Vashi (earlier known as Demonstration Plant for Spice Irradiation) operating since January 2000 has also been performing very well with an enlarged scope of products being processed.

Future: Where do we go from here?

Today BRIT is geared up to take the challenges of the new millennium. The number of people demanding sophisticated healthcare facilities is growing by leaps and bounds. Nuclear medicine which was restricted to the metro cities is now penetrating to the bigger towns and even in the agriculturally prosperous mofussil areas. Immunodiagnostics is also offering fresh demands in terms of new parameters. Further BRIT can position itself as a leader in providing cutting edge technology in the emerging areas like molecular diagnostics, micro arrays, PCR based diagnostic system etc. by leveraging its competencies already available.

BRIT can enter into the exciting area of lead molecule evaluation in drug discovery process as it has robust experience in synthesis of radiolabelled compounds and biomolecules. Leading pharmaceutical majors can outsource part of their R&D work from BRIT opening up a

Radiation Processing Plant at Vashi, Navi Mumbai

totally new market segment for BRIT. Biotechnology is the next frontier of business breakthroughs. BRIT is finely placed to provide help in future products and services uniquely suited to the specific demands in areas such as genetic engineering and molecular biology, cell biology and animal sciences and validation of genetically modified organisms etc.

In the field of radiation processing, in addition to setting up large radiation processing plants in the private sector, BRIT is also moving towards making available compact, portable irradiators for specific users with limited demand of in-house applications.

BRIT is also gearing up to use the expertise developed for setting up radiation processing plants on a turnkey basis in the international market.

Evolving from the demonstration stage to prototypes, BRIT is now poised for taking the role of a steady and confident supplier of products and services and the main thrust would be operation in a more commercial and market-friendly mode without totally compromising the societal obligations. In this march towards self-sufficiency, BRIT would try to develop more linkages with industrial partners and also with other social organizations to carry its mission forward and let the common people enjoy the fruits of development so assiduously carved out through decades of efforts.

In the Golden Jubilee Year of the Department of Atomic Energy, BRIT sincerely re-dedicates itself to address this noble task assigned to it.

During November 1-5. 2003, at Pragati Maidan, New Delhi, the 19th World Mining Expo.2003 and the World Mining Congress were held. Both the events were inaugurated by the President of India Shri A.P.J. Abdul Kalam.

The Department of Atomic Energy, Uranium Corporation of India Ltd. and Atomic Mineral Directorate for Exploration and Research had played active role in the Congress. About 2000 delegates, that included a number of dignitaries from India and from countries such as Canada, Australia, Iran, China, Congo and others, had participated in the Congress.

Winners of the DAE's Golden Jubilee Logo Contest-2003 with Dr. Anil Kakodkar, Chairman, AEC (Centre) and Shri B. Bhattacharya, Director, BARC (3rd from left).
Winner of the first prize Shri Mandhar Kanvinde (3rd from right) of Thane, and Winners of consolation prizes S/Shri Samir Phulpagar (second from left) of Mumbai, and Sudhir Vetal (second from right) of Kalyan.

Institute's Golden Jubilee Celebration.

Shri Satyabrata Mookherjee, Minister of State for Statistics & Programme Implementation, Planning, Atomic Energy & Space and Dr. Anil Kakodkar, Chairman, Atomic Energy Commission & Secretary, Department of Atomic Energy at the Institute of Physics, Bhubaneshwar, on the occassion of the Institute's Golden Jubilee Celebration.

Award...

Shri R. Bhiksham, Station Director, Kakrapar Atomic Power Station was awarded the first World Association of Nuclear Operators (WANO) Excellence Award on October 14, 2003 during the WANO Biennial General Body Meeting held in Berlin, Germany.

This Award has been instituted by WANO with the aim of recognizing the work of individuals who have made exceptional or extraordinary contribution to excellence in the nuclear industry.

MANGALORE UNIVERSITY MICROTRON CENTRE FOUDATION DAY

National workshop on radiation processing of food items and Public Awareness Exhibition

A Variable Energy Microtron was installed in Mangalore University in collaboration with CAT, Indore and BARC, Mumbai and it was commissioned by Dr R Chidambaram on September 29, 1995. The Department of Atomic Energy and the Department of Science and Technology, have sponsored major research projects. With this support a good laboratory infrastructure has been developed for conducting research in radiation physics and related disciplines. With all these, the Microtron Centre has become an unique R&D facility in the country. A number of R&D programmes have been initiated on radiation dosimetry, photofission, irradiation of semiconductor materials/devices, polymers and non-linear optical crystals, radiation biophysics and food irradiation for quality upgradation. The results obtained in many of these studies have also been found to be immensely useful for applications in industries such as electronics industries and food processing industry.

Dr.Anil Kakodkar inaugurated the programme. He informed that AEC is working with the Ministry of Food Processing Industries to include radiation technology as one of the items qualifying for their support.

He felt that linkages between the national laboratories, universities and industries are important for having a flourishing, vibrant and high quality higher education programme and said that Microtron Centre was a model example in this respect.

Dr. Anil Kakodkar, Chairman, Atomic Energy Commission at Mangalore University on the occasion of Microtron Centre foundation Day

RADIATION INDUCED DWARF MUTANT IN SUNFLOWER

Sanjay J. Jambhulkar
Nuclear Agriculture & Biotechnology Division
Bhabha Atomic Research Centre

Sunflower (*Helianthus annuus*) is cultivated as an oilseed crop since 1970. Increasing genetic variability and development of high yielding varieties/hybrids is an important objective. 'Surya' is the first high yielding variety released for cultivation. Induced mutation studies were initiated at the Nuclear Agriculture and Biotechnology Division, Bhabha Atomic Research Centre. Large spectrum of variability for morphological characters was isolated using gamma rays. Dwarf mutant of sunflower is one of them, which was observed in the 9^{th} generation and in subsequent generations too indicating that the dwarf character is heritable and governed by genes.

Significant attribute of the dwarf mutant is the drastic reduction in the plant height to 10-12cm compared to 180cm of normal tall plant. However number of leaves (34 -37) were similar to normal tall plants. Flower (head) diameter (7-8cm) and length of leaf (9-12cm) were reduced to approximately half compared to normal plant. Normal plant flowered in 40-45 and matured in 95-100 days whereas dwarfs flowered in 120-125 and matured in 160-170 days. Central flowers (disc florets) on head (flower) were sterile and no seed setting was observed. This is one of the difficulties to use dwarf mutant in the breeding programme. Efforts are being made to induce the fertility. This novel genetic stock has been designated as Trombay Dwarf Sunflower. Application of GA_3 (Gibberellic acid) restored normal plant height in dwarfs indicating mutation in gene(s) responsible for GA_3 pathway. This is the first report on extreme dwarfness in sunflower induced through radiation.

In sunflower, stalk breakage caused by excessive growth is known to be associated with yield reduction. Therefore, development of dwarf and semi-dwarf varieties/hybrids is one of the major objectives. The dwarfing genes in rice and wheat brought green revolution in agriculture. Potentiality of Trombay Dwarf Sunflower will be exploited to develop desirable plant type in sunflower.

Trombay Groundnuts at high altitudes

Trombay groundnut (TG) variety, TAG 24 was released in 1992 for *Kharif* and *Rabi*/summer cultivation for Vidharba region in Maharashtra. It was also released/identified by Karnataka, Rajasthan and West Bengal. Simultaneously, it became popular in Andhra Pradesh, Orissa, Madhya Pradesh, Punjab and Tamil Nadu. It had made an entry into Gujarat, Goa and Uttar Pradesh also. Currently, TAG 24 is used as National Check variety in *Rabi*/summer trials in the All India Coordinated Groundnut varietal trials. Another variety, TG 26, released in 1996 for Gujarat, Maharashtra and Madhya Pradesh has similar features of TAG 24 with an additional trait of seed dormancy. TAG 24 and TG 26 are characterized by semi-dwarf habit, determinate flowering, early maturity, enhanced dry matter partitioning and high harvest index which were all combined together by planned breeding. Intensive efforts to disseminate these varieties facilitated TAG 24 and TG 26 to become popular among the farming community. A number of farmers have recorded very high yields with these two TG varieties.

Under the collaboration between BARC and Defence Agricultural Research Laboratory, Defence Research and Development Organisation (DRDO), Pithoragarh, TAG 24 and TG 26 varieties were initially introduced for cultivation at high altitudes during 2000. Initial results were very much encouraging. Subsequently, BARC had supplied the breeder seed of these two varieties again for further evaluation. With the guidance of National Research Centre for Groundnut (NRCG), Junagadh, TAG 24 and TG 26 were grown by DRDO at Field Research Laboratory, Leh at an altitude of 3505 meters above mean sea level using polythene mulch. The crop was raised from second week of May to last week of September, 2002. The yield realized was 736 to 924 kg pods /ha. According to NRCG, cultivating TAG 24 and TG 26 at Leh, may be the world's first report of groundnut cultivation at an altitude of 3505 meters above mean sea level (NRCG Newsletter Vol. II (1), March 2003). Simultaneously, to suit the needs of the Leh and other high altitude regions, BARC has also developed other new groundnut lines having improved yields and early crop maturity.

Nuclear Agriculture Division, BARC

Farmers' Rallies on Trombay Groundnut Varieties

Dr Anand Badigannavar
Nuclear Agriculture &Bio Technology Division,
BARC, Mumbai-400 085

Breeder seed multiplication of the most popular Trombay groundnut variety, TAG 24 was arranged on more than 20 hectares by University of Agricultural Sciences (UAS), Dharwad during summer, 2003 at Bhoj village, Belgaum Dist. in Karnataka. In this connection, the University of Agricultural Sciences had organized a Farmers' Rally on 6 April 2003. The farmers have grown TAG 24 with improved agronomic practices in this sugarcane belt under the banner "*Shashwat Krishi Vigyan Kendra*. About twenty scientists from BARC, Trombay, UAS, Dharwad and Tamil Nadu Agricultural University, Coimbatore, and over 500 farmers had participated. The scientists visited various farmers' fields and studied the performance of TAG 24. This multi-dimensional team of scientists, farmers and experts discussed the social, financial, technical and marketing factors in Bhoj village. The opinion was that TAG 24 was best suited variety for that region and was becoming rapidly popular among the farmers of this region. The team of BARC scientists was impressed by the enthusiasm of farmers and hoped that the chronic problem of seed multiplication of popular Trombay groundnut varieties could be resolved only with such a group activity and expressed all support for the success of the project. Officials from Seed Unit of the University of Agricultural Sciences, Dharwad harvested more than 500 quintals of TAG 24 (breeder seed) during summer 2003 which would be entering into seed multiplication chain with various agencies.

Kisan Mela on summer groundnut for Trombay groundnut varieties, TAG 24 and TG 26 was organized on 28th May, 2003 at Kehal Village, Parbhani Dist. in Maharashtra. These varieties were raised under high input agro-ecological conditions. Statistical wing of Department of Agriculture, Government of Maharashtra, based on crop cutting surveys, recorded 119 and 140 quintals of wet pods/ha of TAG 24 and TG 26 respectively, during summer, 2003. Correspondingly, the final dry pod yields were 73 and 80 quintals/ha as against 15 quintals of national average.

Field view of TAG 24 at Bhoj

Field visit of dignitaries at Bhoj

Farmers' rally at Bhoj village

Founder MD of ECIL passes away

The founder Managing Director of Electronics Corporation of India Ltd.(ECIL), Dr. A.S. Rao, died here late on Friday, October 31st, 2003. He was 89. Dr Rao, who died of complications of pneumonia, is survived by wife, four sons and three daughters.

A close associate of Dr Homi Bhabha, Dr Rao was one of the chief architects of the country's atomic energy programme and in building the first nuclear reactor APSARA. A firm believer in self-reliance and indigenous technology capability, Dr Rao built ECIL, a public sector unit under the DAE, from its inception in 1967 to 1978 on the foundation of developing electronics in the country.

Prize winners Essay Contest

Km. Aparna Narayan (Surat)

Km. Sonia Bopche (Damangaon)

Km. Kadrekar Riddhi Harish (Ratnagiri)

Km. J. Sarala (Hyderabad)

Sh. K Murugesan (Hyderabad)

Km. Aarti Upadhyay (Khandwa)

Winners of the DAE's 15th All India Essay Contest with Dr. Anil Kakodkar, Chairman, AEC and Shri B. Bhattacharjee, Director, BARC.

Every year, DAE organises Essay Contest on nuclear science and technology for under graduate students. This year, the topics for the contest were :

1. Electricity from Atom : Achievements and Looking beyond, and

2. Radiation and Radioisotopes for better quality of life.

In addition to the above topics, a common topic titled "Fifty years of India's Atomic Energy Programme : Evolution and Achievements" was also the part of the contest.

In all 690 essays — 400 on the first topic and 290 on the second topic, were received. Of these 179 essays were written in the Indian languages other than English.

From the first topic, 17 contestants, and from the second topic 15 contestants, were invited to make oral presentation of their essays, on the BARC's Foundation Day celebration, on October 30, 2003.

Following were the prize winners :

1. Electricity from Atom : Achievements and Looking beyond,

First prize : Km. Aparna Narayan (Surat)
Second prize : Km. Kadrekar Riddhi Harish (Ratnagiri)
Third prize : Sh. K Murugesan (Hyderabad)

The 13 consolation prizes included one each in Hindi, Tamil & Urdu, and 10 in English.

2. Radiation and Radioisotopes for better quality of life.

First prize : Km. Sonia Bopche (Damangaon)
Second prize: Km. J. Sarala (Hyderabad)
Third prize : Km. Aarti Upadhyay (Khandwa)

The 12 consolation prizes included 7 in Hindi and 5 in English.

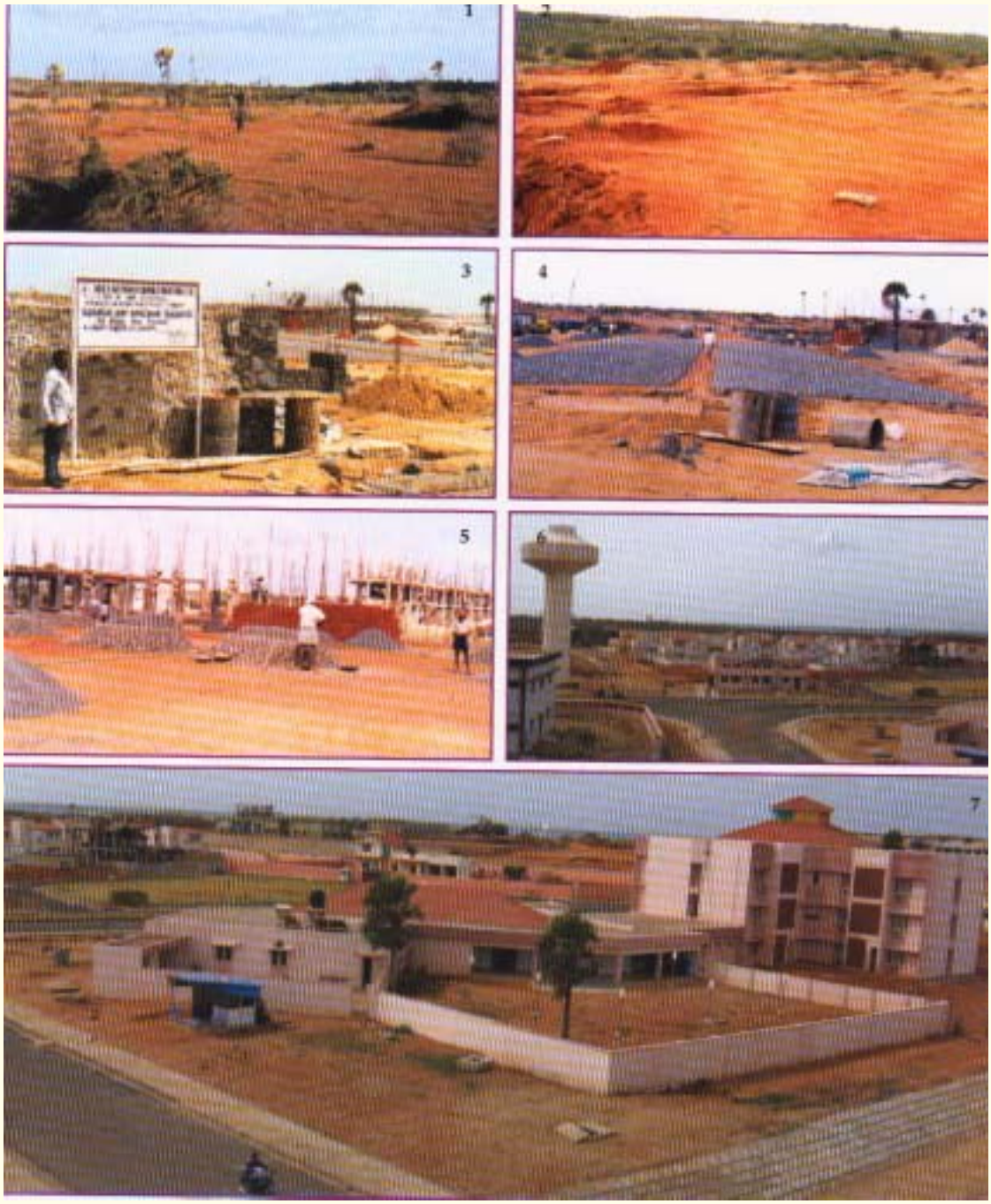
Rangoli creation by Shri S.B. Jadhav, an employee of the DAE's Directorate of Construction, Services and Estate Management.

R.No 9002/62

Anu-Vijay Township

The residential township of Kudankulam Nuclear Power Project has modern facilities. Besides residential flats, it has a school, swimming pool, guest house, hospital, recreational facilities, a bank with ATM, Environmental Survey Laboratory and a Reverse Osmosis Plant.

Before



Now

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