



MALAYSIAN NUCLEAR AGENCY,
MINISTRY OF SCIENCE, TECHNOLOGY
AND INNOVATION

Kandungan

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VISI
VISION

Sains dan teknologi nuklear untuk penjanaan ilmu, kemakmuran dan kesejahteraan masyarakat dan negara

Nuclear science and technology for knowledge generation, wealth creation, and societal and national well-being

MISI
MISSION

Meneraju kecemerlangan dalam penyelidikan dan penggunaan teknologi nuklear untuk pembangunan lestari

Excellence in research and applications of nuclear technology for sustainable development

MISI
MISSION

- ❖ Menjana produk dan teknologi baru melalui penyelidikan dan inovasi berdasarkan agenda pembangunan negara
To generate new products and technologies through research and innovation based on the national development agenda
- ❖ Mencapai sasaran minimum 30% dari bajet mengurus tahunan, menerusi pemindahan dan pengkomersilan teknologi
To achieve an income, at minimum 30% of the annual operating budget, through transfer and commercialisation of technology
- ❖ Meningkatkan kecemerlangan organisasi melalui perancangan dan pengurusan kualiti
To enhance organisational excellence through planning and quality management

PERUTUSAN MENTERI SAINS, TEKNOLOGI DAN INOVASI

MESSAGE FROM THE MINISTER OF SCIENCE, TECHNOLOGY AND INNOVATION



Keselamatan bekalan tenaga elektrik ialah perkara yang diutamakan pasca 2020 kerana peningkatan permintaan serta kenaikan harga bahan bakar fosil. Malaysia kini secara serius mempertimbangkan punca tenaga alternatif, termasuk tenaga nuklear. Jemaah menteri pada 26 Jun 2009 telah meluluskan memorandum Bersama Kementerian Sains, Teknologi dan Inovasi dan Kementerian Tenaga, Teknologi Hijau dan Air, mengenai cadangan penggunaan nuklear sebagai opsyen sumber penjanaan elektrik negara. Sumber tenaga ini bukan sahaja dapat menjamin keselamatan bekalan tenaga negara tetapi juga mesra alam sekitar dan bebas daripada pelepasan gas rumah hijau yang menyebabkan pemanasan dan perubahan iklim global.

The energy security will be a primary concern post-2020, due to increase in demand for electrical energy and increasing price of fossil fuel. Malaysia is seriously considering alternative sources of energy including nuclear power. The Cabinet, on the 26th June 2009, had approved the Joint Memorandum between the Ministry of Science, Technology and Innovation and the Ministry of Energy, Green Technology and Water, on the proposal of using nuclear as an option for electricity generation. The source of energy not only guarantees energy security but is also environmental friendly and free from emission of green house gases that cause global warming and climate change.

Berdasarkan kecemerlangan dalam sains dan teknologi nuklear, Nuklear Malaysia telah diamanahkan menerajui Jawatankuasa Kerja Pembangunan Program Kuasa Nuklear di bawah Jawatankuasa Pemandu Pembangunan Kuasa Nuklear (JPPKN). Jawatankuasa tersebut diberi peranan melaksanakan Persediaan Kuasa Nuklear, yang antara lain melaksanakan aktiviti-aktiviti seperti penerimaan awam, pembangunan modal insan dan budaya kerja berkualiti dan selamat, perancangan serta pembangunan dan persediaan infrastruktur serta pemilihan tapak loji nuklear. Road-map bagi pembangunan kuasa nuklear yang disediakan oleh Nuklear Malaysia dijadikan asas pelaksanaan aktiviti untuk memenuhi sasaran negara mempunyai loji kuasa nuklear elektrik menjelang 2021.

Selain dari penjanaan tenaga elektrik, teknologi nuklear turut digunakan dalam pelbagai bidang seperti pertanian, perindustrian, perubatan dan alam sekitar. Aktiviti R&D dalam sains dan teknologi perlu dikembangkan, dipertingkatkan dan dilestarikan yang saya percaya boleh dicapai menerusi pembudayaan kreatif dan inovatif. Oleh itu, hasil R&D yang efisien, efektif dan berimpak tinggi boleh dihasilkan untuk bersaing dalam pasaran yang kompetitif.

Based on the excellent performance in nuclear science and technology, Nuclear Malaysia was entrusted to lead the Working Committee on the Development of Nuclear Power Programme, a sub-committee under the Nuclear Power Development Steering Committee. The working committee was given the role to implement the Nuclear Power Preparation, which include, amongst others: public acceptance, human capital development and development of quality and safe work culture, and planning, preparation and development of infrastructure and site identification for the nuclear power plant. The nuclear power road-map prepared by Nuclear Malaysia can be used to implement activities to achieve the target of Malaysia having its first nuclear power plant by 2021.

Apart from nuclear power generation, nuclear technology has been applied in various other sectors including agriculture, industry, medical and environment. R&D activities in science and nuclear technology require enhancement, strengthening and sustainability which I believe can be achieved through a creative and innovative culture. Therefore efficient, effective and high impact R&D output can be generated to enter the market with a competitive edge.

Sesungguhnya kemampuan Nuklear Malaysia menjana dan memperkenalkan teknologi nuklear di dalam pelbagai sektor sosioekonomi sehingga berjaya menyumbang RM23 billion atau 0.032% dari pendapatan per kapita negara (GDP) kepada ekonomi negara adalah amat memberangsangkan. saya juga amat berbangga dengan pencapaian Nuklear Malaysia meraih pendapatan 20 - 40% daripada belanja mengurus dalam beberapa tahun terakhir ini iaitu dalam lingkungan 30% seperti yang ditetapkan oleh Dasar Sains Dan Teknologi Negara Kedua (DSTN2).

Adalah diharap Nuklear Malaysia akan terus mempertingkatkan dan memperkukuh usaha pemindahan teknologi dan penyampaian perkhidmatan dengan lebih kreatif dan berinovasi melalui pelbagai program yang dirancang. Kreativiti dan inovasi melahirkan budaya kerja yang lebih efisien dan berimpak tinggi. RMK-9 telah menghasilkan pelbagai kejayaan dalam R&D yang boleh dibanggakan. Justeru pada penghujung tahun 2009 persiapan untuk formulasi projek untuk RMK-10 perlu dilaksanakan. Matlamat projek keseluruhan adalah untuk meningkat dan mengukuhkan R&D yang lebih kreatif dan inovatif berpandukan NKRA.

Nuclear Malaysia's ability to generate and promote nuclear technology in various socio-economic sectors contributed RM23 billion or 0.032% of the Gross Domestic Product towards the nation's economy. This is very encouraging. It is also noteworthy that in the past few years Nuclear Malaysia had managed to generated 20-40% of her annual operating budget which is within the 30% target as set in the Second National Science and Technology Policy.

It is hoped Nuclear Malaysia, through creativity and innovation, will continue to enhance and strengthen its efforts towards technology transfer and service delivery in various planned activities and programmes. Creativity and innovation will produce an efficient and high impact work culture. RMK-9 has seen great success in R&D of which we can all be very proud of. Therefore, project formulation for RMK-10 needs to be implemented in the last quarter of 2009. The formulation exercise is aimed at enhancing and strengthening R&D to be more creative and innovative in line with the NKRA.

Saya yakin usaha yang dilakukan oleh Nuklear Malaysia dalam membangunkan sains dan teknologi nuklear akan terus menyumbang kepada pembangunan sains dan teknologi negara khasnya dan seterusnya memberi nilai tambah kepada pembangunan sosioekonomi negara.

I am confident that the efforts made by Nuklear Malaysia in developing nuclear science and technology will contribute to the nation's science and technology development and add value to the socioeconomic development of our country.



Y.B. DATUK SERI DR. MAXIMUS JOHNNITY ONGKILI
MENTERI SAINS, TEKNOLOGI DAN INOVASI
*MINISTER OF SCIENCE, TECHNOLOGY AND
INNOVATION*

PERUTUSAN KETUA SETIAUSAHA KEMENTERIAN SAINS, TEKNOLOGI DAN INOVASI

SECRETARY GENERAL,
MINISTRY OF SCIENCE, TECHNOLOGY AND INNOVATION



Kementerian Sains, Teknologi dan Inovasi (MOSTI) sebagai pendokong dan tonggak dalam kemajuan Sains dan Teknologi (S&T) negara terus mengorak langkah dan memainkan peranan aktif dalam memajukan R&D. Seiring dengan hasrat kerajaan yang mendahulukan kepentingan rakyat, R&D yang diutamakan mestilah mampu membawa sumbangan langsung kepada kemajuan sosioekonomi rakyat dan negara melalui aktiviti penyelidikan, pembangunan dan pengkomersilan (R&D&C). Demi mencapai hasrat ini, hasil R&D seharusnya berbentuk mesra pengkomersilan.

The Ministry of Science, Technology and Innovation (MOSTI), as the bearer and bastion in the development of S&T strides ahead and plays an active role in advancing the nation's R&D. In tandem with the government's aspiration to prioritise on the need of the population, the emphasis is on R&D that can contribute directly to the development of the people and the nation's socio-economy through commercialisation activities. To achieve this aspiration, the outputs of R&D should be people friendly and commercial ready.

Bagi merealisasikan hasrat ini, MOSTI sentiasa memberi penekanan di samping mengatur dan mengambil daya usaha proaktif bersungguh-sungguh untuk meningkatkan pengkomersilan. Dalam hubungan ini saya ingin mengucapkan setinggi-tinggi penghargaan dan terima kasih kepada Nuklear Malaysia yang sentiasa memandang ke hadapan dalam program R&D&C dan berjaya menerajui usaha-usaha pengkomersilan dengan berkesan.

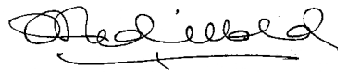
Saya sedar, bukanlah suatu perkara yang mudah untuk membuahkan kejayaan seumpama itu terutama membabitkan teknologi termaju seperti teknologi nuklear. Namun, saya yakin dan percaya perancangan yang rapi, kesepakatan yang sinergi dan kegigihan serta komitmen yang tinggi dari pelbagai lapisan warga Nuklear Malaysia mampu mengukir kejayaan sedemikian. Kemudahan yang berkualiti di samping penyelidikan bertaraf dunia bukan sahaja modal asas bagi kejayaan R&D&C tetapi juga menjadi rebutan sebagai pusat sumber rujukan teknologi nuklear dari seluruh dunia. Pengiktirafan sebagai Pusat Latihan Serantau, 'IAEA's International Collaborating Centres (ICC)' dan 'Regional Resource Units (RRU)' yang diterima oleh Nuklear Malaysia di samping jemputan khidmat kepakaran ke luar negara serta penerimaan sejumlah pelatih luar negara ke Nuklear Malaysia sesungguhnya jua telah menaikkan imej negara di persada dunia.

To make this aspiration a reality, MOSTI always emphasises and strategises to under-take pro-active efforts to increase the commercialisation rate. Within this context, I would like to express my highest appreciation and confidence that Nuclear Malaysia's far sighted vision, realistic R&D&C programmes coupled with effective management will enable her to forge significant commercialisation efforts.

Being at the helm of the most advanced of technologies such as nuclear technology; thorough planning, synergised coordination, concerted efforts and unwavering commitment at all levels in the organisation, I believe Nuclear Malaysia will create waves of success. Equipped with high quality facilities and world class researchers, Nuclear Malaysia has all the key ingredients for success in R&D&C and as well as it's recognition as a nuclear technology reference resource centre, a sought after recognition worldwide. Being recognised as the regional training centre, IAEA's International Collaborating Centre (ICC) and Regional Resource Units (RRU) as expert missions overseas and as resource to train foreigners at Nuclear Malaysia has directly enhanced the nation's image worldwide, particularly in the safe use of nuclear technology.

Berikutan bekalan tenaga negara yang tidak menentu, kerajaan mengambil daya usaha ke arah campuran pelbagai sumber tenaga termasuk nuklear. Saya ingin mengucapkan tahniah dan berterima kasih kepada Nuklear Malaysia kerana telah mengorak beberapa langkah awal merancang, mempromosi dan membangunkan teknologi relevan ke arah penggunaan tenaga nuklear sebagai salah satu sumber tenaga negara.

In ensuring the long term energy security of the country, the Malaysian Government has introduced the energy mix policy. Nuclear power has been identified as one of the alternative energy sources to support the base load for electricity supply. It is essential that Nuclear Malaysia starts early in planning, promoting and developing technology that are relevant to realise nuclear power as one of the nation's alternative energy sources. May I thank and congratulate the management and staff of Nuclear Malaysia with their current efforts and urge them to continue gaining wider recognition.



Y. BHG. DATO' MADINAH BINTI MOHAMAD
KETUA SETIAUSAHA,
KEMENTERIAN SAINS, TEKNOLOGI DAN INOVASI
SECRETARY GENERAL,
MINISTRY OF SCIENCE, TECHNOLOGY AND INNOVATION

LAPORAN KETUA PENGARAH AGENSI NUKLEAR MALAYSIA

REPORT OF THE DIRECTOR GENERAL MALAYSIAN NUCLEAR AGENCY



Tahun 2009 adalah tahun yang mencabar berikutan krisis ekonomi dunia yang turut menjejaskan prestasi ekonomi negara. Sebagai sebuah agensi kerajaan, Nuklear Malaysia turut terkena tempiasnya apabila kerajaan terpaksa melaksanakan perbelanjaan berhemah bagi memastikan pelaksanaan aktiviti dapat dijalankan secara optimum dengan kos yang minimum. Dalam bidang R&D, Nuklear Malaysia sentiasa meletakkan sasaran pencapaian projek yang dilaksanakan dengan mengambil kira agenda negara yang telah digariskan seperti Petunjuk Prestasi Utama (KPI), Bidang Keberhasilan Utama Negara (NKRA), Rancangan Malaysia Kesembilan (RMK-9), Dasar Sains dan Teknologi Negara Kedua (DSTN2) dan Sistem Inovasi Kebangsaan (NIS). Justeru, KPI untuk aktiviti R&D terus diperkasa menerusi penumpuan di dalam empat bidang utama, iaitu teknologi industri dan persekitaran, teknologi pemprosesan sinaran, teknologi perubatan, serta agroteknologi dan biosains. Bidang keselamatan sinaran dan pengurusan sisa turut diberi keutamaan.

The global economic crisis in 2009 has also affected the nation's economic performance. In the midst of the economic downfall, Nuclear Malaysia also suffered the consequences when the government enforced prudent spending to ensure optimum activities with minimum cost. Nuclear Malaysia sets its performance target in R&D while taking into account the relevant national agenda spelt out such as KPI, NKRA, RMK-9, DSTN2 and NIS. Thus, KPI for R&D activities are continuously given emphasis by focusing on four key areas; industrial and environmental technology, radiation processing technology, medical technology, as well as agrotechnology and biosciences. Emphasis is also given to radiation safety and waste management.

Penyelidikan dan Pembangunan Teknologi

Secara keseluruhannya, aktiviti R&D meliputi aktiviti-aktiviti penyelidikan asas sebagai teras, pra-pengkomersilan, pengkomersilan dan pendaftaran paten. Penyelidikan asas ini perlulah berorientasikan pasaran dan keperluan strategik, bagi meningkatkan kemampuan, daya tahan dan daya saing negara di peringkat nasional dan antarabangsa.

Nuklear Malaysia terus mempertingkatkan dan memantapkan penyelidikannya untuk memberi sokongan padu kepada hasrat MOSTI dalam usaha menjuarai penerokaan dalam penemuan saintifik dan penggerak inovasi. Projek-projek penyelidikan Nuklear Malaysia dibiayai melalui seed-fund Nuklear Malaysia sendiri, ScienFund (MOSTI), TC, RCA, CRP (Agensi Tenaga Atom Antarabangsa) dan FNCA.

Pada tahun ini juga Nuklear Malaysia terus melaksanakan pelbagai perancangan strategik bagi menempatkan agensi ini pada kedudukan yang lebih inovatif, interaktif dan informatif. Antara pendekatan Nuklear Malaysia dalam menjayakan hasrat ini ialah:

- Kesedaran umum tentang prospek penggunaan tenaga nuklear untuk tempoh selepas tahun 2020
- Menjadi penggerak inovasi yang akan memacu anjakan paradigma pasaran utama industri termasuk merangsang dan membangunkan teknousahawan tempatan
- Memberikan perhatian yang serius kepada bioteknologi dan pengeluaran makanan

Research and Development Technology

In general the R&D activities consist of basic research, pre-commercialisation, commercialisation and filing of patent. The core of R&D activities is basic and applied research and for 2009 comprises of research projects funded by various funding bodies including Nuclear Malaysia, MOSTI (ScienceFund), IAEA (TC, RCA, CRP) and FNCA.

Basic research oriented to market-driven and strategic-need to enhance capability, competitiveness and stability of products in the local and global arena were continuously carried out in 2008. These research activities were continuously upgraded and sustained to strongly support MOSTI's effort to champion scientific discovery and being a mover for innovation. Implementation of strategic programme to make the agency more innovative, interactive and informative were continuously carried out. Amongst the approaches adopted to achieve the targets are:

- *Public awareness on the prospect of nuclear power beyond 2020*
- *Transforming innovation to inspire paradigm shift of the primary industrial market including stimulation and development of local technopreneurs*
- *To seriously look into biotechnology and food production*

- Membangunkan prasarana ilmu dan modal insan serta persekitaran yang sesuai bagi pembangunan industri Negara
- Memberi penekanan berterusan kepada kepentingan pengantarabangsaan dan menjadi pemain global yang proaktif serta mempunyai jaringan dan rangkaian kerja yang kukuh di peringkat antarabangsa.
- Membudayakan dan menggalakkan kesedaran sains, teknologi dan inovasi di kalangan masyarakat umum untuk menghasilkan penerbitan saintifik dan menghasilkan lebih ramai penyelidik, saintis dan jurutera (RSE).
- Mewujudkan program modal insan bagi menjana pekerja dan masyarakat yang berpengetahuan, berkemahiran, kreatif dan inovatif berlandaskan sains dan teknologi.

Pemantauan projek penyelidikan yang sistematik dan cekap serta berkesan terus dilaksanakan bagi memastikan kesinambungan implementasi R&D yang dilaksanakan. Ini merangkumi saringan di peringkat cadangan projek sehingga tamatnya sesuatu projek R&D yang dilaksanakan. Menetapkan pencapaian utama projek penyelidikan melalui pentunjuk utama prestasi (KPI) merangkumi jumlah output, geran, pemfailan paten dan penerbitan adalah antara insentif dan galakan yang dilaksanakan bagi meningkatkan produktiviti dan kecekapan.

- *Development of infrastructure for knowledge generation and human capital as well as conducive environment for national development*
- *Continuously focus on globalisation and be a proactive global player adequately equipped with solid networking at international level*
- *To develop culture and encouraging awareness in science, technology and innovation amongst the general public for generation of scientific publication and to produce more researchers, scientists and engineers (RSE).*
- *To create a human capital programme to produce knowledgeable, skilful, creative and innovative workers and society based on science and technology*

To ensure continuous implementation of R&D, a systematic, efficient and effective project monitoring system was established. This comprises vetting, right from the project proposal until the completion of the project. Taking the key performance indicator (KPI) as the main achievement of research project through determining total output, grants, patent filing and publication are some of the incentive and motivation to increase productivity and efficiency.

Bagi mempertingkatkan R&D yang kreatif dan inovasi serta memastikan kesinambungan aktiviti penyelidikan yang dijalankan, pencapaian akhir sesuatu projek dinilai berasaskan laporan akhir projek dan juga novelty sesuatu output R&D. Penilaian juga dibuat untuk menentukan nasib, kedudukan serta tindakan susulan kepada sesuatu output R&D asas yang telah dibangunkan. Penemuan baru atau bernilai tambah baru akan didaftarkan patenkan. Sesetengah produk pula dinilai melalui aktiviti pra-pengkomersialan misalnya melalui pelaksanaan proses up-scaling bagi kesediaan pengkomersilan.

Seperti tahun-tahun sebelumnya hasil dan penemuan penyelidikan asas serta inovasi teknologi telah diperagakan di beberapa ekspo dan pameran teknologi di peringkat organisasi, tempatan dan antarabangsa. Peningkatan dalam jumlah anugerah dan penghargaan yang diterima pada 2009, menunjukkan peningkatan prestasi Agensi ini dalam menjalankan aktiviti R&D yang kreatif dan inovatif. Usaha berterusan dilaksanakan bagi memastikan kesinambungan dan peningkatan aktiviti R&D bukan sahaja terhadap kepada segi kuantiti tetapi juga kualiti.

The final achievement of a project evaluated based on the final project report and the novelty of the research output are incentive and effort towards a more creative and innovative R&D as well as ensuring continuity of the research activity. Evaluation is also carried out to decide on the status and follow-up action on R&D outputs. New findings or value added will be filed for patents. Some products are evaluated through pre-commercialisation activities, for example, process up-scaling prior to commercialisation.

As in previous years products and basic research findings as well as technology innovation have been presented at various expos and technology exhibitions at organisational, national and international levels. An increase in the number of awards and recognitions received in 2008 indicated an increase in the Agency's performance in creative and innovative R&D activities. Continuous effort was given to ensure continuity and improvement in R&D activities not only in terms of quantity but also quality.

Pengkomersilan Teknologi

Nuklear Malaysia terus mengintai peluang niaga bagi menempatkan hasil dan penemuan R&D dalam pasaran untuk maslahat komuniti, selaras dengan dukungan untuk mengurangkan kemiskinan, menjana pendapatan dan meningkatkan kesejahteraan masyarakat. Hasil R&D yang diperoleh sepanjang 2009 masih berada dalam peringkat padanan dengan usahawan teknologi, dan sebilangannya pula dalam proses mendapatkan paten. Tumpuan utama dalam padanan ini adalah syarikat-syarikat dalam kalangan perusahaan kecil dan sederhana (PKS) dengan harapan syarikat-syarikat tersebut dapat dijelmakan menjadi sebuah syarikat berdaya maju.

Keupayaan Nuklear Malaysia menjana pendapatan terus meningkat. Pada tahun 2009 pendapatan yang dijana adalah sebanyak RM24.95 juta, kira-kira 37.07% daripada jumlah belanja mengurus organisasi. Sebahagian besar khidmat ini diberikan melalui 23 pusat khidmat yang diwujudkan untuk menyelaras pelbagai aktiviti pengkomersilan. Di samping itu, rakan niaga di kalangan PKS turut bekerjasama memastikan produk Nuklear Malaysia dapat bersaing dalam pasaran secara saksama, sementara usaha meningkatkan kerjasama penyelidikan dan pemasaran hasil telah digiatkan dengan termeterai beberapa dokumen perjanjian.

Technology Commercialisation

Business opportunities for marketing R&D research findings for the benefit of the community continued to be explored in an effort to alleviate poverty, for wealth creation and improve societal well-being. R&D research findings in the year 2009 were at the stage of matching the research findings with existing technology entrepreneurs and some were at the stage of patent application. The matching of these companies within the small and medium industries was focused in the hope that these companies can be transformed into dynamic companies.

In relation to this, in the year 2009 Nuclear Malaysia provided services which contributed a total of RM24.95 in revenue and this figure was approximately 37.07% of the operational budget. These services were provided through 23 service centres in Nuclear Malaysia, and these service centres were created to coordinate various commercialisation activities. Collective efforts with business partners from SMI's have ensured Nuclear Malaysia's products remains competitive in the market while enhanced efforts in research collaborations and product marketing were achieved by forging cooperations through the signing of agreements.

Walaupun inisiatif untuk membangunkan teknousahawan tidak serancak yang diharapkan, namun usaha kecil melalui latihan telah dibuat bagi memupuk minat dagang dan mendedahkan warga kerja dengan alam niaga sebenar, sementara beberapa syarikat PKS telah menggunakan kemudahan yang disediakan. Memang menjadi prinsip Nuklear Malaysia, setiap produk berpotensi dimurnikan terlebih dahulu di peringkat makmal sebelum menerjah pasaran.

Perkhidmatan Teknikal

Penyediaan prasarana yang mencukupi dan selesa, persekitaran tempat kerja yang kondusif, kebolehgunaan peralatan saintifik dan kemudahan dengan *down-time* yang rendah, adalah antara aktiviti yang dilaksanakan oleh Perkhidmatan Teknikal dalam membudayakan R&D yang kreatif dan inovatif berlandaskan sains dan teknologi. Pelaksanaannya bagi menjamin kelicinan proses dan kemakmuran aktiviti R&D yang dilakukan di Nuklear Malaysia. Aktiviti hiliran R&D juga menjadi sebahagian agenda, termasuk pembangunan prototaip bagi upscaling penghasilan produk R&D pra-pengkomersilan atau yang sedia untuk dikomersilkan, begitu juga dengan pembangunan loji perintis bagi meningkatkan pengeluaran sesuatu proses yang telah dibangunkan dalam aktiviti R&D asas.

Even though the initiatives made to develop technopreneurs were at a small scale, efforts to inculcate interest and provide exposure to entrepreneurship were delivered through trainings and several SMI companies have utilised the facilities offered by Nuclear Malaysia. Products which have the potential to be commercialised are further developed in the laboratories before they are released in the market.

Technical Services

Adequate and comfortable infrastructure preparation, conducive workplace environment, applicable scientific instruments and facilities with minimum down-time, are some of the activities that have been implemented by the Technical Services in to inculcate creative and innovative R&D on the platform of science and technology. Its implementation guarantees a smooth process and vibrant R&D activities carried out in Nuclear Malaysia. Downstream R&D activities are also part of the agenda, which include the development of prototype for the up scaling of pre- and ready to be commercialised R&D products, as well as development of pilot plants to enhancing basic R&D activities.

Perhatian kepada kebolehgunaan dan peningkatan gunasama peralatan juga mengalami proses kreativiti dan inovatif. Sistem pengurusan bersepadu (IMS) misalnya telah dibangunkan, dan telah berjaya mengoptimumkan penggunaan dan meningkatkan gunasama sistem peralatan dan kemudahan tertentu serta aset lain yang terdapat di pelbagai lokasi di Nuklear Malaysia. Begitu juga dengan pembangunan pelbagai perisian komputer, bukan sahaja untuk meningkatkan kecekapan pengurusan peralatan kritikal dan aset, tetapi juga dalam membantu meningkatkan prestasi atau nilai tambah operasi sesuatu loji atau sesuatu sistem peralatan, bagi kepastian peningkatan sistem penyampaian perkhidmatan secara keseluruhan. Penggunaan *Sharepoint Portal* telah diperkenalkan bagi perkongsian maklumat dikalangan staf Nuklear Malaysia. Aplikasi ini akan mempermudah pencarian dan capaian maklumat

Keselamatan dan Kesihatan

Seiring dengan slogan “Keselamatan dan Kesihatan Asas Kerja Berkualiti”, Nuklear Malaysia terus memberi komitmen dalam keselamatan, kesihatan dan perlindungan tempat kerja dengan menjamin kemudahan dan persekitaran pekerjaan supaya sentiasa selamat untuk kebaikan pekerjaanya. Pada masa yang sama, Nuklear Malaysia juga komited dalam menjaga keselamatan negara and alam sekitar melalui proses dan aktiviti pemantauan secara berterusan. Beberapa latihan kecemasan untuk menambahbaik pelan tindakan kecemasan telah dilaksanakan. Selain itu, siri aktiviti audit luaran juga telah dijalankan, sekaligus menunjukkan keprihatinan Nuklear Malaysia dalam mematuhi sistem keselamatan, kesihatan dan alam sekitar yang disyaratkan dalam Akta 514, Akta 304, Akta 127 dan garis panduan IAEA. Risiko bahaya operasi dan kemalangan sifar dan persekitaran yang bersih adalah sasaran pelaksanaan sistem pengurusan keselamatan ini.

The attention to the applicability and sharing of equipment also undergoes innovative and creative processes. The Integrated Management System (IMS) has succeeded in optimising the usage and enhancing the sharing system of equipment and certain facilities as well as other assets available at various locations in the organisation. Likewise, the development of several computer softwares, not only improve the efficiency of the critical equipment and asset management but also facilitate the performance or add value of the plant operation in general. SharePoint Portal was introduced to share information among Nuclear Malaysia's staff. This application facilitates search and retrieval of information.

Safety and Health

The occupational safety and health aspect is also given due attention, so that operation involving equipment and hazardous materials such as ionising radiation and radioactive material are guided by the safety procedures and standards. Preparation towards the safety, health and environment (SHE-MS) certification system based on the needs and requirement as stipulated in Atomic Energy Act (Act 304), Occupational Safety and Health Act and Clean Environment Act, is at the final implementation stage. Operational risk, zero accident and clean environment are the targets for the safety management system.

Nuklear Malaysia telah melakar satu lagi sejarah dalam arena keselamatan dan kesihatan dengan perasmian Stesen Pemantauan Radionuklid RN42 (Stesen RN42) di Cameron Highlands sebagai salah satu bahagian dalam Sistem Pemantauan Antarabangsa (IMS) di bawah Suruhanjaya Persediaan Triti Pengharaman Ujian Senjata Nuklear (Suruhanjaya Persediaan CTBTO). Stesen ini mampu mengesan partikel radionuklid yang terhasil daripada aktiviti buatan manusia seperti letupan atau kemalangan nuklear.

Di samping memastikan pematuhan kepada prosedur dan cara kerja selamat, pelbagai aktiviti membudayakan dan memantapkan kesedaran kepada keselamatan dan kesihatan di tempat kerja telah dijalankan, melalui minggu SHE-MS dan latihan kesiapsiagaan kecemasan.

Dengan kepercayaan produktiviti serta kecemerlangan terhasil dari warga penyelidik yang sihat, ceria dan cerdas, pembinaan dan penyelenggaraan kemudahan sukan dan rekreasi juga difokuskan. Kepentingan beriadah untuk kesihatan dan kecerdasan digalakkan melalui aktiviti sukan yang diadakan di Nuklear Malaysia dan juga galakkan penyertaan dalam aktiviti sukan anjuran MOSTI atau organisasi tempatan.

Nuclear Malaysia created yet another history in the safety and health arena with the launching of Radionuclide Monitoring Station RN42 (Station RN42) in Cameron Highlands as part of the International Monitoring System (IMS) under the Preparatory Commission of the Comprehensive Nuclear-Test-Ban Treaty Organisation (CTBTO Prep Com). This station is able to detect radionuclide particles produced by man-made activities such as nuclear explosion or accident.

Besides warranting the compliance to the procedures and safe working practices, various adoption and strengthening safety and health awareness activities in the workplace have been conducted, through SHE-MS week and emergency preparedness drills.

In producing active, cheerful and sound researchers, the establishment and maintenance of sports and recreational facilities are emphasised. Nuclear Malaysia also encourages participation from its personnel in sports activities organised by MOSTI or other local organisations.

Khidmat Pengurusan

Sesuai dengan peranannya, aktiviti khidmat sokongan telah digemblengkan dengan baik bagi merangsang pelaksanaan aktiviti utama dengan lancar. Fungsi-fungsi pentadbiran, pengurusan kewangan, perancangan strategik, kualiti dan inovasi serta usaha peningkatan imej organisasi telah digerakkan bagi memenuhi kehendak pelanggan, selaras dengan hasrat piagam pelanggan yang ditunjangi.

Prestasi kewangan menunjukkan peningkatan berbanding tahun sebelumnya. Prestasi perbelanjaan mengurus begitu cemerlang mencapai tahap 98.64 peratus manakala prestasi perbelanjaan pembangunan pula melebihi 90 peratus. Pengurusan kewangan telah dijalankan secara berhemat sehingga tidak banyak teguran dalam hasil pemeriksaan Jabatan Audit Negara.

Semua pusat khidmat yang berurusan dengan pelanggan luar terus memantapkan penyampaian dengan menambahbaikkan sistem pengurusan kualiti masing-masing. Pada tahun 2009, 7 pusat khidmat telah berjaya meneruskan pengiktirafan sistem pengurusan kualiti ISO di mana tiga makmal telah Berjaya dinaiktaraf manakala dua lagi dalam proses dinaiktaraf ke ISO 9001:2008.

Management Services

With the role given to them, the management support group has managed to consolidate the implementation of the organisation's main activities. The functions of administration, management of finance, strategic planning, quality and innovation and image enhancement have been mobilised to fulfill client's needs, This is in line with the organisation client's charter.

The financial performance shows an improvement compared with the year before for operational and development budget which exceeded 98.64 %, whereas for the Trust Fund, the expenditure reached the level of 90 %. Financial management was carried out prudently and there were little queries from the investigation team from the Auditor General Department.

All service centres that deal directly with our external clients have continuously enhanced their delivery by improving their quality management system. In the year 2009, seven service centres managed to maintain their ISO quality management system whereas two laboratories upgraded their accreditation level

Kerjasama teknikal terus dijalinkan dengan organisasi dari dalam dan luar Negara, untuk faedah bersama dalam memajukan projek penyelidikan dan latihan, di samping keperluan melaksanakan sesuatu triti yang berkepentingan. Kerjasama sebegini bukan sahaja memberikan manfaat kepada Nuklear Malaysia, malah institusi pengajian tinggi dan institusi penyelidikan lain di Malaysia juga turut memperoleh dividen. Nuklear Malaysia juga telah berjaya melaksanakan tugasnya sebagai hos dalam beberapa mesyuarat dan latihan anjuran bersama dengan badan antarabangsa di bawah Agensi Tenaga Atom Antarabangsa (IAEA) serta Forum Kerjasama Nuklear Asia (FNCA).

Bagi meningkatkan persekitaran kerja yang kondusif dan jaminan keselamatan, prosedur keselamatan telah diperkemaskan menepati keperluan standard ISO, untuk diamalkan oleh semua warga kerja. Usaha-usaha telah dibuat bagi memupuk budaya keselamatan termasuk langkah-langkah menghadapi sebarang kecemasan pekerjaan. Begitu juga dengan sistem keselamatan yang telah dipertingkatkan bagi menghindari sebarang masalah pencerobohan premis dan peralatan. Aktiviti sukan dan kegiatan kebajikan turut dititikberatkan melalui Kelab, Koperasi serta Puspanita bagi mewujudkan semangat setia kawan, kerja berpasukan dan daya tahan dalam kalangan warga kerja. Disiplin dan integriti juga diberikan penekanan dalam menjalankan amanah serta tanggungjawab masing-masing. Majlis Bersama Jabatan (MBJ) turut digiatkan untuk mewujudkan sinergi dan resonans di antara pihak pengurusan dan pekerja bagi memajukan organisasi.

The technical cooperation continues with local and overseas organisations where all parties could benefit in advancing their research projects and training, besides the need for implementing treaties of importance to the parties. This form of cooperation not only benefits Nuclear Malaysia but also other higher learning institutions and research institutions in the country. The organisation has also successfully carried out their duties as host for many meetings and training with other international bodies under the IAEA and FNCA.

In providing a conducive and ensuring a safe working environment, safety procedures are updated in accordance to the ISO standard to be adhered to by all personnel in Nuclear Malaysia. Efforts have been under taken to cultivate the safety culture among the personnel and this includes steps in facing emergencies at workplace. The same implies to the safety system that has been enhanced to prevent intrusion of the work premises and the safety of apparatus. The importance of sports and welfare activities are also emphasised through the activities of the social club, Cooperative as well as PUSPANITA in instilling the values of camaraderie, teamwork and tolerance amongst fellow workers. Integrity and discipline are also emphasised in implementing trust and responsibility in the organisation. The "Majlis Bersama Jabatan" (MBJ) plays an active role instilling synergy and resonance among the management group and workers for organisational advancement.

Sesuai dengan peningkatan kemahiran tenaga kerja dan tugas setimpal yang dilaksanakan, urusan kenaikan pangkat telah dibuat mengikut saluran biasa bagi semua peringkat jawatan, di samping usaha mengisi kekosongan jawatan. Inisiatif ini telah membolehkan aktiviti Nuklear Malaysia dapat dijalankan seperti dirancang.

Pembangunan Modal Insan

Menyedari kepentingan modal insan sebagai pemacu pertumbuhan organisasi, Nuklear Malaysia memberikan tumpuan kepada pembangunan kerjaya dan rancangan penggantian. Perhatian dalam hal ini tidak hanya kepada merapatkan jurang di antara kemahiran yang ada berbanding kepakaran yang diperlukan, malah memberikan peluang sebaik mungkin kepada setiap warga mendapat latihan yang sesuai, selaras dengan konsep pembelajaran sepanjang hayat dan keperluan 7 hari latihan setahun. Rancangan pembangunan modal insan terus diperkukuh untuk melahirkan generasi pekerja yang berpengetahuan, berkemahiran, kreatif dan inovatif.

Keperluan latihan warga organisasi telah dikenal pasti berdasarkan padanan dengan peta teknologi yang dibangunkan. Keperluan latihan ini merangkumi kompetensi umum dan kompetensi khusus dibangunkan sebagai panduan dalam melaksanakan sesuatu latihan. Penilaian Tahap Kompetensi (PTK) telah dijalankan mengikut rencana bagi memastikan perkembangan kerjaya dan peluang berkaitan tidak terjejas. Nuklear Malaysia memandang serius perancangan pembangunan modal insan dengan menyediakan peluang melanjutkan pengajian khususnya ke peringkat pasca ijazah.

With the advancement in human capital skill and duties, promotional exercises were carried out through the normal channels for all levels of positions and filling up vacancies in positions in the organisation. These initiatives have enabled Nuklear Malaysia's activities to run smoothly as planned.

Human Capital Development

In cognisance of the importance of human capital development as the driver for organisational growth, Nuclear Malaysia has given greater attention to its employee's career development and succession plan. Emphasis is given not only on bridging the gap between existing and required expertise but also in providing opportunities on appropriate trainings in line with the life-long learning concept and the 7 days training requirement for all employees. Human capital development plans were enhanced to make way for a generation of knowledgeable, skilled, creative and innovative workers.

Technology maps were developed and used to match and identify employees training needs. The training needs for general and specific competencies were developed as a guide for organising trainings. Competency Level Assessment (PTK) courses were carried out as planned to ensure employees career development and related opportunities are not affected. Nuclear Malaysia's seriousness in human capital development planning is reflected in its provision of opportunities for further studies at the postgraduate level for its employees.

Berasaskan kepada kejayaan rancangan pengijazahan pascaijazah yang dimulakan pada tahun 2007, pendekatan ini telah diteruskan pada tahun semasa, bagi membolehkan warga organisasi mendapat ijazah tinggi semasa dalam pekerjaan. Adalah diharapkan melalui mekanisme ini, Nuklear Malaysia berupaya meningkatkan peratusan nisbah pemegang ijazah tinggi dalam kalangan warga kerja, selaras dengan usaha kerajaan menambahkan kadar para penyelidik, saintis dan jurutera (RSE) seperti yang dihasratkan.

Kejayaan pembangunan modal insan ini dapat dilihat daripada perspektif pengiktirafan agensi antarabangsa, khususnya IAEA terhadap kemampuan Nuklear Malaysia. Hasil yang diraih melalui program sangkutan, latihan dan lawatan ke agensi nuklear terkemuka dunia, membolehkan kita berhak mendapat pengiktirafan tersebut.

Perancangan dan Persediaan Program Kuasa Nuklear

Dalam menuju ke arah Program Kuasa Nuklear, Nuklear Malaysia telah mengorak langkah dalam mengkaji, merancang dan menyelaraskan semua aspek persediaan bagi memastikan pelaksanaannya berjalan lancar.

Perancangan program kuasa nuklear dibuat berpandukan garis panduan yang ditetapkan oleh IAEA. Selain itu, IAEA juga membantu Malaysia untuk membangunkan program ini melalui latihan dan khidmat pakar.

Based on the success of the postgraduate degree program initiated in 2007, the same approach was used in the current year to enable employees to further their studies while in service. It is hoped that this mechanism will enable Nuclear Malaysia to increase the percentage ratio of degree holders of its employees, in conforming to the government's aspirations in increasing the rate of researchers, scientists and engineers (RSE).

Recognitions from international agencies on Nuclear Malaysia's capability, specifically from the IAEA are an affirmation of Nuclear Malaysia's success in the area of human capital development. Benefits gained from attachment programs, training and visits to prestigious nuclear agencies has made the recognitions received more deserving.

Nuclear Power Planning and Preparation

Nuclear Malaysia has started reviewing, planning and coordinating all aspects of preparation for implementing nuclear power programme.

The planning of nuclear power programme is based on the guideline stipulated by IAEA. Additionally, IAEA also assists Malaysia in developing this programme through training and expert mission.

Pada 26 Jun 2009, keputusan Mesyuarat Jemaah Menteri telah meluluskan Memorandum Bersama Kementerian Tenaga, Teknologi Hijau dan Air (KeTTHA) dan Kementerian Sains, Teknologi dan Inovasi, mengenai cadangan penggunaan kuasa nuklear sebagai sumber penjanaan elektrik negara.

Berdasarkan keputusan Mesyuarat Jemaah Menteri pada 26 Jun 2009, Jawatankuasa Kerja Pembangunan Program Kuasa Nuklear di bawah Jawatankuasa Pemandu Pembangunan Kuasa Nuklear (JPPKN) telah ditubuhkan. Di bawah JPPKN ini, tiga lagi jawatankuasa kerja yang kesemuanya dianggotai oleh Nuklear Malaysia telah diwujudkan iaitu:

- Jawatankuasa Kerja Pembangunan Program Kuasa Nuklear (JKPPKN);
- Jawatankuasa Kerja Pembangunan Projek Kuasa Nuklear (JKPPKN); dan
- Jawatankuasa Penyelarasan Pembangunan Perundangan Kuasa Nuklear (JKPPPN).

Tumpuan utama aktiviti NPP terbahagi kepada:

- Kajian Perancangan Dasar dan semua aspek persediaan bagi pelaksanaan Program Kuasa Nuklear Negara dalam tempoh jangka panjang; dan
- Perancangan Pembangunan Modal Insan bagi Perancangan Persediaan dan Pelaksanaan Program Kuasa Nuklear

On 26 June 2009, the Ministerial Cabinet Meeting has approved the Memorandum between the Ministry of Energy, Green Technology and Water and Ministry of Science, Technology and Innovation on the proposal to use nuclear power for electricity generation in the country.

Following the cabinet's decision on June 26, 2009, the Executive Committee for the Development of Nuclear Power Programme under the Nuclear Power Steering Committee Nuclear Power Development (JPPKN) was established. In addition, Nuclear Malaysia is also a member of 3 other working committees established under the JPPKN;

- *Jawatankuasa Kerja Pembangunan Program Kuasa Nuklear (JKPPKN);*
- *Jawatankuasa Kerja Pembangunan Projek Kuasa Nuklear (JKPPKN); dan*
- *Jawatankuasa Penyelarasan Pembangunan Perundangan Kuasa Nuklear (JKPPPN).*

The main focus of NPP activities is as follows:

- *Studying of Policy Planning and all aspects of preparation for the implementation of the National Nuclear Power Program in the long term and*
- *Planning for the Development of Human Capital Programme for the implementation of Nuclear Power Programme.*

Pelbagai aktiviti dalam aspek penerimaan awam, pembangunan modal insan dan budaya kerja meliputi kesemua lapisan masyarakat telah dilaksanakan seperti taklimat kuasa nuklear kepada semua Ahli Parlimen, NGO dan badan-badan berkaitan.

Pengantarabangsaan

Nuklear Malaysia banyak mendapat faedah daripada pelbagai inisiatif yang dilaksanakan di peringkat nasional dan antarabangsa. Melalui kerjasama teknikal, hubungan antara negara dan hos program antarabangsa telah banyak melonjak kedudukan Nuklear Malaysia di pentas dunia, di samping beberapa pengiktirafan yang terus diperolehi. Penyertaan kita dalam beberapa pameran dan ekspo teknologi di luar Negara telah meraih beberapa anugerah utama di samping hadiah sagu hati, sekali gus meletakkan Nuklear Malaysia di kedudukan yang disegani di persada antarabangsa.

Kemampuan tenaga kerja kita pula sering kali menjadi sebutan rakan-rakan di luar negara sehingga tidak sedikit yang telah diundang sebagai pakar atau tenaga pengajar, khususnya dalam kalangan negara-negara ASEAN, Afrika, Asia Barat, Asia Selatan dan Asia Tengah. Kejayaan ini telah juga dikaskadkan kepada syarikat PKS tempatan sehingga ada dalam kalangan mereka yang telah berjaya menembusi pasaran global.

A number of activities involving public acceptance, development of human capital and work culture were performed such as briefing on nuclear power to all Members of Parliament and NGO.

Internationalisation

Nuclear Malaysia has gained many benefits as a result of various initiatives carried out at the national and international levels. Through technical cooperations, bilateral and multilateral cooperations, the hosting of international programmes and the international recognitions received, has elevated Nuclear Malaysia's standing in the world arena. Nuclear Malaysia has gained respect and international standing through award winnings and consolation prizes received from participations in several overseas technology exhibitions and expos.

The ability of our employees has gained international recognition and many were invited to ASEAN countries, Africa, West Asia, South Asia and Central Asia, as experts or teaching staff. This success has also been cascaded into companies in the local small and medium industry, whereby several of these companies have succeeded in penetrating the global market.

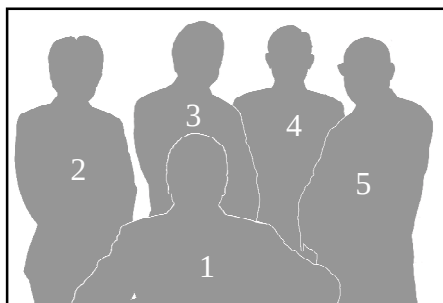
Hubungan baik di antara negara kita dengan negara-negara tersebut juga memberikan kelebihan kepada Nuklear Malaysia menembusi pasaran di negara berkenaan. Penglibatan kita dalam forum antarabangsa anjuran IAEA dan FNCA telah menaikkan citra negara dan menimbulkan persepsi baik di mata dunia. Atas keyakinan yang tinggi terhadap Nuklear Malaysia, banyak rakan penyelidik dan pelatih dari kalangan negara-negara anggota IAEA telah meletakkan Nuklear Malaysia sebagai pilihan utama destinasi mereka

The good rapport between Malaysia and these countries has given Nuclear Malaysia the added advantage in penetrating the markets in these countries. Our involvements in international forums organised by IAEA and FNCA has helped to elevate the country's image and create a favourable perception in the eyes of the world. Fellow researchers and trainees from IAEA member countries have placed a high confidence in Nuclear Malaysia as their main training destination.



Y. BHG. DATUK DR DAUD MOHAMAD
KETUA PENGARAH, AGENSI NUKLEAR MALAYSIA
DIRECTOR GENERAL, MALAYSIAN NUCLEAR AGENCY

Barisan Pengurusan *Management Team*



1. Y. BHG. DATUK DR. DAUD B. MOHAMAD
Ketua Pengarah
Director General

2. DR. MUHD NOOR B. MUHD YUNUS
Timbalan Ketua Pengarah (Teknikal)
Deputy Director General (Technical)

3. ADNAN B. HJ. KHALID
Pengarah Kanan (Pengurusan)
Senior Director (Management)

4. MOHD SHAHID B. AYUB (MEMANGKU)
Pengarah Kanan (Pengkomersilan
& Perancangan Teknologi)
*Senior Director (Technology Planning
& Commercialisation)*

5. DR. MUHAMAD B. LEBAI JURI
Timbalan Ketua Pengarah (Penyelidikan
& Pembangunan Teknologi)
*Deputy Director General (Research
& Technology Development)*

Barisan Pengurusan

Management Team



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1. DR. ABDUL NASSIR B. IBRAHIM
Pegarah Bhg. Teknologi Industri
Director of Industrial Technology Div.
2. DR. NORIMAH BT. YUSOF
Pegarah Bhg. Agroteknologi & Biosains
Director of Agrotechnology & Biosciences Div.
3. DR. KHAIRUL ZAMAN B. HJ. DAHLAN
Pegarah Bhg. Teknologi Pemprosesan Sinaran
Director of Radiation Processing Technology Div.
4. Y. BHG. DATO, DR. REHIR B. DAHALAN
Pegarah Bhg. Teknologi Perubatan
Director of Medical Technology Div.
5. DR. MUHAMAT B. OMAR
Pegarah Bhg. Teknologi Sisa & Alam Sekitar
Director of Waste Technology & Environment Div.
6. DR. MOHD ASHHAR B. HJ. KHALID
Pegarah Bhg. Sokongan Teknikal
Director of Technical Support Div
7. IR. DR. MOHAMAD PUAD B. HJ. ABU
Pegarah Bhg. Kuasa Nuklear
Director of Nuclear Power Div.

Barisan Pengurusan *Management Team*



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8. JAMAL KHAER B. IBRAHIM
Pegarah Bhg. Perancangan &
Hubungan Antarabangsa
*Director of Planning & International
Relation Div.*

9. DR. WAN MANSHOL B. WAN ZIN
Pegarah Bhg. Pengkomersilan
Teknologi
*Director of Technology
Commercialisation Div.*

10. IR. ALWI B. OTHMAN
Pegarah Bhg. Kejuruteraan
Director of Engineering Div

11. MOHD YUSOF B. MOHD ALI
Pegarah Bhg. Keselamatan &
Kesihatan Sinaran
*Director of Health & Radiation
Protection Div.*

12. SAMSURDIN B. AHAMAD
Pegarah Bhg. Komunikasi Korporat
dan Pengurusan Maklumat
*Director of Corporate Communication
and Information Management Div.*

13. RABIAH BT. ABU HASSAN
Pegarah Bhg. Pembangunan Sumber
Manusia
*Director of Human Resources
Development Div.*

14. MASRI B. MISRAN
Pegarah Bhg. Khidmat Pengurusan
Director of Management Services Div.

Carta Organisasi

Organisational Chart



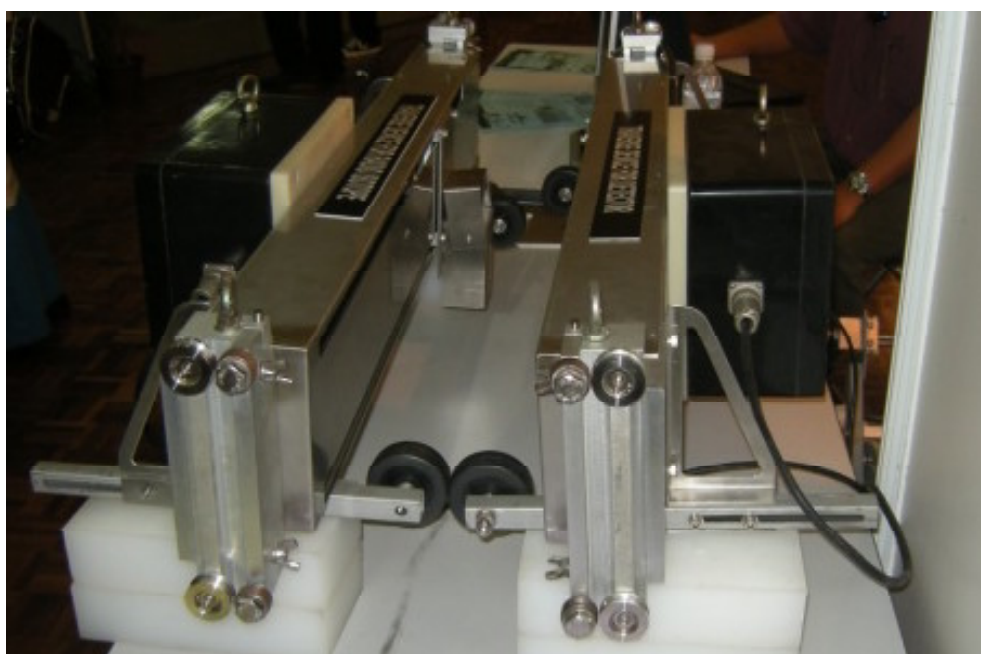
DIARY KORPORAT

Penyelidikan dan Pembangunan Teknologi

Research and Technology Development

PENYELIDIKAN DAN PEMBANGUNAN TEKNOLOGI

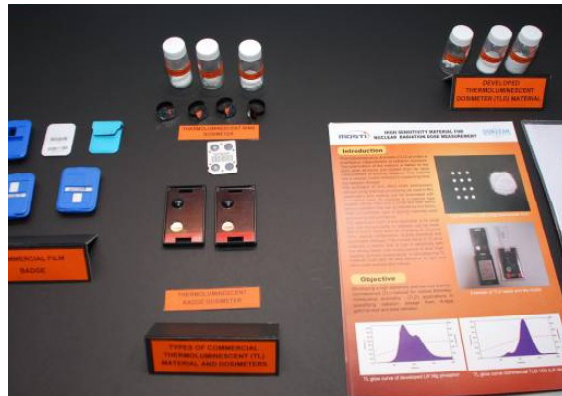
Nuklear Malaysia sentiasa meletakkan sasaran pencapaiannya dalam R&D dengan mengambil kira agenda negara yang digariskan seperti Petunjuk Prestasi Utama (KPI), Bidang Keberhasilan Utama Negara (NKRA), Rancangan Malaysia Kesembilan (RMK-9), Dasar Sains dan Teknologi Negara Kedua (DSTN2) dan Sistem Inovasi Kebangsaan (NIS). Justeru, KPI untuk aktiviti R&D terus diperkasa serta diperkukuhkan menerusi penumpuan di dalam empat bidang utama iaitu teknologi industri dan persekitaran, teknologi pemprosesan sinaran, teknologi perubatan serta agroteknologi dan biosains. Bidang keselamatan sinaran dan pengurusan sisa turut diberi keutamaan.



RESEARCH AND TECHNOLOGY DEVELOPMENT

Nuclear Malaysia always sets her performance target in R&D by taking into account the relevance of national agenda such as the Key Performance Indicators (KPI), the National Key Results Areas (NKRA), the Ninth Malaysia Plan (RMK-9), the Second National Science Technology Policy (DSTN2) and the National Innovation System (NIS). Thus, KPI for R&D activities is continuously being given emphasis by focusing on four priority areas; industrial and environment technology, radiation processing technology, medical technology and, agrotechnology and biosciences. Radiation safety and waste management is also being emphasised.

Sejumlah 89 projek penyelidikan yang merangkumi 10 bidang penekanan utama telah dilaksanakan. Seperti tahun-tahun sebelumnya, sesi pemantauan projek diadakan bagi memantau dan meneliti perkembangan tahap pencapaian projek di mana semua projek telah dikategorikan mengikut tahap pencapaian masing-masing. Dari sejumlah 25 projek yang telah tamat, sebanyak 20 projek berpotensi dikomersilkan. Jadual 1 dan 2 menunjukkan bilangan projek penyelidikan mengikut bidang penekanan dan projek kerjasama dengan agensi luar. Penyelidikan yang dijalankan telah berjaya menghasilkan 20 produk baru (Jadual 3), dua proses baru (Jadual 4), dua pangkalan data berkomputer (Jadual 5) dan satu prosedur baru berkenaan dengan analisis pencemaran bahan toksik di persekitaran lautan Malaysia.



A total of 89 research projects which encompasses ten priority areas have been carried out. As in previous years, project monitoring sessions were conducted for progress review to ensure the smooth implementation of the projects and they were categorised according to their level of progress. Out of the 25 projects completed, 20 have the potential to be commercialised. Tables 1 and 2 show the number of projects according to priority areas and external cooperation projects respectively. These research projects have resulted in 20 new products (Table 3), two new processes (Table 4), two computerised database (Table 5) and a new procedure with regards to analysis of toxic element pollutants in Malaysian marine environment.



Jadual 1. Bilangan projek penyelidikan mengikut bidang penekanan
Table 1. Research projects according to priority areas

Bidang <i>Field</i>	Bilangan projek <i>Number of projects</i>
Bahan Terpilih <i>Specialty Materials</i>	12
Alam Sekitar dan Sisa <i>Environment and Waste</i>	10
Radiofarmasi dan Biofarmasi <i>Radiopharmacy and Biopharmacy</i>	2
Produk Asli <i>Natural Products</i>	7
Pengimejan Perubatan <i>Medical Imaging</i>	1
Tenaga Boleh Diperbaharui <i>Renewable Energy</i>	1
Keutuhan Loji dan Struktur <i>Plant and Structure Integrity</i>	8
Tanaman Industri <i>Industrial Crops</i>	6
Polimer Asli <i>Natural Polymers</i>	5
Pembangunan Kejuruteraan <i>Engineering Development</i>	3

Jadual 2. Projek kerjasama dengan agensi luar
Table 2. Cooperation projects with other agencies

Projek <i>Project</i>	Bilanganprojek <i>Number of projects</i>
Kerjasama dengan industri <i>Cooperation with Industry</i>	12
IAEA Coordinated Research Project (CRP) <i>IAEA Coordinated Research Project (CRP)</i>	7
Kerjasama Teknikal IAEA <i>IAEA Technical Cooperation</i>	6
Kerjasama dua hala <i>Bilateral</i>	2
Perjanjian Kerjasama Serantau untuk Penyelidikan, Pembangunan dan Latihan dalam Sains dan Teknologi Nuklear bagi Asia dan Pasifik (RCA) <i>Regional Cooperative Agreement for Research, Development and Training in Nuclear Science and Technology in Asia and the Pacific (RCA)</i>	12
Forum Kerjasama Nuklear di Asia (FNCA) <i>Forum for Nuclear Cooperation in Asia (FNCA)</i>	8

Jadual 3. Produk baru
Table 3. New products

Bil. No.	Produk baru New products
1.	Pemecut Elektron Tenaga Rendah (160KeV, 10mA) daripada mesin sinar-x (Baby EBM) <i>Low Energy Electron Accelerator (160KeV, 10mA) from X-ray Machine (Baby EBM)</i>
2.	Prototaip Pemprosesan Polimer Baru berasaskan Kelembapan untuk Pengeluaran Bahan Biokomposit <i>Novel Moisture-Based Polymer Processing Prototype for Production of Biocomposite material</i>
3.	Aruhan Mutasi Tanaman Orkid dengan menggunakan Alur Ion <i>Mutation Induction of Orchids using Ion Beam</i>
4.	Aruhan Rintangan Serangga pada Orkid <i>Induction of Insect Resistance in Orchids</i>
5.	Bahan Bersaiz Nano Berasaskan Getah Asli menggunakan Teknik Sol-gel <i>Natural Rubber based Nano-sized Materials Prepared using Sol-gel Technique</i>
6.	Nanokomposit "getah asli/ polipropilena/tanah liat" untuk Aplikasi Automotif" <i>Natural rubber/polypropylene/clay" Nanocomposite for Automotive Applications</i>
7.	Sebatian Polimer dari Getah Kitar Semula <i>Polymer Compounds from Recycled Rubber Inducer</i>
8.	Gaharu dan Pengurusan Agronomi Pokok Karas <i>Gaharu Inducer and Agronomic Management of Aquilaria</i>
9.	Menambahbaik Pembangunan Biobaja untuk Tanaman Industri melalui Penyinaran dan Teknologi Penyurih Isotop <i>Enhancement of Biofertiliser Development for Industrial Crops through Irradiation and Isotopic Tracer Technology</i>
10.	Produk Herba untuk Meningkatkan Kesan Terapeutik dalam Terapi Sinaran. <i>Herbal Products to Enhance Therapeutic Effects in Radiation Therapy.</i>
11.	Tomografi Industri Berkomputer dan Proses Pengimejan. <i>Industrial Computed Tomography and Imaging Process.</i>
12.	Sistem Pengesan Pintar Tanpa Wayar untuk Pengimbasan Turus Gama <i>Smart and Wireless Detector System for Gamma Column Scanning</i>
13.	Sistem Pengimbasan Turus Automatik <i>Automatic Column Scanning System</i>

Bil. No.	Produk baru New products
14.	Pembangunan dan Kesan Sinaran ke atas Sel Bahanapi Mikrob dalam Penjanaan Biotenaga daripada Air Buangan Pertanian <i>Development and Effects of Radiation on Microbial Fuel Cell in Generating Bioenergy from Agricultural Wastewater</i>
15.	Pembangunan Graf Tulang Poros Makro sebagai Scaffold Melalui Teknik Pengekstrudan untuk Barangan Perubatan <i>Development of Macro Porous Bone Graft as Scaffold via Extrusion Technique for Medical Devices</i>
16.	Pembangunan Hidroksil Apatit (HA) dan Trikalsium Fosfat (TCP) Poros Makro melalui Teknik Tuangan Slip untuk Barangan Perubatan <i>Development of Macro Porous Hydroxyapatite (HA) and Tricalcium Phosphate (TCP) Via Slip Casting for Medical Devices</i>
17.	Pembangunan Scaffold Poros untuk Kejuruteraan Tisu Tulang <i>Development of Porous Scaffolds for Bone Tissue Engineering</i>
18.	Serbuk Nano Titania dari Galian Ilmenit Tempatan <i>Nano Titania Powder from Local Ilmenite Mineral</i>
19	Pembangunan Meter Dos Pendaflur Haba (TLD) dengan Menggunakan Material Dopan Bersaiz Nano <i>Development of Thermoluminescence Dosemeter (TLD) using Nano-Sized Dopant Material</i>
20	Pembangunan Pes Konduktor untuk Aplikasi LTCC <i>Development of Conducting Paste for Low Temperature Co-fired Ceramic (LTCC) Application</i>

Jadual 4. Proses baru
Table 4. New process

Bil. No	Proses/teknik baruNew processes/techniques
1.	Pembangunan Kaedah untuk Pengasingan Radium daripada Air Buangan Industri Menggunakan Asid Humik terikat ke atas Bahan Pegun <i>Development of Radium Removal Method from Industrial Wastewater using Humic Acid fixed onto Immobilised Material</i>
2.	Rawatan Air Sisa Organik Industri dengan Menggunakan Mesin Alur Elektron dan Sistem Biologi <i>Industrial Organic-wastewater Treatment using Electron Beam Machine and Biological System</i>

Jadual 5. Pangkalan data berkomputer
Table 5. Computerised database

Bil. No	Pangkalan data baru New database
1.	Identifikasi Sumber Hidrokarbon Petroleum dalam Persekitaran Marin di Kawasan Persisiran Sabah dan Sarawak <i>Identification of Petroleum Hydrocarbons Sources in Marine Environment of Sabah and Sarawak Coastal Area</i>
2.	Penilaian Elemen Toksik di Kawasan-kawasan yang dilanda Tsunami Menggunakan Teknik Analisa Nuklear <i>Assessment of Toxic Elements in the Tsunami Affected Areas using Nuclear Analytical Techniques</i>

Sementara itu, Nuklear Malaysia telah memfailkan satu paten dan memperoleh lima paten seperti yang disenaraikan di Jadual 6.

Meanwhile, Nuclear Malaysia has filed a patent and was granted five patents as listed in Table 6.

Jadual 6: Paten yang diperolehi
Table 6: Patents granted

Tajuk Title	Tarikh diperolehi Date granted	Nombor Paten Patent Number
Penambahbaikan Kaedah Penghasilan Pembalut Hidrogel <i>An Improvement to Method of Manufacturing Hydrogel Dressing</i>	30 Jan 2009	MY-137279-A
Adunan Polimer yang boleh Ditaub Silang dengan Sinaran <i>Radiation Cross-linkable Polymer Blends</i>	30 Jan 2009	MY-137367-A
Proses untuk Menghasilkan Alumina Berketulenan Tinggi <i>Process for Producing High Purity Alumina</i>	31 Mac 2009	MY-137792-A
Proses untuk Menghasilkan Zirkonia Bergred Lebih Tinggi <i>Process for Producing Higher-Grade Zircon</i>	30 Apr 2009	MY-138054-A
Hidrogel kanji (diperolehkan di Taiwan) <i>Starch Hydrogels (granted in Taiwan)</i>	11 Nov 2009	I 316950

Nuklear Malaysia sentiasa memberi sokongan kepada stafnya untuk menerbitkan buku, jurnal, laporan penyelidikan, tesis dan pembentangan di peringkat kebangsaan dan antarabangsa yang menunjukkan hasil yang memberangsangkan. Sejumlah 589 penerbitan telah diterbitkan seperti di Jadual 7.

The continuous support given by Nuclear Malaysia for her staff to publish books, journals, research reports, theses as well as presentations at national and international levels has shown encouraging results. A total of 589 publications were published as shown in Table 7.

Jadual 7. Penerbitan
Table 7. Publication

Bentuk penulisan <i>Publication type</i>	Bilangan <i>Number</i>
Buku <i>Books</i>	2
Bab dalam buku <i>Chapters in Book</i>	3
Jurnal antarabangsa <i>International Journals</i>	88
Jurnal tempatan <i>Local Journals</i>	25
Pembentangan Kertas Kerja di Peringkat Antarabangsa <i>Presentation of Papers at International Level</i>	72
Pembentangan Kertas Kerja di Peringkat Kebangsaan <i>Presentation of Papers at National Level</i>	226
Penerbitan Am <i>General Publications</i>	7
Laporan Teknikal <i>Technical Reports</i>	152
Tesis <i>Theses</i>	14
Jumlah Total	589

Nuklear Malaysia sentiasa berusaha mempromosikan hasil penyelidikannya melalui pelbagai saluran termasuk penyertaan dalam pameran di peringkat kebangsaan dan antarabangsa serta rancangan TV dan radio (Jadual 8). Sebanyak lima temuramah telah disiarkan di radio dan TV untuk memberi publisiti kepada hasil penyelidikan yang sedia untuk dikomersilkan.

Nuclear Malaysia has strived to promote research findings through various channels including participation in national and international exhibitions as well as in TV and radio programmes (Table 8). A total of five interviews were broadcasted in radio and TV to promote research findings that are ready for commercialisation.

Jadual 8 : Pameran
Table 8 : Exhibitions

Bil. No.	Pameran Exhibition	Tarikh Date	Tempat Venue
1.	Pameran Klaster Bioteknologi MOSTI <i>MOSTI Biotechnology Cluster Exhibition</i>	1 Jan -28 Feb 2009	MOSTI, Putrajaya
2.	Pameran Klaster Industri dan Hari Klaster Industri MOSTI <i>MOSTI Industrial Cluster Exhibition and Industrial Cluster Day</i>	1 Mar – 31 April	MOSTI, Putrajaya
3.	Pameran Sempena Minggu Sains dan Matematik SMK Jalan Bukit, Kajang <i>Exhibition in conjunction with Science and Mathematics Week, SMK Jalan Bukit, Kajang</i>	5 Mar 2009	Dewan Ilmu, SMK Jalan Bukit, Kajang, Selangor
4.	Mini Ekspo Pendidikan anjuran Universiti Teknologi Petronas <i>Mini Education Expo Organised by Petronas University of Technology</i>	24 Mar 2009	Rembau, Negeri Sembilan
5.	Ekspo Hari Harta Intelek Negara 2009 <i>National Intellectual Property Day Expo 2009</i>	23-26 Apr 2009	KLCC, Kuala Lumpur
6.	Pesta Keamatan <i>Harvest Festival</i>	9-10 May 2009	Kota Marudu, Sabah
7.	Pameran Mini sempena Forum Industri MOSTI 2009 <i>Mini Exhibition in conjunction with MOSTI-Industry Forum</i>	16 Jun 2009	Hotel Marriot, Putrajaya
8.	Persidangan Nuklear Antarabangsa 09 (INC'09) <i>International Nuclear Conference 09 (INC'09)</i>	29 Jun – 1 Jul 2009	Kuala Lumpur
9.	Pameran sempena Lawatan Panel AKPM 2009 <i>Exhibition in conjunction with AKPM 2009 Panel Visit</i>	6 Julai 2009	Nuklear Malaysia, Bangi, Selangor
10.	Hari Inovasi Nuklear Malaysia 2009 <i>Nuclear Malaysia Innovation Day 2009</i>	21-23 Julai 2009	Nuklear Malaysia, Bangi, Selangor
11.	Pameran Minggu Sains, Teknologi dan Inovasi (MISTI) MOSTI 2009 <i>Science, Technology and Innovation Week (MISTI) MOSTI Exhibition 2009</i>	27 Jul – 2 Aug 2009	Kuching Waterfront, Sarawak

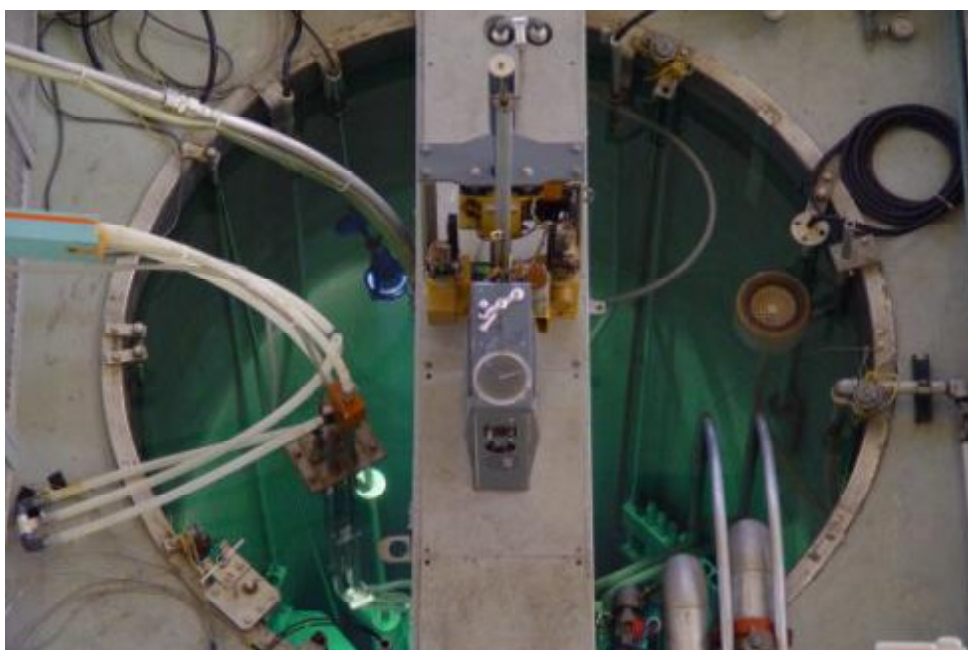
Bil. No.	Pameran Exhibition	Tarikh Date	Tempat Venue
12.	Pameran Karnival Kreativiti dan Inovasi Sarawak <i>Sarawak Creativity and Innovation Carnival Exhibition</i>	14-16 Aug 2009	Kompleks Pelancongan, Sarawak
13.	Techmart Vietnam ASEAN+3 <i>Vietnam ASEAN+3 Techmart</i>	17-20 Sept 2009	Vietnam Exhibition Trade Fair Center
14.	Konvensyen Teknikal Nuklear Malaysia <i>Nuclear Malaysia Technical Convention</i>	6-8 Oct 2009	Nuklear Malaysia, Bangi, Selangor
15.	Seminar Keselamatan PETRONAS <i>PETRONAS Safety Seminar</i>	14 Oct 2009	KLCC, Kuala Lumpur
16.	Persidangan Pendidikan S&T Kebangsaan <i>National S&T Education Conference</i>	26-27 Oct 2009	Universiti Tun Hussein Onn, Batu Pahat, Johor
17.	Persidangan dan Pameran Inovasi Kebangsaan, NICE'09 <i>National Innovation Conference and Exhibition, NICE'09</i>	29-31 Oct 2009	Kuala Lumpur
18.	<i>BioMalaysia 2009</i>	17-19 Nov 2009	Kuala Lumpur
19.	<i>Public Information on Nuclear Energy (PINE3)</i>	9-11 Nov 2009	Kuala Lumpur
20.	FLORA 2009	11-12 Nov 2009	Taman Botani, Putrajaya
21.	Pesta Jagung <i>Corn Festival</i>	22-23 Nov 2009	Kota Marudu, Sabah
22.	Taklimat kepada Ahli Politik tentang Tenaga Nuklear <i>Luncheon Talk for Political Stakeholders on Nuclear Energy</i>	25 Nov 2009	Parlimen, Kuala Lumpur

Teknologi Industri

Industrial Technology

TEKNOLOGI INDUSTRI

Nuklear Malaysia sering menjadi rujukan bagi bidang integriti loji dan struktur, bahan termaju, dan polimer asli melalui R&D teknologi industrinya. Dalam bidang integriti loji dan struktur, projek Pembangunan Prob Rendam untuk Pemeriksaan Tangki Reaktor TRIGA MK II PUSPATI telah berjaya mendapat pembiayaan ScienceFund. Melalui projek ini, prosedur untuk Ujian Tanpa Musnah (NDT) bagi pemeriksaan tangki reaktor boleh dibangunkan. Satu lagi projek dalam bidang integriti loji dan struktur iaitu Pembangunan Peranti Tomografi Sinar Gama Mudah alih juga telah berjaya mendapat pembiayaan ScienceFund.



INDUSTRIAL TECHNOLOGY

Nuclear Malaysia is often referred to in the field of plant and structural integrity, advanced materials, and natural polymers through R&D in industrial technology. In the field of plant and structural integrity, the project on Development of Immersion Probe for Inspection of Reactor Tank of TRIGA MK II PUSPATI was funded under the ScienceFund grant. Through this project, procedures on Non-Destructive Testing for the inspection of the reactor tank can be developed. Another project in the field of plant and structural integrity is the Development of Gamma Ray Tomography Portable Hardware and also funded by the ScienceFund.

Hasil daripada projek ini dijangka dapat memberi impak positif kepada industri terutamanya yang melibatkan pemeriksaan sistem paip di loji-loji industri. Melalui sistem ini kadar kakisan karat pada sistem paip dapat dianalisa menggunakan imej keratan rentas. Dalam bidang bahan termaju, kajian berkenaan sifat *Multilayered Nanowires with Giant Magnetoresistance (GMR)* dijalankan dan dibiayai oleh ScienceFund. Projek berkaitan *Catalyst-Assisted Growth of Silicon Nanowires* juga berjaya mendapat pembiayaan ScienceFund. Penyelidikan ini dapat meningkatkan pengetahuan mengenai sintesis wayar nano silikon menggunakan teknik pertumbuhan berbantuan pemangkin.

This project is expected to give positive impact to the industry, especially in the inspection of piping system in industrial plants. This system can be used to analyse the corrosion rate using the cross-sectional images. For the advanced materials group, the project on the characteristic of Multilayered Nanowires with Giant Magnetoresistance (GMR) was conducted and funded by ScienceFund. Another project from the advanced materials group is the Catalyst-Assisted Growth of Silicon Nanowires. This research will increase the knowledge on the synthesis of silicon nanowires using catalyst-assisted growth.



Projek lain yang mendapat pembiayaan dalaman ialah penyelidikan membangunkan *Biocomposite Calcium Deficient Hydroxyapatite (CDHA)* menggunakan biodegradasi polimer asli dan protein bagi memulihkan tisu keras, dan projek Pembangunan Bahan Geseran Automotif Diperkuatkan daripada Abu Terbang. Projek penyelidikan yang telah berjaya ditamatkan ialah pembangunan produk *scaffold* porous bagi tisu tulang. Bagi kumpulan polimer asli, tiga penyelidikan telah berjaya mendapat pembiayaan ScienceFund. Antara penyelidikan yang dijalankan ialah kitar semula getah menggunakan sinaran alur elektron dan

Pembangunan Nanokomposit getah asli/polipropilena/tanah liat yang memberi manfaat kepada industri automotif tempatan. Penyelidikan seterusnya yang dibiayai oleh ScienceFund dalam bidang polimer asli ialah penyediaan bahan bersaiz nano berasaskan getah asli menggunakan teknik sol-gel.



Other internally funded projects were the Development of Biocomposite Calcium Deficient Hydroxyapatite (CDHA) using biodegradable natural polymers and proteins to restore hard tissues, as well as the Development of Fly Ash-reinforced Automotive Friction Material. The Development of Porous Scaffold Product for Bone Tissue was successfully completed. For the natural polymers group, three projects have been granted funding from ScienceFund. Among the research conducted was the recycling of rubber using electron beam irradiation and Development of Natural Rubber/Polypropylene/Clay Nanocomposite which benefit the local automotive industry. The research on Preparation of Natural Rubber Based Nano-sized Material Using Sol-Gel Technique was also funded by ScienceFund.

Agroteknologi dan Biosains *Agrotechnology and Biosciences*

AGROTEKNOLOGI DAN BIOSAINS

Aktiviti penyelidikan agroteknologi dan biosains Nuklear Malaysia memberi fokus kepada pemodenan dan kemajuan industri asas tani dan bioindustri, selaras dengan langkah kerajaan menjadikan sektor ini antara pemacu utama kepada pertumbuhan ekonomi negara. Projek ScienceFund yang telah mencapai tahap akhir adalah kajian kesan sinaran ke atas beberapa herba dan biakbaka tanaman makanan (pisang, betik, padi dan nanas). Penyelidikan biakbaka padi juga dilaksanakan di bawah program FNCA dan RCA bagi membangunkan varieti yang berkualiti dari segi agronomi dan nilai pemakanannya. Projek pembangunan strain bakteria menggunakan teknologi mutagenesis sinaran bagi penghasilan gula dari tandan kosong kelapa sawit masih giat dijalankan.



AGROTECHNOLOGY AND BIOSCIENCES

Agrotechnology and biosciences research activities of Nuclear Malaysia focus on modernisation and development of agro-based industry as well as bioindustry, in tandem with the government's call to revitalise this sector as the propeller for the country's economic growth. ScienceFund projects that have reached the final stage of implementation were studies on irradiation effects on selected herbs and breeding of industrial crops (banana, papaya, paddy and pineapple). Paddy breeding research was also carried out under FNCA and RCA programme to develop new varieties with improved agronomic and nutritional characteristics, whilst project on development of bacterial strains through radiation mutagenesis production of sugar from oil palm empty fruit bunches is still being conducted.

Selain daripada itu, projek lain yang berada pada tahap akhir adalah kajian pengaruh gaharu bagi pengeluaran komersil, pembangunan teknologi mikropropagasi karas berskala besar di bawah peruntukan Institut Agrobioteknologi (ABI) dan penambahbaikan biobaja menggunakan teknik sinaran dan isotop penyurih. Nuklear Malaysia turut mengadakan projek kerjasama penyelidikan dengan agensi luar. Ini termasuk kajian modifikasi kanji sagu menggunakan sinaran yang telah mula dilaksanakan, manakala penyelidikan biak baka mutasi dan pembangunan sistem bioreaktor tanaman karas telah berjaya disiapkan. Dengan kepakaran dan pengalaman yang sedia ada di dalam penyelidikan biak baka tanaman hiasan melalui teknik mutasi aruhan, Nuklear Malaysia telah menandatangani kontrak penyelidikan dengan Jabatan Landskap Negara dalam kajian pembangunan



varieti baru tanaman renek menggunakan teknologi nuklear. Pada peringkat antarabangsa pula, Nuklear Malaysia menjalinkan kerjasama dua hala dengan Jepun bagi penyelidikan pembiakbakaan kekwa menggunakan teknologi alur ion.

In addition, other projects that have reached the final stage are induction of gaharu for commercial production and development of large scale micropropagation technology for Aquilaria sp., funded by Agrobiotechnology Institute

(ABI) and enhancement of biofertiliser using irradiation and isotopic tracer technique. Nuclear Malaysia has also implemented collaboration projects with other agencies. These include radiation modification of sago starch which is at the early stage of implementation whereas development of Aquilaria bioreactor system has been successfully completed. With the expertise and experience in ornamental plant breeding using radiation induced mutation, Nuclear Malaysia has signed a contract research with the National Landscape Department (JLN) on production of new varieties of shrubs through mutagenesis. At international level, Nuclear Malaysia collaborated with Japan in a bilateral cooperation project in the application of ion beam technology in developing new varieties of chrysanthemum.

Melalui kerjasama serantau (FNCA), projek biakbaka orkid rintang serangga telah berjaya disiapkan, manakala kajian penghasilan biobaja masih giat dijalankan dan berada pada peringkat akhir. Projek dalaman di peringkat akhir adalah biakbaka cendawan dan pembangunan sistem bioreaktor Tongkat Ali. Projek-projek yang telah tamat adalah kajian pembangunan *inducer* gaharu dan pengurusan agronomi pokok Karas. Projek baru yang bermula pada tahun yang dilaporkan adalah penyelidikan

biakbaka mutasi aruhan pokok jarak (*Jatropha*) bagi membangunkan varieti yang mempunyai hasil yang tinggi. Antara perkhidmatan dan produk yang ditawarkan ialah analisa sampel N-15 dan C-14, khidmat nasihat dan penyinaran graf tisu untuk kegunaan klinikal, program latihan dalam bidang berkaitan, kultivar baru tanaman hiasan untuk perlandskapan, anak benih kultur tisu benih cendawan dan *inducer* gaharu.



Through the regional cooperation (FNCA), the project on the development of insect resistant orchids was completed, whilst research on biofertiliser is still in progress and has reached final stage. Internal projects which are at the final stage are mushroom mutagenesis and development of Tongkat Ali (*Eurycoma longifolia* Jack) bioreactor system. Projects

which have been completed are development of gaharu inducer and agronomic management of *Aquilaria*. A new project carried out is the mutation breeding of *Jatropha* to develop a variety with higher yield. Among the services and products offered are N-15 and C-14 analysis, consultation and irradiation of tissue graft for clinical use, training programmes, new ornamental cultivars for landscaping, tissue culture seedlings, mushroom cultures and gaharu inducer.

Keselamatan dan Kesihatan *Safety and Health*

Keselamatan dan Kesihatan

Seiring dengan slogan 'Keselamatan dan Kesihatan Asas Kerja Berkualiti', Nuklear Malaysia terus memberi komitmen dalam keselamatan, kesihatan dan perlindungan tempat kerja dengan menjamin kemudahan dan persekitaran pekerjaan sentiasa selamat untuk kebaikan pekerjaannya. Sehubungan itu, latihan amal kecemasan untuk menambahbaik pelan tindakan kecemasan telah dilaksanakan. Selain itu, siri aktiviti audit luar juga telah dijalankan, sekaligus menunjukkan keprihatinan Nuklear Malaysia dalam mematuhi sistem keselamatan, kesihatan dan alam sekitar yang disyaratkan dalam Akta 514, Akta 304, Akta 127 dan garis panduan IAEA.

Safety and Health

In tandem with the slogan 'Safety and Health as Fundamentals of Quality Work', Nuclear Malaysia pledges its commitment to safety, health and workplace protection by ensuring that the facilities and working environment are safe for the well being of her employees. To this end, emergency drills were executed to enhance the emergency response plan. In addition, a series of external audit activities were also performed this year, accentuating Nuclear Malaysia's attentiveness in complying with the safety, health and environmental system as stipulated in Act 514, Act 304, Act 127 and IAEA guidelines.



Pada 27 Mac 2009, Nuklear Malaysia telah melakar satu lagi sejarah dalam arena keselamatan dan kesihatan dengan perasmian Stesen Pemantauan Radionuklid RN42 (Stesen RN42) di Cameron Highlands sebagai salah satu bahagian dalam Sistem Pemantauan Antarabangsa (IMS) di bawah Suruhanjaya Persediaan Triti Pengharaman Ujian Senjata Nuklear (Suruhanjaya Persediaan CTBTO). Stesen ini mampu mengesan partikel radionuklid yang terhasil dari aktiviti buatan manusia seperti letupan atau kemalangan nuklear. Hari Kualiti, Keselamatan, Kesihatan dan Alam Sekitar atau dikenali sebagai Hari Q-SHE telah dianjurkan pada 22 Disember. Pelaksanaan program ini menzahirkan iltizam Nuklear Malaysia dalam menjana dan meningkatkan minat serta kesedaran berkaitan dengan Keselamatan dan Kesihatan Pekerjaan dan berkongsi maklumat, pengetahuan, pengalaman serta amalan keselamatan terbaik di tempat kerja. Dalam perkembangan lain, Nuklear Malaysia telah member khidmat ujian kebocoran kepada 213 syarikat.

On 27 March 2009, Nuclear Malaysia created yet another history in the safety and health arena with the launching of Radionuclide Monitoring Station RN42 (Station RN42) in Cameron Highlands as part of the International Monitoring System (IMS) under the Preparatory Commission of the Comprehensive Nuclear-Test-Ban Treaty Organisation (CTBTO Prep Com). This station is able to detect radionuclide particles produced from man-made activities such as nuclear explosion or accident. The Quality, Safety, Health and Environment Day, or better known as Q-SHE Day was held on 22 December 2009. The implementation of this programme envisaged Nuclear Malaysia's commitment to generate and heighten interest and awareness of Occupational Safety and Health as well as sharing of information, knowledge, experiences and best safety practices at the workplace. In other developments, Nuclear Malaysia has provided leak test services to 213 companies.



Selain daripada melaksanakan pemantauan dos kepada pekerja, Nuklear Malaysia juga telah menjalankan program pemantauan alam sekitar untuk mengesan perubahan aras sinaran dan keradioaktifan alam sekitar. Pemantauan ini dilakukan dengan menganalisa kandungan keradioaktifan sampel air, tanah, sedimen dan flora di lokasi yang telah ditentukan. Di samping itu, Nuklear Malaysia turut memberikan perkhidmatan pemantauan alam sekitar kepada beberapa syarikat yang menggunakan mineral yang mengandungi bahan radioaktif tabii (NORM) bagi memastikan prosedur standard operasi bukan sahaja selamat, malah mematuhi standard yang telah ditetapkan.



In addition to implementing dose monitoring to the personnel, Nuclear Malaysia has also carried out its environmental monitoring programme to detect changes in radiation level and environmental radioactivity. This monitoring is done by analysing the radioactivity content of the water, soil, sediment and flora samples in selected locations. Additionally, Nuclear Malaysia provided its environmental monitoring services to various companies utilising minerals containing naturally occurring radioactive materials (NORM) in their processes to ensure the standard operating procedures are not only safe, but in accordance with the stipulated standards.

Perubatan Medical

PERUBATAN

Nuklear Malaysia terus menyumbang kepada arah kemajuan teknologi perubatan. Nuklear Malaysia membekalkan Penjana Tc-99m untuk kegunaan perubatan nuklear pada setiap minggu kepada Hospital Universiti Kebangsaan Malaysia, Hospital Kuala Lumpur, Pusat Perubatan Universiti Malaya, Hospital Universiti Sains Malaysia Kubang Kerian, Hospital Pulau Pinang, Hospital Sultanah Aminah Johor Bahru, Hospital Umum Kuching, Sime Darby Medical Centre Subang Jaya dan National Cancer Society Hospital Nilai. Khidmat biodosimetri terus disediakan bagi menilai dos pekerja sinaran melalui Lembaga Perlesenan Tenaga Atom (AELB). Selain itu, kajian biodosimetri untuk membangunkan lengkung piawai melalui analisis disentrik dan teknik *Florescence In-situ Hybridisation (FISH)* telah mendapat pembiayaan ScienceFund.



MEDICAL

Nuclear Malaysia continues to contribute towards the advancement of medical technology. Nuclear Malaysia supplies Tc-99m Generator for use in nuclear medicine on a weekly basis to the Hospital Universiti Kebangsaan Malaysia, Hospital Kuala Lumpur, University Malaya Medical Center, Hospital Universiti Sains Malaysia Kubang Kerian, Hospital Pulau Pinang, Hospital Sultanah Aminah Johor Bahru, Hospital Umum Kuching, Sime Darby Medical Center Subang Jaya and National Cancer Society Hospital Nilai. Biodosimetry services are continuously provided to evaluate dose received by radiation workers through AELB. Biodosimetry studies to develop a standard curve using dicentric and Florescence In-situ Hybridisation (FISH) technique is being funded by ScienceFund.

Nuklear Malaysia menjalankan khidmat ujian kawalan mutu mikrobiologi berkala ke atas produk perubatan di kemudahan siklotron Hospital Putrajaya dan Pusat Perubatan Antarabangsa Wijaya, Petaling Jaya. Projek ScienceFund mengenai pembangunan komposit perangka 3D berasaskan polimer dan seramik terbiodegradasi bagi kegunaan kejuruteraan tisu tulang telahpun selesai dilaksanakan. Ia menggunakan teknik pengubahsuaian gas bagi menghasilkan perangka 3D tersebut. Projek ini merangkumi pembangunan teknik komposit polimer-seramik porous, kajian terhadap sifat kimia, fizikal dan mekanikal serta kesan tiga jenis seramik yang berbeza terhadap prestasi perangka 3D tersebut. Sebagai sumbangan kepada industri kosmetik dan penjagaan kesihatan, satu produk pelembap bibir yang berasaskan bahan semula jadi serta didekontaminasi melalui teknologi sinaran telah dihasilkan dan sedia untuk dikomersilkan. Selain itu, produk pembalut luka hidrogel berasaskan sagu, agar dan kitosan telah dihasilkan dan sedia untuk pemindahan teknologi dan komersialisasi.



Nuclear Malaysia continues to provide periodic microbiological quality control test services on medical products at the cyclotron facility, Putrajaya Hospital and Wijaya International Medical Centre, Petaling Jaya. Study on the development of composite 3D scaffolds based on biodegradable polymer and ceramics for use in bone tissue engineering funded by ScienceFund was completed. Gas modification technique was employed to develop these 3D scaffolds. The project includes the development of porous composite polymer-ceramic, study on chemical, physical and mechanical properties as well as the effects of three different types of ceramic on the performance of 3D scaffolds. As a contribution to the health care and cosmetic industry, a natural product based lip balm decontaminated by radiation technology was produced and ready for commercialisation. In addition, hydrogel wound dressings based on sago, agar and chitosan were produced and ready for technology transfer and commercialisation.

Alam Sekitar Environment

ALAM SEKITAR

Nuklear Malaysia sentiasa mempelopori penggunaan teknologi nuklear dan teknologi berkaitan di dalam pemuliharaan alam sekitar. Dua projek penyelidikan di bawah pembiayaan ScienceFund telahpun berjaya dilaksanakan pada tahun ini. Projek pertama yang juga merupakan projek usahasama dengan Universiti Kebangsaan Malaysia adalah untuk membangunkan kaedah bagi menyingkirkan radium daripada air sisa industri dengan menggunakan asid humik. Kaedah yang dibangunkan ini berpotensi untuk digunakan di dalam rawatan air sisa industri khususnya bagi melindungi alam sekitar dan memberi nilai tambah kepada tanah gambut dan sisa pertanian.



ENVIRONMENT

Nuclear Malaysia has always championed the use of nuclear and related technologies for the conservation of the environment. Two research projects funded by ScienceFund have been successfully completed this year. The first project, in collaboration with Universiti Kebangsaan Malaysia (UKM) was to develop a method in removing radium from industrial wastewater using humic acid. The method developed has potential to be used in industrial wastewater treatment for environment preservation and gives added value to peat soil and agricultural waste.

Projek kedua pula memperkenalkan gabungan proses sinaran mengion dan biologi untuk merawat sisa air industri. Kajian untuk membangunkan pangkalan data bagi sumber-sumber bahan hidrokarbon petroleum dalam persekitaran maritim di persisiran pantai Sabah dan Sarawak sedang giat dilaksanakan dibawah pembiayaan ScienceFund. Ia adalah projek kerjasama dengan Universiti Kebangsaan Malaysia (UKM), Universiti Malaysia

Terengganu (UMT) dan Jabatan Perikanan Malaysia. Nuklear Malaysia juga melaksanakan kajian air bawah tanah di Pulau Langkawi yang dibiayai oleh IAEA bagi mengenalpasti perubahan kualiti air bawah tanah di pulau tersebut. Kajian ini melibatkan penggunaan teknik isotop penyurih serta pendekatan geologi, hidrogeologi dan hidrokimia.



The second project introduced the combination of ionising radiation and biological processes to

treat industrial wastewater. A project in collaboration with Universiti Kebangsaan Malaysia (UKM), Universiti Malaysia Terengganu (UMT) and the Department of Fisheries Malaysia has been actively carried out under ScienceFund to develop a database on sources of petroleum hydrocarbons in the marine environment of Sabah and Sarawak coastal areas. Nuclear Malaysia has also conducted a study which was funded by the IAEA, on groundwater quality in Langkawi Island to identify the trend of groundwater quality. The study involved the application of isotopic tracer techniques, and geological, hydrogeological and hydrochemical approaches.

Projek lain yang dijalankan adalah dengan kerjasama Jabatan Pengairan dan Saliran (JPS) melibatkan penggunaan isotop bagi memperoleh data mengenai tahap keselamatan dan integriti untuk 14 empangan iaitu Empangan Macap, Labong, Bekok, Sembrong, Pontian, Anak Endau, Bukit Merah, Padang Saga, Perting, Repas, Batu, Timah Tasoh, Bukit Kwong dan Beris. Khidmat lain yang ditawarkan adalah analisis keradioaktifan, pengiraan keaktifan gros alfa dan beta, pengandilisaan multi-unsur serta logam berat dalam sampel sekitaran, industri, makanan dan minuman.



Other projects included a collaboration with the Department of Irrigation and Drainage (JPS) involving the use of isotopes in providing information on the safety and integrity of 14 dams, namely Macap, Labong, Bekok, Sembrong, Pontian, Anak Endau, Bukit Merah, Padang Saga, Perting, Repas, Batu, Tasoh Timah, Bukit Kwong and Beris. Other services offered are radioactivity analysis, gross alpha and beta activity counting, multi-element and heavy metal analyses in environmental, industrial, food and drinking water samples.

Pengkomersilan dan Pemindahan Teknologi

Commercialisation and Technology Transfer



PENGKOMERSILAN DAN PEMINDAHAN TEKNOLOGI

Program pengkomersilan dan pemindahan teknologi adalah platform utama bagi mengetengahkan inovasi dan hasil R&D. Program ini telah berjaya menjana RM24.95 juta seperti dalam Jadual 9.

COMMERCIALISATION AND TECHNOLOGY TRANSFER

Commercialisation and technology transfer programme is a major platform to innovations and R&D findings. This programme has successfully generated RM24.95 million as shown in Table 9.

Jadual 9. Pendapatan Nuklear Malaysia
Table 9. Nuclear Malaysia's Revenue

Aktiviti <i>Activities</i>	Pendapatan (RM juta) <i>Revenue (RM million)</i>
Pembekalan Produk <i>Product Supplies</i>	4.40
Khidmat Latihan <i>Training Services</i>	3.09
Perkhidmatan Teknikal <i>Technical Services</i>	3.70
Kontrak/Geran Penyelidikan <i>Research Contract/Grant</i>	13.71
Dividen dari Pelaburan <i>Dividends from Investments</i>	0.05
Jumlah Keseluruhan <i>Grand Total</i>	24.95

Bagi pelaksanaan program teknoprenur Nuklear Malaysia, Budiman Research and Training Sdn. Bhd. telah dilantik sebagai perunding. Seramai 28 staf telah mendaftar untuk mengkomersilkan hasil R&D Nuklear Malaysia yang terpilih.

Aktiviti-aktiviti yang telah dijalankan bagi membantu membangunkan IKS adalah seperti berikut:

1. Perkhidmatan pengimbasan kolum dan ujian kekandasan bahan di Pengkalan Offshore Sdn. Bhd., Kemaman Terengganu.
2. Lima lawatan industri bagi program kesedaran dan pemasaran kepada IKS.
3. Penyediaan gudang, mesin dan peralatan yang sedia diguna pakai bagi membantu syarikat IKS dalam mengkomersilkan hasil R&D Nuklear Malaysia.

Dalam usaha meningkatkan keupayaan teknologi, sebanyak 3 projek *up-scaling* dijalankan dengan kerjasama syarikat berikut:

1. Alphaprima Engineering Sdn. Bhd.
2. Intestmal Holdings Sdn. Bhd.
3. Pengkalan Offshore Sdn. Bhd.

Nuklear Malaysia telah menandatangani perjanjian pemindahan teknologi dengan Alphaprima Engineering Sdn. Bhd. bagi pengkomersilan produk pelindung karat á-XRP.

Budiman Research and Training Sdn. Bhd. was appointed as a consultant to implement the techno-entrepreneur program. Twenty eight staff has registered to participate in the program to commercialise selected Nuclear Malaysia's research findings.

The activities undertaken to enhance the development of SMEs are as follows:

1. *Column scanning service and material failure analysis at Pengkalan Offshore Sdn. Bhd., Kemaman Terengganu.*
2. *Five industrial visits for awareness and marketing programme for SMEs.*
3. *Providing ready-to-use warehouse, machinery and equipment to assist SMEs to commercialise Nuclear Malaysia's research findings.*

In an effort to improve technological capabilities, three upscaled projects were carried out in collaboration with the following companies:

1. *Alphaprima Engineering Sdn.Bhd.*
2. *Intestmal Holdings Sdn. Bhd.*
3. *Pengkalan Offshore Sdn. Bhd.*

Nuclear Malaysia has signed a technology transfer agreement with Alphaprima Nuclear Engineering Sdn. Bhd. to commercialise rust protector á-XRP.

Kualiti Quality

KUALITI

Nuklear Malaysia mengadakan pelbagai aktiviti untuk memastikan budaya kualiti diamalkan secara berterusan. Hari Kualiti dianjurkan bersama Hari Keselamatan, Kesihatan dan Alam Sekitar (Hari Q-SHE) pada 22 Disember 2009. Tujuh Persijilan ISO 9001 telah berjaya dikekalkan di mana tiga daripadanya telah dinaiktaraf dan dua dalam proses dinaiktaraf kepada ISO 9001:2008. Selain dari itu, persijilan lain yang dikekalkan adalah seperti dalam Jadual 10.

QUALITY

Nuclear Malaysia has conducted various activities to ensure a continuous quality culture. The Quality Day was jointly organised with the Safety, Health and Environment Day (Q-SHE Day) on 22 December 2009. Seven ISO 9001 certifications were successfully maintained where 3 were upgraded and 2 were in the process to be upgraded to ISO 9001:2008. Other certifications are as in Table 10.



Jadual 10 : Senarai Persijilan
Table 10: List of Certifications

Bil No	Proses Process
Persijilan ISO 9001:2000	
1	Perkhidmatan Penyinaran Menggunakan Punca Co-60 untuk Produk Perubatan, Pengguna dan Farmaseutikal <i>Gamma Irradiation Service Using Co-60 Source For Medical Products, Consumer Products and Pharmaceuticals</i>
2	Pembekalan Perkhidmatan Ultrasonik, Radiografi, Ujian Imbasan Paip dan Kolum <i>Provision of Ultrasonic, Radiography, Pipescan and Column Scan Testing Services</i>
3	Pembekalan Perkhidmatan Penyinaran Alur Elektron Untuk Produk Komersil <i>Provision of Electron Beam Irradiation Services for Commercial Products</i>
4	Pengurusan Sisa Radioaktif dan Penyimpanan Bahan Radioaktif <i>Management of Radioactive Waste and Storage of Radioactive Materials</i>
Persijilan ISO 9001:2008	
1	Pembekalan Perkhidmatan Dosimetri Personel Merangkumi Bekalan Lencana dan Penilaian Dosimeter <i>Provision of Personnel Dosimetry Services Covering Supply of Badges and Evaluation of Dosimeters</i>
2	Pentadbiran Program Latihan dan Pengurusan Seminar/Persidangan <i>Administration of Training Programs and Management of Seminar/Conferences</i>
3	Penghasilan Lateks Getah Asli Pra-Tervulkan Menggunakan Sinaran Gama <i>Production of Prevulcanised Natural Rubber Latex by Using Gamma Radiation</i>
Persijilan ISO/IEC 17025	
1	Makmal Radiokimia Dan Alam Sekitar <i>Radiochemical and Environmental Laboratory</i>
2	Makmal Kalibrasi, SSDL <i>Calibration Laboratory, SSDL</i>
Persijilan ISO 13485:2003	
1	Pembekalan Perkhidmatan Pemprosesan Penyinaran Gama Kepada Keperluan Khusus Pengguna, termasuk EN552 dan ISO 11137 <i>Provision of Gamma Irradiation Processing Services to Customer Specified Requirements, including EN552 and ISO 11137</i>
Sijil Amalan Pengilangan Terbaik (cGMP) dari Kementerian Kesihatan Malaysia	
1	Penjana Tc-99m bagi Pembuatan Radiofarmaseutikal Steril <i>Tc-99m Generator for production of Sterile Radiopharmaceuticals</i>

Inovasi *Innovation*

INOVASI

Nuklear Malaysia telah mengambil langkah proaktif bagi menggalakkan inovasi di kalangan stafnya. Antaranya ialah Hari Inovasi Nuklear Malaysia dan penyertaan dalam beberapa ekspo di peringkat kebangsaan dan antarabangsa. Inovasi yang telah memenangi pingat adalah seperti dalam Jadual 11.



INNOVATION

Nuclear Malaysia has taken proactive measures to encourage innovations amongst her staff. These include Nuclear Malaysia Innovation Day as well as participations in various innovation expositions at national and international level. Innovations that have won medals are as in Table 11.

Jadual 11: Peringkat Kebangsaan dan Antarabangsa**Table 11: National and International Level**

**7TH Invention & Innovation Competition, Malaysia Technology Expo 2009
19-21 Feb 2009**

Projek/<i>Projects</i>	Anugerah/<i>Award</i>
<i>Biotechnology Improved Synthetic Seeds – Low Cost Seed Production Technology</i>	Anugerah Terbaik/ <i>The Best Award</i> Emas/ <i>Gold</i>
<i>High Sensitivity Material for Nuclear Radiation Dose Measurement</i>	Emas/ <i>Gold</i>
<i>Preparation of Natural Rubber-based Nano-sized Materials Using Sol-gel Techniques</i>	Emas/ <i>Gold</i>
<i>Development of UV Curable Materials for Hard Armour Panel (HAP)</i>	Emas/ <i>Gold</i>
<i>VacGlow-Non-destructive Vacuum Testing System for sterile Evacuated Vial</i>	Emas/ <i>Gold</i>
<i>SALAMED - Easy Use Medium for Cultured Tissues and Growing Plants</i>	Perak/ <i>Silver</i>
<i>SmartDK-TLC Scanner</i>	Perak/ <i>Silver</i>
<i>Nano Alumina Powders from Schedule Waste</i>	Gangsa/ <i>Bronze</i>
<i>Robotic Ultrasonic Scanning System (RUSS)</i>	Gangsa/ <i>Bronze</i>
<i>BONIGENT – A BGS Drug Delivery System</i>	Gangsa/ <i>Bronze</i>
<i>Biotechnology Improved Synthetic Seeds – Low Cost Seed Production Technology</i>	Emas/ <i>Gold</i>

**2009 Seoul International Invention Fair (SIIF)
3 - 7 Dis 2009**

Projek/ <i>Projects</i>	Anugerah/ <i>Award</i>
Biotechnology Improved Synthetic Seeds – Low Cost Seed Production Technology	Anugerah Terbaik/ <i>The Best Award</i> Emas/ <i>Gold</i>
Column Test Rig Facility (Simulation Facility on Radioisotope Distillation Column Performance)	Emas/ <i>Gold</i>



Pembangunan Modal Insan *Human Capital Development*

PEMBANGUNAN MODAL INSAN

Bagi meningkatkan daya saing dan kecemerlangan agensi, aspek pembangunan kerjaya dan kompetensi kakitangan serta perancangan penggantian modal insan terus diberi tumpuan utama. Ini dilaksanakan menerusi latihan jangka pendek dan panjang, di dalam dan luar negara. Bilangan latihan dan penyertaan adalah seperti dalam Jadual 12.



HUMAN CAPITAL DEVELOPMENT

Personnel's career and competency development; as well as succession planning are the important aspects being continually focussed to enhance the agency's competitiveness and excellence in the future. This is carried out through short and long term training programmes, locally and abroad. The number of training programmes and participations are shown in Table 12.



Untuk memperkasakan kapasiti R&D dan mempergiatkan pengkomersilan teknologi, semua staf digalakkan melanjutkan pengajian di bawah program latihan formal. Seramai 23 orang pegawai telah berjaya menamatkan pengajian. Aktiviti Penilaian Tahap Kecekapan (PTK) pada tahun ini merangkumi sebanyak 14 kursus dan peperiksaan PTK dengan bilangan calon seramai 131 dari semua gred jawatan. Pelaksanaan tatacara baru PTK telah dimulakan pada pertengahan tahun ini untuk memantapkan lagi prosedur penilaian bagi memenuhi keperluan semasa. Nuklear Malaysia telah melatih 163 pelatih dari pelbagai institusi pengajian tinggi dan agensi lain bagi program latihan industri serta menyelia 79 orang pelajar universiti dalam melaksanakan projek penyelidikan mereka. Di bawah Program Kerjasama Teknikal IAEA, lima penyelidik Nuklear Malaysia menjalani program latihan zamalh manakala lima berpeluang mengadakan lawatan saintifik di luar negara dalam pelbagai bidang.

Jadual 12. Bilangan latihan dan penyertaan
Table 12. Number of courses and participations

Kursus dan latihan <i>Courses and training</i>	Bilangan <i>Number</i>	Penyertaan <i>Participation</i>
Kursus Dalam <i>Internal Courses</i>	64	3414
Ceramah Nilai Murni <i>Lectures on Good Values</i>	6	655
Latihan Dalam Negara <i>Local Training Programme</i>	272	1126
Latihan Luar Negara <i>Overseas Training Programme</i>	104	159

To strengthen R&D capacity and enhancing technology commercialisation, staff are encouraged to undergo formal training programme. A total of 23 officers have successfully completed their studies. As for Competency Level Assessment (PTK) activities, Nuclear Malaysia has organised 14 PTK courses and examinations involving 131 candidates from various posts. Implementation of the new PTK procedure was carried out in the middle of the year to strengthen the evaluation to serve the current needs. Nuclear Malaysia has trained 163 trainees from local institution of higher learning and agencies for industrial training, and also supervised 79 university students in their research project. Under the IAEA Technical Cooperation Programme, five research officers have undergone fellowship programme whilst five for scientific visits abroad in various fields.

Nuklear Malaysia telah menerima tujuh saintis luar untuk lawatan saintifik serta melatih tujuh felo dari beberapa negara termasuk Afganistan (1), Algeria (1), Mesir (1), Filipina (1), Arab Saudi (2) dan Tajikistan (1) dalam pelbagai bidang (Jadual 13).

Seramai tiga penyelidik telah menjalankan misi pakar ke luar negara. Nuklear Malaysia pula telah menerima 16 misi pakar bagi memantapkan aktiviti penyelidikannya.

Jadual 13. Bidang zamalah dan bilangan felo yang dilatih
Table 13. Field of fellowship and number of fellow trained

<i>Bidang/Fields</i>	<i>Bilangan/Number</i>
Genetik dan Biakbaka Tumbuhan <i>Plant Breeding and Genetics</i>	1
Teknik Radioanalitikal <i>Radioanalytical Techniques</i>	1
Aplikasi serta Kemudahan Pemprosesan Sinaran <i>Radiation Processing Facilities and Applications</i>	1
Pemeriksaan dan Ujian Tanpa Musnah <i>Non-destructive Testing (NDT) and Examination (NDE)</i>	1
Infrastruktur Penguatkuasa untuk Keselamatan Sinaran dan Sisa <i>Regulatory Infrastructure for Radiation and Waste Safety</i>	2
Perubatan dan Kesihatan Sinaran <i>Radiation Medicine and Health</i>	1

Meanwhile, Nuclear Malaysia accepted seven foreign scientists for scientific visit, and trained seven fellows from countries including Afganistan (1), Algeria (1), Egypt (1), Phillippines (1), Saudi Arabia (2) and Tajikistan (1) in various fields (Table 13).

Three researchers were dispatched on expert mission abroad. Nuclear Malaysia has accepted 16 expert missions to strengthen the R&D activities.

Pembangunan Fizikal Dan Kemudahan Teknologi Maklumat

Physical Development and Information Technology Facilities

PEMBANGUNAN FIZIKAL DAN KEMUDAHAN TEKNOLOGI MAKLUMAT

Sejumlah 21 projek naik taraf dan ubahsuai infrastruktur asas, landskap, mekanikal dan elektrik bagi memantapkan R&D, pengkomersilan dan keselamatan berjaya disiapkan. Penggunaan *Sharepoint Portal* telah diperkenalkan bagi perkongsian maklumat di kalangan staf Nuklear Malaysia. Aplikasi ini akan mempermudah pencarian dan capaian maklumat. Bagi meningkatkan sistem pemantauan kehadiran staf, sistem perakam waktu elektronik (e-PC) telah dibangunkan. Peranti sistem ini ditempatkan di beberapa lokasi strategik. Selain dari itu, sistem ini juga boleh digunakan untuk mencatat kehadiran di seminar, forum dan program lain dan maklumat ini boleh dicapai melalui rangkaian NM-Net.



PHYSICAL DEVELOPMENT AND INFORMATION TECHNOLOGY FACILITIES

A total of 21 upgrading projects and basic infrastructure renovations, landscaping, mechanical and electrical to strengthen R&D, commercialisation and safety have been successfully completed.

SharePoint Portal was introduced to share information among the staff. This application facilitates the search and retrieval of information. To improve monitoring of staff attendance, electronic punch card recording system (e-PC) was developed. The devices are located at several strategic places. In addition, this system can be used to record attendance at seminars, forums and other programmes and the data can be accessed via the NM-Net network.



Prestasi Kewangan

Financial Performance

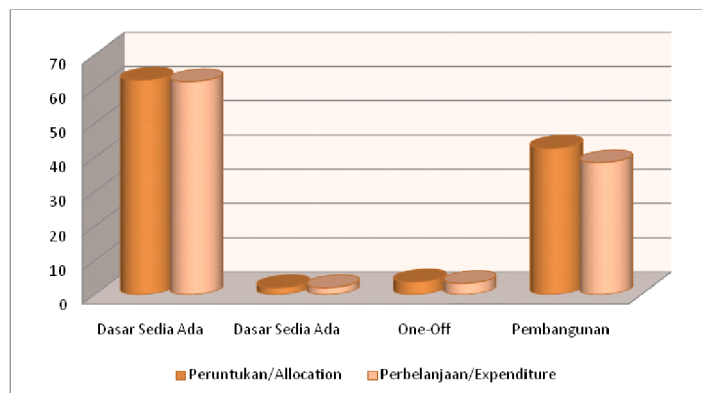
PRESTASI KEWANGAN

Nuklear Malaysia telah menerima peruntukan mengurus berjumlah RM68.23 juta yang merangkumi peruntukan sedia ada (RM62.53 juta), dasar baru (RM2 juta) dan one-off (RM3.70 juta). Peruntukan sedia ada dan dasar baru mencatat prestasi perbelanjaan yang cemerlang, iaitu masing-masing pada 99.27% dan 99.84%, manakala untuk peruntukan one-off, 87.35% telah dibelanjakan. Secara keseluruhannya prestasi perbelanjaan peruntukan mengurus adalah 98.64% (RM67.30 juta). Peruntukan pembangunan berjumlah RM42.68 juta turut mencatat prestasi yang baik dengan peratus perbelanjaan sebanyak 90.02% (RM38.42 juta). Nuklear Malaysia turut menerima peruntukan IRPA (RM0.34 juta), TechnoFund (RM10.05 juta) dan ScienceFund (RM2.08 juta). Sebanyak RM0.17 juta peruntukan IRPA telah dibelanjakan, manakala TechnoFund dan ScienceFund masing-masing RM4.38 juta dan RM1.16 juta.

FINANCIAL PERFORMANCE

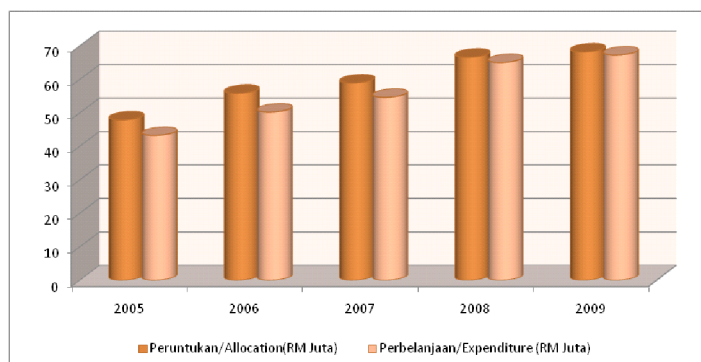
Nuclear Malaysia was allocated RM68.23 million for operating budget, which included existing operating budget, (RM62.53 million), new policy budget (RM2 million) and one-off budget (RM3.70 million). Both existing operating and new policy budgets have shown excellent expenditure performance, at 99.27% and 99.84% respectively. As for the one-off budget, expenditure performance at 87.35% was recorded. The overall expenditure performance for operating budget was 98.64% (RM67.30 million). The development budget of RM42.68 million was spent, at 90.01% (RM38.42 million). Nuclear Malaysia received IRPA Fund (RM0.34 million), TechnoFund (RM10.05 million) and ScienceFund (RM2.08 million). The total expenditure of IRPA Fund was RM0.17 million while TechnoFund and ScienceFund at RM4.38 and RM1.16 million respectively.

Jadual 14: Prestasi Kewangan Nuklear Malaysia bagi tahun 2009
 Table 14: Nuclear Malaysia's Financial Performance for 2009



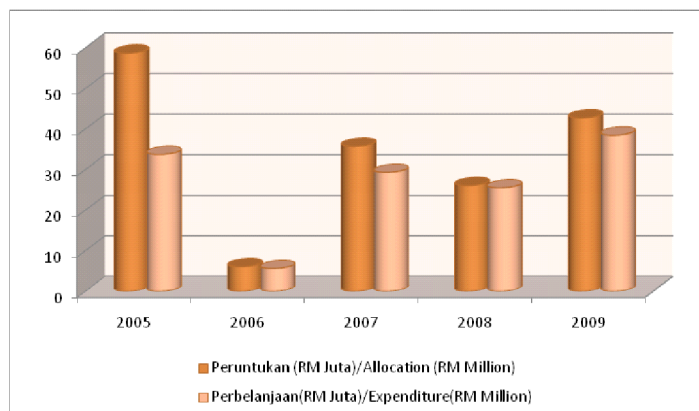
Bil No	Sumber Source	Perbelanjaan Expenditure (RM)	Peruntukan Allocation (RM)	% Perbelanjaan Expenditure
1	Mengurus/ Operational			
	a)Dasar Sedia Ada	62,070,859.79	62,527,650.00	99.27
	b)Dasar baru	1,996,804.10	2,000,000.00	99.84
	c)One-Off	3,234,289.16	3,702,800.00	87.35
2	Pembangunan/ Development	38,418,958.89	42,680,000.00	90.02

Jadual 15: Mengurus (RM Juta)
 Table 15: Operating (RM Million)



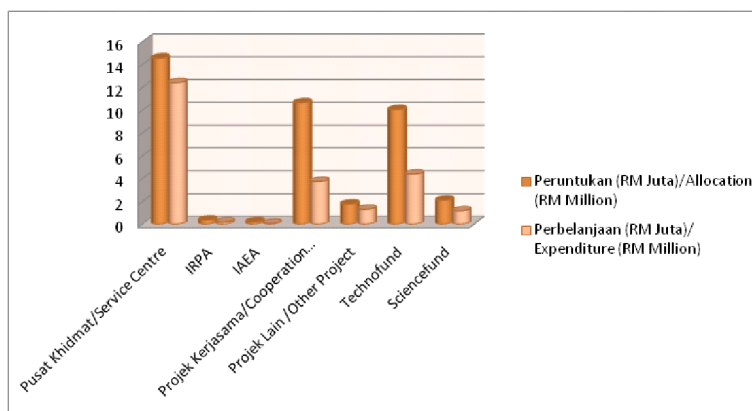
	2005	2006	2007	2008	2009
Peruntukan/Allocation	47.92	55.84	58.94	66.65	68.23
Perbelanjaan/Expenditure	43.24	50.25	54.65	65.06	67.30
Prestasi %/Performance %	90.22	89.97	92.7	97.62	98.64

Jadual 16: Pembangunan (RM Juta)
 Table 16: Development (RM Juta)



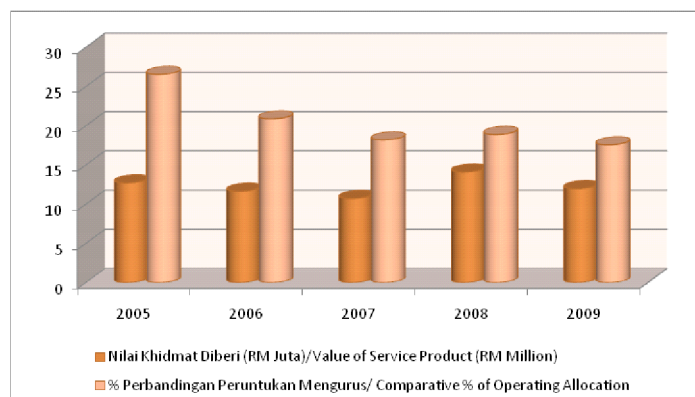
	2005	2006	2007	2008	2009
Peruntukan/ <i>Allocation</i>	58.67	6.00	35.69	26.60	42.68
Perbelanjaan/ <i>Expenditure</i>	33.67	5.54	29.25	25.40	38.42
Prestasi %/ <i>Performance %</i>	57.39	92.33	81.9	97.70	90.02

Jadual 17: Pusat Khidmat dan Projek-projek Bagi Akaun Amanah



	Peruntukan (RM Juta) <i>Allocation (RM Million)</i>	Perbelanjaan (RM Juta) <i>Expenditure (RM Million)</i>	Prestasi % <i>Performance %</i>
Pusat-Pusat Khidmat <i>Service Centre</i>	14.57	12.40	85.09
IRPA	0.34	0.17	51.01
IAEA	0.19	0.05	24.58
Projek Kerjasama <i>Cooperation Project</i>	10.65	3.74	35.14
Projek Lain <i>Other Project</i>	1.76	1.30	74.10
TechnoFund	10.05	4.38	43.58
ScienceFund	2.08	1.16	55.87
Jumlah / Total	39.64	23.20	58.54

Pendapatan *Income*



	2005	2006	2007	2008	2009
Produk dan perkhidmatan (RM Juta) <i>Product and services (RM Million)</i>	12.72	11.65	10.73	14.1	11.98
Peratusan Berbanding Peruntukan Mengurus <i>Comparative Percentage from the Total Operating Allocation</i>	26.55	20.87	18.20	18.89	17.56

Perancangan dan Persediaan Program Kuasa Nuklear

Planning and Preparation for Nuclear Power Programme

PERANCANGAN DAN PERSEDIAAN PROGRAM KUASA NUKLEAR

Nuklear Malaysia telah mula mengkaji, merancang dan menyelaras semua aspek persediaan untuk melaksanakan program kuasa nuklear.

Perancangan program kuasa nuklear (NPP) adalah berpandukan kepada garis panduan yang ditetapkan oleh IAEA. IAEA juga membantu Malaysia untuk membangunkan program ini melalui latihan dan khidmat pakar.

Keputusan Mesyuarat Jemaah Menteri pada 26 Jun 2009 telah meluluskan Memorandum Bersama Kementerian Tenaga, Teknologi Hijau dan Air (KeTTHA), dan Kementerian Sains, Teknologi dan Inovasi (MOSTI), mengenai Cadangan Penggunaan Tenaga Nuklear Sebagai Sumber Penjanaan Elektrik Negara mengukuhkan lagi aktiviti Perancangan dan Persediaan Kuasa Nuklear.

PLANNING AND PREPARATION FOR NUCLEAR POWER PROGRAMME

Nuclear Malaysia has started reviewing, planning and coordinating all aspects of preparatory for implementation of nuclear power programme.

The planning of nuclear power programme (NPP) is based on the guidelines stipulated by IAEA. IAEA also assists Malaysia in developing this programme through training and expert mission.

The Cabinet Meeting's decision on the 26th June 2009 has approved the Joint Memorandum between the Ministry of Energy, Green Technology and Water (KeTTHA) and the Ministry of Science, Technology & Innovation (MOSTI), on the Proposal on the Usage of Nuclear As a Source for Electricity Generation, Nationwide to strengthen the activities on Nuclear Power Planning and Preparation.

Berdasarkan keputusan tersebut, Jawatankuasa Kerja Pembangunan Program Kuasa Nuklear di bawah Jawatankuasa Pemandu Pembangunan Kuasa Nuklear (JPPKN) telah ditubuhkan. Mesyuarat pertama JPPKN telah diadakan pada 21 Julai 2009. Di bawah JPPKN ini, tiga lagi jawatankuasa kerja telah diwujudkan, iaitu :

- Jawatankuasa Kerja Pembangunan Program Kuasa Nuklear (JKPPKN);
- Jawatankuasa Kerja Pembangunan Projek Kuasa Nuklear (JKPPKN);
- Jawatankuasa Penyelarasan Pembangunan Perundangan Kuasa Nuklear (JKPPPN).

Ketiga-tiga jawatankuasa ini dianggotai oleh Nuklear Malaysia. Tumpuan utama aktiviti NPP terbahagi kepada:

- Kajian Perancangan Dasar dan semua aspek persediaan bagi pelaksanaan Program Janakuasa Nuklear Negara dalam tempoh jangka panjang
- Perancangan Pembangunan Modal Insan bagi Perancangan Persediaan dan Pelaksanaan Program Janakuasa Nuklear

Beberapa aktiviti dalam penerimaan awam, pembangunan modal insan dan budaya kerja telah dilaksanakan seperti berikut:

1. Taklimat kuasa nuklear kepada Ahli Parlimen melalui *Luncheon Talk for Political Stakeholders on Nuclear Energy* di Bangunan Parlimen pada 25 November 2009 dengan dihadiri sekitar 50 Ahli Parlimen daripada parti kerajaan dan parti pembangkang.

Following the cabinet's decision, the Executive Committee for the Development of Nuclear Power Programme under the Nuclear Power Steering Committee Nuclear Power Development (JPPKN) was established. The first meeting was held on July 21, 2009. JPPKN had established three other working committees:

- *Jawatankuasa Kerja Pembangunan Program Kuasa Nuklear (JKPPKN);*
- *Jawatankuasa Kerja Pembangunan Projek Kuasa Nuklear (JKPPKN);*
- *Jawatankuasa Penyelarasan Pembangunan Perundangan Kuasa Nuklear (JKPPPN).*

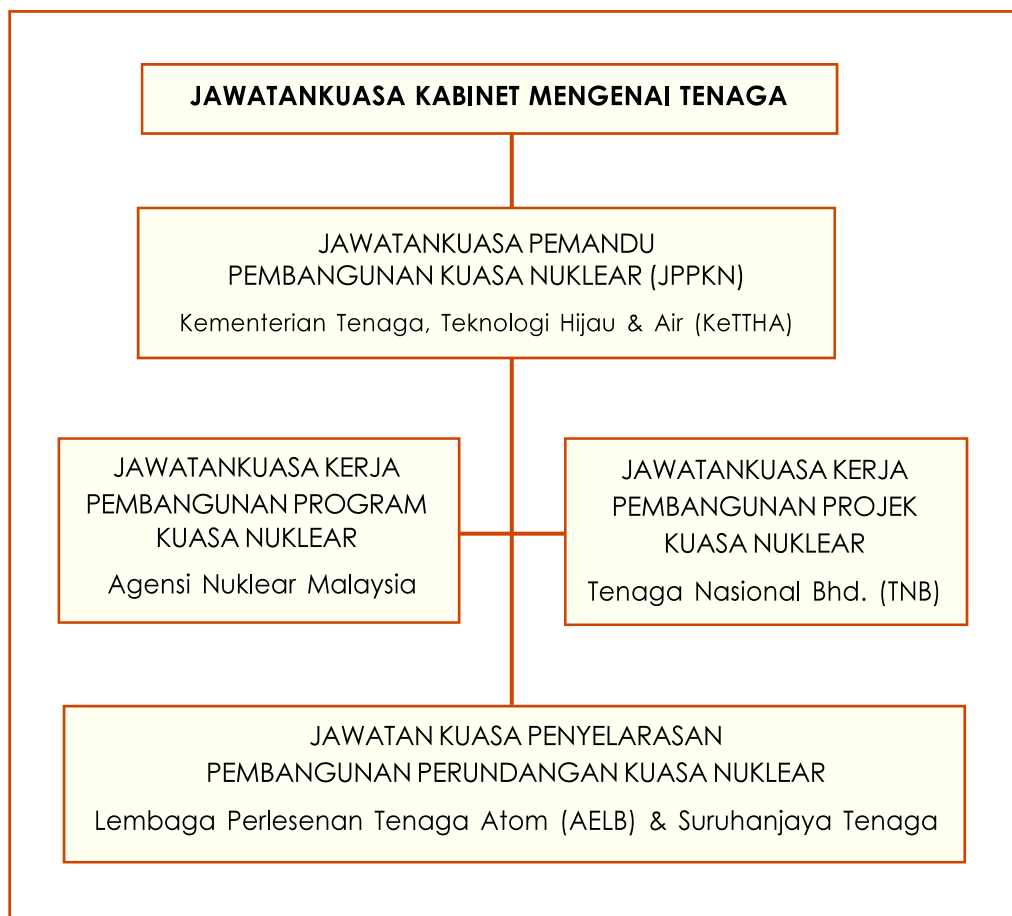
Nuclear Malaysia is a member of all the three committees. The main focuses of NPP activities are as follows:

- *Studies on the Policy Planning and all aspects of preparation for the long term implementation of the National Nuclear Power Program*
- *Planning for the Development of Human Capital Programme for the implementation of Nuclear Power Programme.*

A number of activities involving public acceptance, development of human capital and work culture were performed as follows:

1. *Briefing on nuclear power to all Members of Parliament through the Luncheon Talk for Political Stakeholders on Nuclear Energy at the Parliament on the 25th November 2009. Fifty Members of Parliament from the government and the opposition were present.*

2. Dialog secara terus dengan pertubuhan anti-nuklear dalam negara melalui *Special Session for Civil Society* dalam *3rd National Seminar on Public Information on Nuclear Energy (PINE3)* di Hotel Park Royal, Kuala Lumpur.
3. Penganjuran *International Nuclear Conference (INC'09)* serta siri perbincangan dua hala dengan pelbagai pihak. Dua bengkel dan mesyuarat antara agensi diadakan semasa persidangan tersebut, iaitu *Inter-Agency Meeting on National Self-Assessment for Nuclear Power Programme* dan *Inter-Agency Familiarisation Workshops on Nuclear Power Policy and Programme Planning & Requirements No. 1/2009*.
4. Latihan melalui program IAEA, RCA dan FNCA seperti *National Training Course on MAED*, *National Training Course on WASP* dan *National Training Course on FINPLAN*.
5. Taklimat kepada Institut Jurutera Malaysia (IEM)
6. Penyediaan draf struktur kursus ijazah kuasa nuklear universiti tempatan dengan bantuan misi pakar di bawah program *IAEA Assist Mission on Training & Education*.
7. Membantu Universiti Teknologi Malaysia (UTM) menyediakan cadangan penubuhan Fakulti Kejuruteraan Nuklear serta pembangunan silibusnya, dan juga membantu EPU mengkaji cadangan tersebut.
8. Penganjuran Bengkel Kuasa Nuklear antara agensi sebagai latihan asas seperti *Inter-Agency Familiarisation Workshops on Nuclear Power Policy and Programme Planning & Requirements No. 1/2009*
2. *Dialogue with the local anti nuclear organisation through the Special Session for Civil Society during the 3rd National Seminar on Public Information on Nuclear Energy (PINE3) at Park Royal Hotel, Kuala Lumpur.*
3. *Organising International Nuclear Conference (INC 09) with a series of bilateral talks with various parties. During the conference, two workshops and meetings; the Inter Agency Meeting on National Self-Assessment for Nuclear Power Programme and the Inter-Agency Familiarisation Workshops on Nuclear Power Policy and Programme Planning Requirement No. 1/2009 were organised.*
4. *Various trainings through IAEA, RCA and FNCA programmes such as the National Training Course on MAED, National Training Course on WASP, and National Training Course on FINPLAN.*
5. *Briefing to the Institute of Engineers Malaysia (IEM)*
6. *IAEA Expert Assist Mission on Training & Education to draft the structure for degree courses on nuclear power for local universities.*
7. *Assisting the University of Technology Malaysia (UTM) on the proposal of establishing the Faculty of Nuclear Engineering and the syllabus as well as assisting EPU to review the proposal.*
8. *Organising Nuclear Power Workshop as basic training between agencies such as the Inter-Agency Familiarisation Workshops on Nuclear Power Policy and Programme Planning & Requirements No. 1/2009*



Rajah 1: Carta Jawatankuasa Pemandu Pembangunan Kuasa Nuklear (JPPKN)

Langkah Ke hadapan

The Way Forward

LANGKAH KE HADAPAN

Dalam usaha untuk terus meningkatkan kecemerlangan, Nuklear Malaysia perlu memberi perhatian dan penekanan terhadap matlamat dan hala tujunnya supaya fungsi dan aktiviti adalah selaras dan relevan dengan MOSTI. Pencapaian dan sumbangan Nuklear Malaysia dalam Bidang Keberhasilan Utama Negara (NKRA), sentiasa dipantau bagi memastikan ia selari dengan sasaran yang telah ditetapkan.

Nuklear Malaysia telah mengambil tindakan proaktif dengan merancang aktiviti R&D yang akan dilaksanakan bagi RMK-10. Aktiviti pembangunan dan penggantian modal insan terus diberikan keutamaan. Dalam tempoh lima tahun akan datang Nuklear Malaysia akan menghadapi situasi persaraan wajib sebahagian besar penyelidik kanannya. Oleh yang demikian, pengambilan pegawai penyelidik baru akan terus dilaksanakan.

Dalam usaha untuk meningkatkan pengetahuan dan kemahiran pegawai penyelidik pelapis ini, pengajian ke peringkat ijazah lanjutan dan kursus-kursus formal telah dirancang secara menyeluruh.

THE WAY FORWARD

In an effort to continuously enhance excellence, Nuclear Malaysia needs to focus and emphasize the objectives and direction to ensure that the functions and activities are in-line and relevant with MOSTI. Nuclear Malaysia's contributions and achievements in the NKRA will be monitored to ensure that they are in parallel with the preset objectives.

Nuclear Malaysia has taken proactive actions in planning the R&D activities to be implemented in RMK-10. Development and succession of human capital were given the paramount importance. Within the next five years, Nuclear Malaysia will face a major situation whereby most of the senior researchers will go on obligatory retirement. Thus, recruitment of new researchers will be undertaken.

In an effort to enhance the knowledge and skills of new researchers, post-graduate studies and formal trainings are planned.

Keputusan Mesyuarat Jemaah Menteri pada 26 Jun 2009 telah meluluskan Memorandum Bersama Menteri Tenaga, Teknologi Hijau dan Air, dan Menteri Sains, Teknologi dan Inovasi, mengenai Cadangan Penggunaan Tenaga Nuklear Sebagai Sumber Penjanaan Elektrik Negara mengukuhkan lagi aktiviti Perancangan dan Persediaan Kuasa Nuklear.

Sehubungan dengan itu, draf Dasar Nuklear Negara yang merangkumi aspek penggunaan tenaga nuklear dan penggunaan teknologi nuklear dalam sektor bukan tenaga telah disediakan dan sedang dibincangkan antara MOSTI dan KeTTHA. Ianya dijangka akan siap digubal dalam tahun 2010 untuk dikemukakan kepada Jemaah Menteri.

Sebagai agensi yang bertanggungjawab terhadap pembangunan program kuasa nuklear, Nuklear Malaysia boleh dijadikan sebagai pusat inovasi kebangsaan untuk nuklear, MyNic Nuklear. Nuklear Malaysia mempunyai kelebihan dijadikan MyNic Nuklear kerana ia sudah lengkap dari segi keperluan organisasi, infrastruktur, modal insan dan sumber-sumber lain. Ia disokong oleh integrasi mendatar yang dipupuk di kalangan agensi, institusi serta pihak-pihak berkepentingan bagi pembangunan program kuasa nuklear kebangsaan.

The Cabinet Meeting's decision on 26 June 2009 has approved the Joint Memorandum between the Minister of Energy, Green Technology & Water and the Minister of Science, Technology & Innovation, on the Proposal on the Usage of Nuclear as a Source for Electricity Generation, Nationwide to strengthen the activities on Nuclear Power Planning and Preparation.

Consequently, a draft of the National Nuclear Policy covering aspects of the application of nuclear energy and the application of nuclear technology in non-power sectors has been prepared and is being deliberated between MOSTI and KeTTHA. It is expected to be finalised in 2010 to be forwarded to the Cabinet.

As the agency responsible for nuclear power programme development, consistent with its role as the lead agency for the Nuclear Power Programme, Nuclear Malaysia can serve as a Nuclear MyNic. The advantage of designating Nuclear Malaysia as a Nuclear MyNic is because it is already equipped with the pre-requisite organisational, infrastructural, human capital and other resources. It is also supported by the horizontal integration that is fostered by other relevant agencies, institutions and stakeholders for the development of the national nuclear power programme.

Pemilihan Nuklear Malaysia sebagai MyNic Nuklear akan mempercepatkan proses penubuhan MyNic yang lain dengan modal yang minima dan membolehkan pelaksanaan aktiviti-aktiviti inovasi yang mempunyai impak dan nilai tambah yang tinggi. Ini juga akan memendekkan rangka masa bagi impak MyNic kepada ekonomi negara dan kesejahteraan rakyat.

The designation of Nuclear Malaysia as a Nuclear MyNic should short-circuit the process of establishing other MyNics, with minimal new capital outlay by the government, thereby, enabling the immediate execution of high-impact and high-value added innovation activities. This would also ensure a shorter time frame for the impact of the MyNic to the national economy and social well-being.

Aktiviti Rekreasi Recreational Activities



Perlumbaan Perahu Panjang Antara Agensi Kerajaan di Pesta Sukan Air Putrajaya. Nuklear Malaysia telah berjaya merebut gelaran Naib juara



Kontinjen Nuklear Malaysia di Majlis Sambutan Maulidur Rasul Peringkat Kebangsaan



Aktiviti Rekreasi

Recreational Activities



Mailis ramah mesra bersama Y. Bg. Datin madinah Mohamad, Ketua Setiausaha, Kementerian Sains, Teknologi & Inovasi dan Pn Hajah Ruziah Mohd Tahir isteri Y. B Timbalan Menteri Sains, Teknologi & Inovasi, selaku Timbalan Penaung Puspanita Mosti



Aktiviti senaman pagi sempena Hari Keluarga Nuklear Malaysia



Ibadah Qurban Hari Raya Aidiladha

Senarai Penerbitan

List of Publications

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1. **Abd Aziz Mohd Ramli**, G.D.P Mahalachimi Dave, Gui Ah Auu, **Husaini Salleh**, **Idris Besar**, Lee Peter, Mohamed Ali Abdul Khader, **Mohd Ashhar Khalid**, **Mohd Fazly Abdul Rahim**, **Muhammad Jamal Md Isa**, Ng Chee Moon, Ram Piari, **Shaharuddin Mohd**, **Siti Najila Mohd Janib** and Teoh Hoon Heng, Medical X-Ray. Second Edition, Agensi Nuklear Malaysia, 2009, ISBN 978-967-9970-41-8.
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