INSTITUTE OF NUCLEAR TECHNOLOGY – RADIATION PROTECTION

ANNUAL REPORT 2005 - 2006

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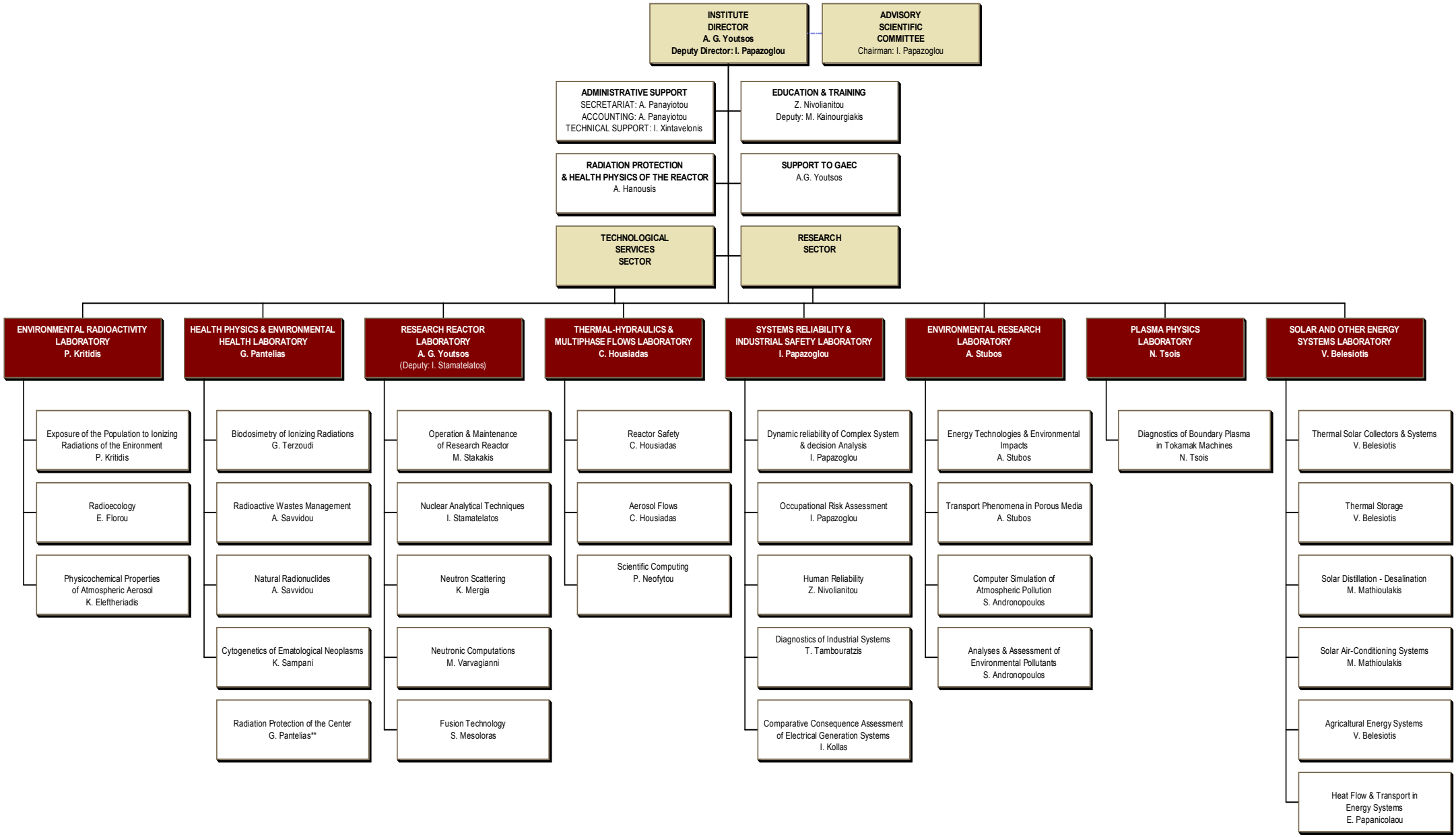
CONTENTS

1.	Organisational Chart	page	4
	Preface	page	5
2.	Activity Report/Perspective	page	6
	2.1 Activity Report		6
	2.2 Achievements in 2005 - 2006 and Perspective		8
	2.3 Education		10
3.	Laboratories	page	11
	Facts and Figures	page	29
4.	Personnel	page	30
5.	Funding	page	31
6.	Expenditure of the Institute	page	34
7.	Publications	page	36
8.	Research Projects	page	72

ORGANISATIONAL CHART 2006



*Laboratory: Research, Development and Services
**reports to the Director of the Centre

PREFACE

The Institute has continued transferring know how from Nuclear Technology to other areas of great importance for the Greek society, such as advanced materials, cultural heritage and medical applications, and the development of environmental, energy and health technologies. The research activities of the Institute attract significant funding from European and National Competitive Research programs and International organizations. The success in the research activities of the Institute is demonstrated by the large number of scientific publications in prestigious international journals and the number of citations.

The Environmental Radioactivity Laboratory carried out research on assessment of the impact of ionizing radiation on several types of ecosystems, atmospheric aerosol, and heavy metal pollution of environment and continued its routine monitoring of environmental radioactivity in Greece.

The Health Physics & Environmental Health Laboratory has developed state of the art methodologies in biological dosimetry and cancer cytogenetics for the evaluation of radiation sensitivity, cancer proneness, myelodysplastic and leukemic diseases, and for these activities it has been nominated as the reference laboratory in Greece.

The Nuclear Research Reactor Laboratory has continued in developing new experimental facilities for fulfilling the aim of becoming a Centre of Excellence in Neutron Science and Technology. The laboratory in collaboration with European partners is participating in the development and characterization of advanced materials for aerospace, fusion and fission applications. At the second part of 2006 an ambitious refurbishment/upgrade programme of the reactor systems has been launched with the aim to extend the reactor lifetime to at least fifteen years and achieve a continuous operation. A Business Plan for the implementation of the reactor renovation plans and its full exploitation is under preparation and it will be submitted to GSRT in early 2007.

The Laboratory of Thermal–Hydraulics and Multiphase Flows (THEMLAB), the newest Laboratory of INT-RP, exploits the longstanding experience of INT-RP in its field and shapes them according to the needs and challenges of currently emerging R&D applications requiring similar scientific know-how, like aerosol medicine, nanotoxicology, industrial hygiene, environmental health, and particle-biofluid mechanics.

The Systems Reliability and Industrial Safety Laboratory (SRISL) continued the development of the methodology for the quantification of the workers' occupational risk, the optimization of risk reducing measures, and the application of this methodology in the Dutch working population. Furthermore SRISL worked on the development of methodologies for the quantification of Human Reliability.

The Environmental Research Laboratory (EREL) has continued to perform R&D in air quality and dispersion of pollutants, decision support systems, nanomaterials and their use in energy and environmental issues, hydrogen safety and storage (the Laboratory staff is coordinating the European Integrated Project on Hydrogen Storage in Solids).

The Laboratory of Thermal Energy Systems continued its R & D work in the area of solar thermal energy utilization and energy savings, with emphasis on the development of new products, methods and analytical tools, and received an award for its long-time involvement with solar energy (over 25 years) at the ISES 2005 Solar World Congress.

Looking in the future, the Institute of Nuclear Technology & Radiation Protection will continue its research activities in the fields in which it has acquired International recognition, and will encourage initiatives in emerging relevant research areas.

Dr. A.G. Youtsos
Director of INT-RP
Member of the Board of Directors of NCSR Demokritos

2. ACTIVITY REPORT/ PERSPECTIVE

2.1. ACTIVITY REPORT

The activities of the Institute of Nuclear Technology – Radiation Protection (INT-RP) cover the following fields:

I. Nuclear Technology & Radiation Protection (NT&RP)

The INT-RP is the only centre in the country encompassing integrated know how on Nuclear Technology and Radiation Protection and operates and exploits unique infrastructure for the benefit of the Greek research community and society. It has established co-operative links with similar Institutions in Europe and internationally and its facilities attract researchers from the neighbouring countries and Europe. Among the activities of the INT-RP, described in detail in other parts of this report, the following are worth mentioning. The INT-RP

- owns, operates and exploits the only Experimental Nuclear Reactor in Greece (5MW). Through the reactor operation, expertise in the field of nuclear reactor technology is maintained and it is transferred to the new generation of engineers and scientists. Around the reactor a number of large scale facilities for research and technology have been developed. Among the application areas of this infrastructure are materials science and nano-technology, health, environment and cultural heritage. Access to these facilities is open to all the Greek, neighbouring countries and European researchers. These large scale facilities, utilizing the reactor produced neutrons, are unique in the Balkan and East Mediterranean region and render the Greek Research Reactor as a Large Scale Facility in the European Research Area. INT-RP also represents Greece in European and International fora on Nuclear Research Reactors, Neutron Scattering, Nuclear Analytical Techniques and on fission and fusion and supports in a large number of relevant activities the Greek Atomic Energy Commission and the Greek State.
- is the only Institution in Greece which carries out research and development in the Fusion Technology for the European Fusion Program and the study of advanced materials for fusion and fission applications. It is also the co-ordinator of the Greek Fusion Program.
- is an integrated radiation protection sector in Greece, a fact that is of significance, considering the existence of a wide range of ionising radiation applications in industry and medicine in the country. The importance of the NT&RP expertise became obvious following the Chernobyl accident, whereby the contribution of the INT-RP for tackling the after-effects of the accident proved decisive. The INT-RP supports – both technically and scientifically - a large number of the activities of the Greek Atomic Energy Commission (GAEC). It is also worth mentioning that the national radiological emergency plan XENOKRATES as well as the greater part of Greek radiation protection safety regulations were developed by the personnel of the INT-RP. The majority of the scientific committee members of the XENOKRATES plan come from the personnel of INT-RP.
- is the sole centre in Greece with expertise and equipment for handling radioactive waste, whereby it constitutes the only unit in the country capable of providing and implementing solutions to the waste handling problem.
- encompasses the only integrated Laboratory of Environmental Radioactivity in Greece, with an extensive network of sampling/measuring/monitoring stations covering the entire country.
- the laboratory of Health Physics and Environmental Health constitutes the sole Greek Laboratory with expertise in the field of overexposure to ionising radiation . It constitutes one of the Laboratories selected by the International Atomic Energy Agency (IAEA) for prototyping the methodology of biological dosimetry.

II. Environmental Technology

A significant number of activities have already been developed in this area, involving a large (larger than the critical mass) number of researchers and specialised operators of the INT-RP. More specifically, the INT-RP is the sole research institute in the country with an integrated R&D approach to environmental matters combining the fields of diagnosis, prognosis, impact and pollution technology.

- The ensemble of activities of the Laboratory of Environmental Radioactivity concerns environmental technology in terms of both pure research and environmental quality evaluation studies. Furthermore, research on aerosols has become a subject of increased interest for the laboratory.
- The same is true of the largest part of activities of the Laboratory of Environmental Research, with its personnel specialising in (conventional and radioactive) pollutant dispersion.
- The Laboratory of System Reliability and Industrial Safety is mainly concerned with R&D in matters of risk analysis, including environmental pollution from large-scale industrial accidents. A number of case studies related to environmental pollution scenarios from chemical industries in Greece have been realised in the framework of the "Sevezo directive" of the European Union.
- The Laboratory of the Experimental Nuclear Reactor has the potential of detecting/identifying environmental contaminants (with a resolution capability of ppm) employing environmental sample neutron activation.
- It becomes clear, thus, that the INT-RP constitutes - by far - the most experienced and reliable consultant of the Greek public and private Greek sector in matters of environmental protection. This is demonstrated by:
  - Its contribution in guiding the environmental crises during the Chernobyl accident and the war at Yugoslavia (fear of depleted of uranium).
  - The increase in incoming funds – during the last five years - from the provision of services to the public and private sector in matters of environmental protection

III. Energy Technology

- It is apparent that the areas related to (both fission and fusion) reactor technology fall into the more general area of energy technology.
- The Laboratory of Thermal Energy Systems receives considerable external funding and provides specialised services R&D in the related productive sectors. The reliability of the provided services is certified by the recently awarded EN45001 accreditation.
- The personnel of the laboratory of System Reliability and Industrial Safety investigates the environmental impact of conventional electricity production plants as well as matters concerning the programming of electrical energy production.
- The laboratory of Environmental Research has developed significant research activity in the areas of enhanced hydrocarbon recovery from underground reservoirs (the emphasis being on the simulation of fluid flow and dispersion processes), hydrogen technology for energy generation (the emphasis being on issues of safety and storage), and energy efficient separations (the emphasis being on membrane technology).

IV. Health Technology

- Biological tissue disinfection/sterilisation (bones, skin, tendons) is performed in the Experimental Nuclear Reactor; these tissues are, subsequently, used in transplant operations.
- The Health Physics & Environmental Hygiene Laboratory gives proper and continuous recognition to problems related to all potential radiation induced health hazards. Specifically, the Laboratory provides operational health physics services related to the Radiation Protection Program in NCSR "Demokritos" and the evaluation of radiation overexposures and radiation accidents in general, by means of biological dosimetry methods. Its research activities involve the use of radiation cytogenetics, molecular genetics and radioisotope methodologies to study questions of basic and applied research in radiation protection, radiobiology and radioactive waste management. In addition, the Laboratory based on its expertise in radiation protection, radiation biology and cancer cytogenetics, offers specialized services for the calibration of radiation survey meters, for the development of individualized protocols for radiotherapy treatment, as well as for the diagnosis of preleukemic and leukemic diseases.
- Nuclear analysis techniques are under development for the in vivo and in vitro study of the composition of the human body.

2.2. ACHIEVEMENTS IN 2005 - 2006 AND PERSPECTIVE

The strategic objectives have been, and will continue to be, to perform research, to develop products and to provide services.

Emphasis has been placed on (a) publishing in international peer reviewed journals, (b) winning R&D programmes, mainly from the EU and (c) providing high technology services. Research and development performance is reflected in the number (Fig.1) and quality of publications and externally financed programs (mainly from EU), Fig2. Commercial exploitation of research activity is reflected mainly in Fig.3, but also in a number of externally financed programs.

The Institute is financially healthy and has self-financed significant building and equipment infrastructures. In addition it finances the employment of a large number of scientific, technical and administrative personnel.

- Since the Nuclear Research Reactor is a unique Large Scale Facility for Greece and of great national importance steps have been taken in order to upgrade and modernize many of its facilites with the aim to attain continuous reactor operation and life extension of its components for another 15-20 years. In the last six months of 2006 all the systems of the reactor were surveyed by experts and reports on their modernization and upgrading are expected early in 2007.
- Through INT-RP participation in the European Integrated Project "Materials at Extreme Environments" we have solely assigned the undertaking to characterize materials for aerospace, fission and fusion applications by neutron scattering techniques. This serves as an example of the European wide recognition of the INT-RP expertise in employing neutron scattering techniques for the study of advanced materials.
- Extension of the neutron scattering facilities through the development of complementary X-ray techniques. Already a SAXS apparatus has been installed and it is operational.
- Through our participation in the project "Integrated Enviromental Centre" new experimental facilities and computational infrastructure are under development.
- A new contemporary building, for handling and temporary storage of radioactive sources, was erected to international standards (funding by the ministry of Environment and Public Works and the Greek Atomic Energy Commission).

Mid term goals include

- A Strategic Planning for upgrading, full operation and exploitation of the Nuclear Research Reactor is planned to be ready early in 2007.
- Full renovation and upgrading of the Nuclear Research Reactor operation facilities are planned. Early 2007 the reports and preliminary estimates for this undertaking will have been delivered. Once funding has been attracted, the necessary procedures will be intiated. A large part of the work will be put for International competition for companies specializing in Nuclear reactors and also steps will be taken for Greek companies to participate in the consortium. These actions will require a long scheduled reactor shutdown and re-deployment of some of the personnel.
- Trainning of young engineers in the field of Nuclear Technology.
- The suggestion of the international scientific jury of the "Centre of Excellence Programme" (which is in agreement with the policy of the INT-RP) of giving priority to the neutron diffractometer and the development of new neutron scattering facilities will be fully implemented. For this the installation of a TOF reflectometer, SANS and USANS facilities are being implemented.
- Emphasis will be given in the applicaton of nuclear analytical techniques in industrial, environmental and medical studies.
- The development of a methodology for the evaluation of environmental quality, as related to conventional and radioactive pollution, is in progress at the ERL, based on the analysis of cytogenetic mutations in natural aquatic populations. Development of methodology for source identification and apportionment of atmospheric pollutants, by means of elemental and radioactive aerosol tracers.
- The SRISL will develop optimum strategies for responding to Emergencies owing to major industrial accidents. (Previous peer review recommendation) and quantified risk models for various cases of work related accident extending the concept of risk assessment of major accidents to the

smaller accidents involving individual workers (Participation to Large Programme by ministry of Labour and Social Affairs of the Netherlands). It will also continue R&D in risk assessment and management methodology and application on new technologies (e.g. nanotechnology) and assessment of the integrity of vital infrastructures. It will also develop models for integrating human factors in safety analysis of complex technological systems and continue work on Soft Computing.

Finally it should be noted that the importance – for the country, the protection of the environment and the health of the population - of maintaining a critical mass of researchers working in the area of NT&RP is self evident. Consequently, special emphasis has been given, and will continue to be given, in this direction.

2.3 EDUCATION

The Institute provides, each year, a number of seminars and courses on the following topics

(i) radiation protection
(ii) nuclear technology

Lecture notes are available on these topics and are continuously being updated.

It is worth noting that the IAEA mission on Integrated Safety Assessment of the Research Reactor found that our reactor is a safe system, operated by experienced, well trained personnel with high standard of safety. The mission characterised as "good practice"[1]: (a) the personnel training (b) dosimetry and (c) the existence of a Probabilistic Safety Assessment in the Safety Analysis Report of the Reactor.

In the period 2005-2006, 4 Doctoral Dissertations, 5 Post-graduate Diploma Theses, 9 Diploma Theses and 8 Training Courses have been completed

[1] Definition of "good practice", as given by IAEA: "It is a proven performance, activity of use of equipment, which the team considers to be markedly superior to that observed elsewhere. It should have broad application to other facilities".

3. Laboratories

- **Research field**
- **Achievements**

NUCLEAR RESEARCH REACTOR LABORATORY (NRRL)

Head: Dr A. Youtsos
Deputy Head: Dr I.E. Stamatelatos

Personnel

Researchers and Functional Scientific Personnel	6
Other Scientists:	3
Co-operating Researchers:	1+1
Scholarships:	3
Technicians:	14

Subject

The Research Reactor Laboratory:

- Operates the Greek Research Reactor (GRR-1)
- Maintains and develops know-how on Reactor Technology
- Carries out research on reactor technology and physics
- Participates in a number of EU, IAEA and GSRT research programs
- Provides services on environmental, health and material issues
- Participates in International fora and has collaborative agreements and links with European and International research centers
- Trains young scientists and students on reactor physics, technology and radiation protection, neutron scattering and nuclear analytical techniques
- Provides support to Government, public bodies, organizations and industries

Activities

The R&D activities at the reactor during 2005-2006 can be summarized as following:

- Materials and Nanotechnology
  - Magnetic thin films studied by neutron scattering techniques and magnetic measurements
  - Electrical, magnetic and structural properties of ITER materials
  - Porosity of graphites by neutron scattering techniques
  - Development of oxidization resistance in multilayered structures
  - Oxidization phenomena of thin films of SiC
  - Oxidization of ITER first wall materials studied by neutron reflectivity
  - Development of multilayered structures for aerospace applications
  - Neutron scattering on rare-earth molybdates
  - Amorphous bulk magnetic materials
- Environmental Studies
  - Study of nanomaterials for environmental applications using neutron and X-ray techniques
  - Study of surface phenomena
- Health
  - Study of toxic trace elements in tissues and biological fluids
  - Small animal body composition studies
  - Feasibility studies on elemental analysis of large volume biomedical samples using the neutron activation technique

- Cultural Heritage
  - Non-destructive, multi-element analysis of whole artifacts for provenance and authenticity studies using large sample neutron activation technique
- Nuclear Technology & Radiation Protection
  - Neutronic analysis of reactor core
  - Criticality, safety, fuel burn-up
  - Thermohydraulics
  - Instrument design
  - Shielding optimization
  - Characterization of radioactive waste using non-destructive techniques
  - Development of nuclear techniques for analysis of large volume environmental and cultural heritage samples and biomedical applications
  - Study of leaching mechanisms of ions incorporated in blocks of solidified waste
- Infrastructure development
  - Design and development of neutron Time-of-Flight apparatus
  - Neutron optical devices
  - Neutron detection electronics
  - Neutron monochromatization instrumentation
  - Automation and control of micro-positioning devices
  - Development of data acquisition systems
  - High and low temperature apparatus
  - Gamma-ray spectrometry laboratory
- Software development for
  - Data acquisition
  - Neutron scattering data analysis
  - Neutron detection
  - Instrument control
  - HP Germanium semiconductor detector modeling

During the period 2005-2006, GRR-1 was shutdown for maintenance and preparation of core conversion to LEU. GRR-1 is scheduled to restart in 2007 using exclusively LEU fuel.

Achievements:

- A new Reactor Safety Committee has been apointed and outside experts were employed and the first administrative steps were taking in order to modernize the Reactor operations procedures and train the personnel according to Interantionally required standards.
- In the last six months of 2006 all the systems of the reactor operation were surveyed by experts and reports on their complete modernization and upgrading are expected early in 2007.
- The report for HEU to LEU core conversion has been completed and sumitted to Reactor Safety Committee.
- Through the laboratory participation in the European Integrated Project "Materials at Extreme Environments" we have solely assigned the undertaking to characterize the within the project developed the materials for aerospace, fission and fusion applications by neutron scattering techniques. This serves as an example of the European wide recognition of the INT-RP expertise in employing neutron scattering techniques for the study of advanced materials.
- Extension of the neutron scattering facilities through the development of complementary X-ray techniques. Already a SAXS apparatus has been installed and it is operational.
- Through our participation in the project "Integrated Enviromental Centre" new experimental facilities and computational infrastructure are under development.

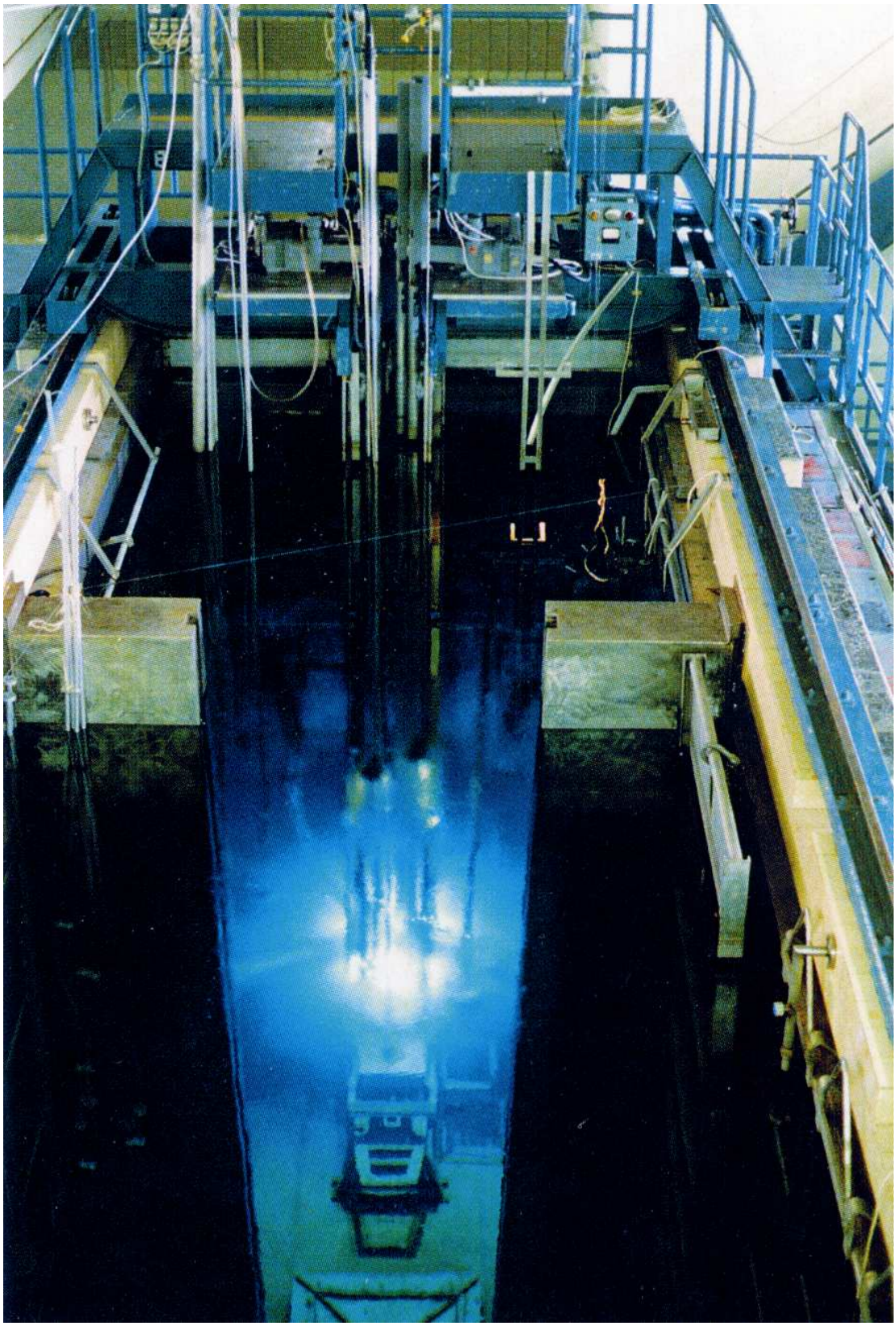
Education

Diploma Theses

1. Παναγιώτης Ανδρικόπουλος, «Σχεδιασμός, κατασκευή και λειτουργία chopper νετρονίων», Καποδιστριακό Πανεπιστήμιο, Τμήμα Φυσικής, (2006)
2. Θεοδώρα Βασιλοπούλου, «Ανάλυση δειγμάτων με νετρονική ενεργοποίηση», ΕΜΠ, Σχολή Εφαρμοσμένων Μαθηματικών και Φυσικών Επιστημών, (2006)
3. Φανουρία Αντωνίου, «Χαρακτηρισμός και βελτιστοποίηση φασματοσκοπικής διάταξης ανιχνευτή γερμανίου και εφαρμογές στην ακτινοπροστασία πυρηνικού αντιδραστήρα», ΕΜΠ, Σχολή Εφαρμοσμένων Μαθηματικών και Φυσικών Επιστημών, (2006)

Training courses

1. Θεοδώρα Βασιλοπούλου, ΕΜΠ, Σχολή Εφαρμοσμένων Μαθηματικών και Φυσικών Επιστημών, (2005)
2. Φανουρία Αντωνίου, ΕΜΠ, Σχολή Εφαρμοσμένων Μαθηματικών και Φυσικών Επιστημών, (2005)
3. Ιωάννα Μαυροπούλου, ΕΜΠ, Σχολή Εφαρμοσμένων Μαθηματικών και Φυσικών Επιστημών, (2006)
4. Στέλλα Μεράκου, Καποδιστριακό Πανεπιστήμιο, Τμήμα Φυσικής, (2005)
5. Ζωή Κότσινα, Καποδιστριακό Πανεπιστήμιο, Τμήμα Φυσικής, (2006)
6. Διονύσης Νανόπουλος, ΕΜΠ, Σχολή Εφαρμοσμένων Μαθηματικών και Φυσικών Επιστημών, (2006)
7. Ελένη Μαρίνου, ΕΜΠ, Σχολή Εφαρμοσμένων Μαθηματικών και Φυσικών Επιστημών, (2006)
8. Μέρσια Αγαμέμνωνος, ΕΜΠ, Σχολή Εφαρμοσμένων Μαθηματικών και Φυσικών Επιστημών, (2005)



Research Reactor

ENVIRONMENTAL RADIOACTIVITY LABORATORY (ERL)

Head: P. Kritidis

Personnel

Researchers and Functional Scientific Personnel	4
Other Scientists:	1
Co-operating Researchers:	0.3 (1 part-time)
Scholarships:	2
Technicians:	5
Post-doc fellows:	0
Graduate students (diploma):	1

General description

The scientific subject of ERL is the environmental radioactivity (soil radioactivity, indoor radon, marine radioactivity, aerosol radioactivity). ERL operates also a network of 40 sampling and measuring stations across the country, which is a key part of the National routine network. ERL is also engaged with radiological certification of imported and exported foods and materials.

Research activities

1. Coordinated research projects in collaboration with other scientific teams from research centers and universities, local authorities and international organizations. Topics:
   - Radioecology and radio-eco-toxicity.
   - Physicochemical properties of atmospheric aerosol.
   - Source apportionment and receptor modeling.
   - Risk assessment in indoor, urban and natural environments.

2. Applied research projects related to the radiological and conventional impact of human activities.

3. Control of radioactivity in various environmental media and food radioactivity control, in accordance with the frame program REM of DG XI / EU and the national obligations related to it. The routine monitoring network includes 40 stations for sampling of air, radioactive deposition, surface and drinking water, soil and food. The routine monitoring is performed according to assignment of the Greek Atomic Energy Commission.

4. Technical studies and measurements on demand of third parts.

ERL is a part of the REM network of DG XI / EU (Environmental Radioactivity of the European Community). The services provided are of approximately 75 000 Euro per year and include:

- Analysis of radionuclides in food and other samples and issuing of related certificates to Greek and foreign enterprises and persons.
- Radiological studies in regions of enhanced natural radioactivity, after the request of private enterprises or governmental organizations.
- Analysis of heavy metals in environmental and other samples.

The scientific staff of ERL provides expert services in national and/or international committees (EU, IAEA, Greek ministries), including reviews in scientific journals. They are also engaged in educational activities (supervising of PhD fellowships, diploma works, participation in university post-graduate studies and seminars, EU and IAEA seminars e.a.).

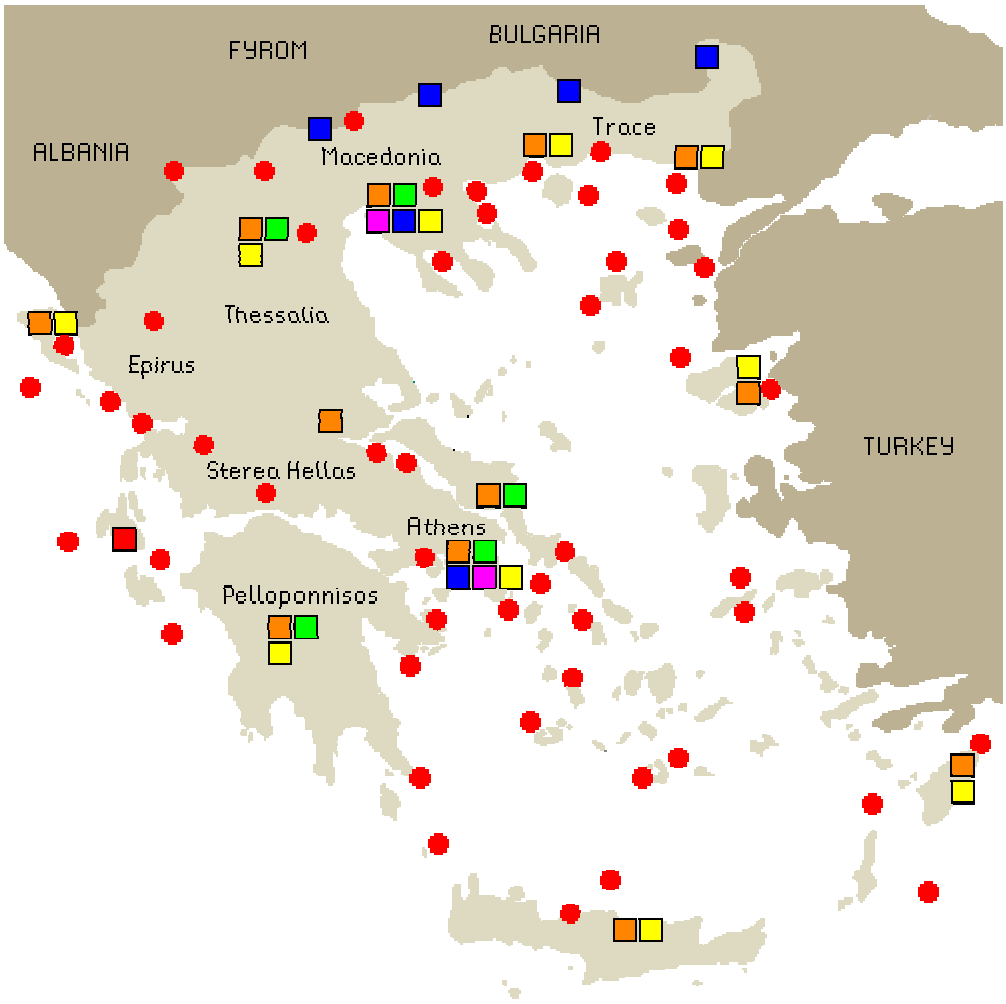
Education

Post graduate diploma theses

1. Ευαγγελίου Ν., 2005. Οριζόντια διασπορά και κατακόρυφη κατανομή Cs137 στην υδάτινη στήλη περιοχών του Κορινθιακού και Πατραϊκού κόλπου με δύο μεθόδους συγκριτικά. ΜΔΕ (Master of Science), ΕΚΠΑ, Τμήμα Χημείας.

2. Μποκώρος Π., 2006. Οριζόντια διασπορά και κατακόρυφη κατανομή Cs137 στην υδάτινη στήλη του Βρειοανατολικοί Αιγαίου πελάγους, ΜΔΕ (Master of Science), Παν. Πατρών, Τμήμα Χημείας.

The sampling network:



*The **red circles** represent areas where marine radioactivity studies have been performed **occasionally**.*

Total beta activity in air
Radioactive deposition
Total beta activity of surface and drinking water
Gamma-ray intensity
Specific radionuclides in milk and mixed diet

HEALTH PHYSICS & ENVIRONMENTAL HYGIENE LABORATORY (HPEHL)

Head: G. Pantelias

Personnel

Researchers and Functional Scientific Personnel	3
Other Scientists:	1
Co-operating Researchers:	-
Scholarships:	2
Technicians:	4

General Description

Since the early days of its foundation in 1960 the Health Physics & Environmental Hygiene Laboratory of the Institute of Nuclear Technology & Radiation Protection, gives proper and continuous recognition to problems related to all potential radiation induced health hazards. Specifically, the Laboratory provides operational health physics services related to the Radiation Protection Program in NCSR "Demokritos" and the evaluation of radiation overexposures and radiation accidents in general, by means of biological dosimetry methods. Its research activities involve the use of radiation and cancer cytogenetics, molecular genetics and radioisotope methodologies to study questions of basic and applied research in radiation protection, radiobiology, cancer genetics and radioactive waste management. In addition, the Laboratory, based on its expertise in radiation protection, radiation biology and cancer cytogenetics, offers specialized services for the calibration of radiation survey meters, for the development of individualized protocols for radiotherapy treatment, and for the diagnostic and follow-up cytogenetic evaluation of patients with hematological neoplasms.

Research activities

The research activities of the Laboratory contributed essentially to the:

- Elucidation of the mechanisms underlying the biological effects of ionizing radiation at the molecular, chromosomal and cellular level.
- Development of cytogenetic methodologies in combination with molecular DNA-probes for biomonitoring purposes and the development of reliable and sensitive biological dosimeters for the estimation of absorbed radiation doses and cancer risk.
- Development of cytogenetic methodologies for the identification of persons with increased radiosensitivity and genetic predisposition to cancer, and the individualization of radiation therapy treatments.
- Study of the role of stable reciprocal translocations and chromosomal rearrangements in the mechanism of radiation induced carcinogenesis.
- Development of cytogenetic methods for the evaluation of mutagenic and carcinogenic potential of genotoxic chemicals.
- Molecular cytogenetic analysis of hematological neoplasms: characterization of genomic rearrangements, amplification of specific genes, exploration of genetic recombinations for the identification of critical mechanisms involved in leukemogenesis.
- Interindividual differences in susceptibility to leukemia and neurological diseases: polymorphisms of genes involved in the detoxification of xenobiotic compounds after genotoxic exposures.

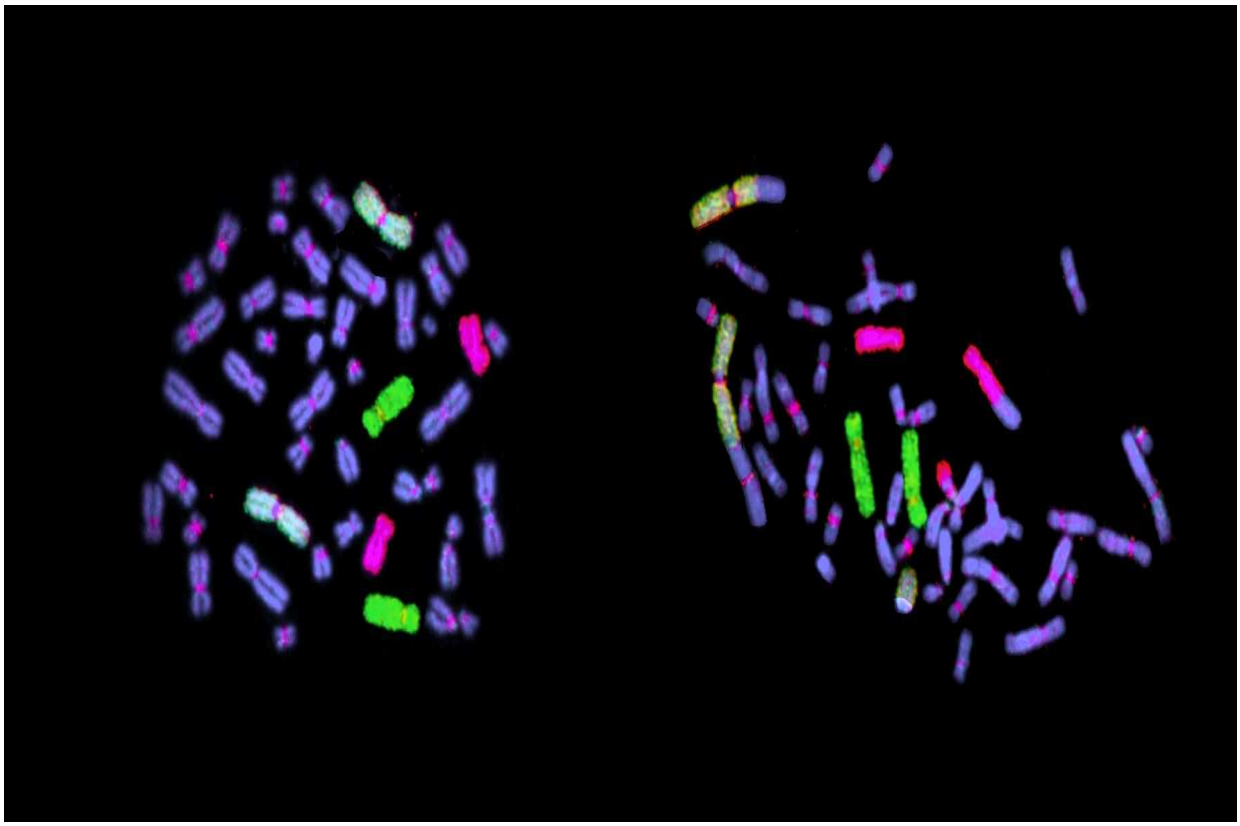
Achievements

The Health Physics & Environmental Hygiene Laboratory has been the reference laboratory of the Greek Atomic Energy Commission and the International Atomic Energy Agency (IAEA) for biological dosimetry studies and the evaluation of absorbed doses in cases of radiation accident, as well as for standardization of state of the art methodologies applied for biodosimetry purposes. The Laboratory belongs to the "European LeukemiaNet"(ELN), (Network of Excellence for Leukemia, supported from the FP6 Program of the European Community) and it is the National Reference Laboratory for the cytogenetic characterization of myelodysplastic syndromes (nominated by the Hellenic Society of Hematology). Specialized scientific services offered to major hospitals and private clinics for the improvement of diagnostic and prognostic evaluation of leukemic diseases. During the year 2006, bone marrow biopsies obtained from 2565 patients were analyzed and characterized using cytogenetic methodologies.

Education

Post-graduate Diploma Theses

1. Jana Meresova 2005 "Διαπανεπιστημιακό και Διατμηματικό Μεταπτυχιακό Ακτινοπροστασίας":



Cytogenetics of hematological neoplasms

ENVIRONMENTAL RESEARCH LABORATORY (EREL)

Head: Dr. A. Stubos

Personnel:

Researchers and Functional Scientific Personnel	2
Other Scientists:	6
Co-operating Researchers:	1
Scholarships:	2
Technicians:	1

General Description

The Environmental Research Laboratory (EREL) is part of the Institute of Nuclear Technology-Radiation Protection of the National Centre for Scientific Research "Demokritos" (NCSRD). EREL with its over 20-years experience and its highly specialised scientific staff is one of the leading environmental research laboratories in the country with strong scientific links to many Research and Academic Organizations worldwide. The general aim of EREL is the production of scientific know-how and innovative tools for research and provision of services in the fields of environment and energy. The Laboratory is equipped with modern facilities for the measurement of air pollution and powerful computing equipment and provides high-level services in a wide range of issues related to environment and energy (air quality and environmental impact assessment, nanoporous materials characterization, gas storage). The Laboratory has been awarded ISO 9001 for software development in atmospheric applications while accreditation according to EN 17025 for specific gas pollutant measurements is underway (particulate matter, volatile organics, etc). EREL carries out several research projects with substantial external funding (mainly from EC), in several of which acts currently as coordinator of European consortia of universities, research institutions and industries. In the framework of these activities, EREL has developed a broad range of cooperation with Public and Private Organisations both within and outside Greece, while actively participating in international scientific networks (e.g. ENERO, ERCOFTAC, MESAEP).

Research activities

In line with current international trends, EREL places emphasis in R&D activities relevant to hydrogen technology, simulation of atmospheric pollutant dispersion in realistic conditions, diagnostic and prognostic meteorological modelling, contribution of anthropogenic and biogenic pollutants to global warming and urban pollution, simulation of underground hydrocarbon and water reservoirs and characterization of nanoporous materials for environmental (gas separations, storage of CO_2 and H_2) and bio-medical applications (controlled release systems, transdermal drug delivery).

In parallel, EREL continues to produce and publish original methods and results in the wider area of computational fluid mechanics, with applications in pollutant dispersion, influence of meteorology and pollutant sources distribution in urban pollution, tropospheric ozone concentrations due to anthropogenic and biogenic pollutants in the Mediterranean area, turbulence simulation, transport phenomena in porous media, and flow and mass transport in multiphase systems.

The high R&D performance of EREL is deduced from: (i) its wide experience in carrying out (not only as participating research organisation but also as coordinator) large scale research projects, (ii) the large number of scientific publications in international journals and conferences, (iii) the successfully accomplished contracts of service provision to Public and Private Bodies, (iv) the organisation of international conferences, (v) the participation in International networks and (vi) acting as national representative in various international organisations.

Achievements

In addition to the above, important achievements of the Laboratory include the following:

- Coordination of the NESSHY FP6 Integrated Project on Hydrogen Storage in Solids
- Development of state-of-the-art software for diagnostic and prognostic meteorological simulations, atmospheric dispersion of pollutants (toxic, radioactive, flammable, photochemical, heavier or lighter than air) in complex terrains
- Development of software for the simulation of sorption, flow and diffusion in porous materials
- Development of computational and experimental methods for the characterization of porous materials

- Fully equipped laboratory for organic pollutant measurements with high sensitivity analytical chemistry devices (GC/FID/FPD, GC/MS with Thermal Desorption Unit, HPLC)
- Highly specialised portable unit for field measurements of atmospheric pollutants
- Development and use of RODOS (Real-time On-line DecisiOn Support for nuclear emergencies in Europe) system
- Participation in the "Nuclear Technology" Group of the Emergency Plan of the Greek Atomic Energy Commission
- National representation in COST Senior Official Committee and in Advisory Committee for Radioactive Waste Management (ACPM) of the EU.

Education

Doctoral Dissertations

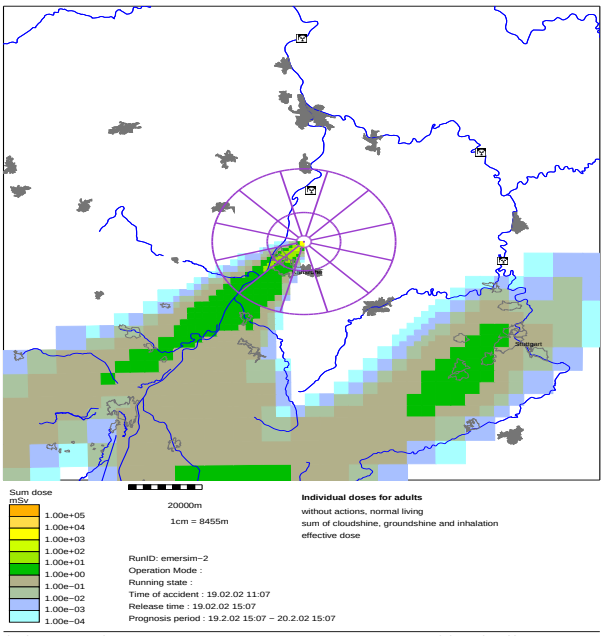
1. Μ. Σταματάκης (2005), "Μελέτη Διεργασιών Ροής και Καταβύθισης σε Πορώδη Μέσα με Χρήση Ιχνηθετών" Τμήμα Χημικών Μηχανικών του Εθνικού Μετσόβιου Πολυτεχνείου

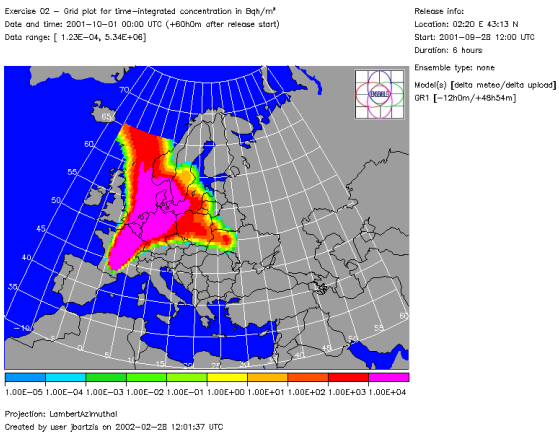
Post-graduate Diploma Theses

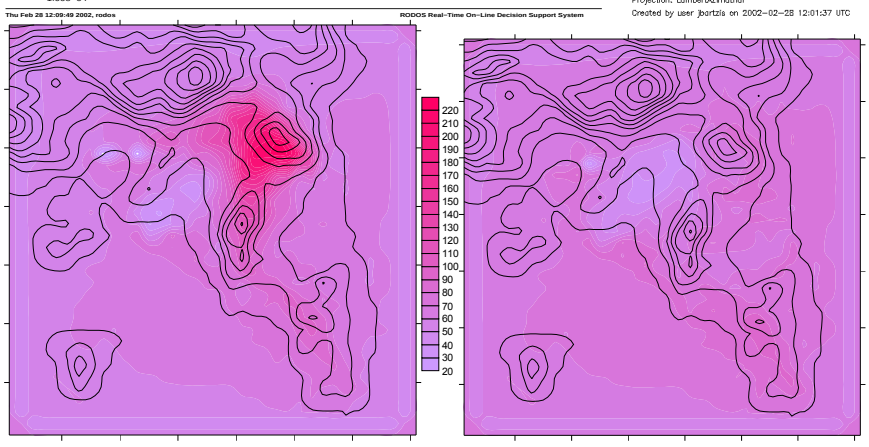
1. Δ. Σαραγά, (2006), "Μελέτη της επίδρασης του καπνίσματος στην ποιότητα του εσωτερικού αέρα σε κατοικίες στην Αθήνα " ΜΔΕ Φυσικής Περιβάλλοντος, Τμήμα Φυσικής του Πανεπιστημίου Αθηνών.
2. Στ. Πατεράκη (2006), "Μελέτη των χαρακτηριστικών αιωρούμενων σωματιδίων PM10, PM2.5, PM1 σε συνδυασμό με πτητικές οργανικές ενώσεις και μετεωρολογικές συνθήκες" ΜΔΕ Φυσικής Περιβάλλοντος, Τμήμα Φυσικής του Πανεπιστημίου Αθηνών

Diploma Theses

1. Χ. Αγριοδήμας, (2005) «Μέτρηση αέριας ρύπανσης σε δρόμους διαφορετικής γεωμετρίας και συσχέτισή της με μετεωρολογικές και κυκλοφοριακές παραμέτρους», Φυσικό Τμήμα του Πανεπιστημίου Αθηνών







Prediction of maximum ozone concentrations in Athens area for the years 1990 (left) and 2004 (right)

SYSTEM RELIABILITY AND INDUSTRIAL SAFETY LABORATORY (SRISL)

Head: Ioannis A. Papazoglou

Personnel

Researchers and Functional Scientific Personnel: 5
Dr. Ioannis A. Papazoglou (Director of Research)
Dr. Ioannis Kollas (Director of Research)
Dr. Zoe Nivolianitou (Researcher)
Dr O. Aneziri (Researcher)
Ms. Vana Synodynou (ELE C)

Other Scientists: 1
Myrto Konstandinidou (Chemical Engineer)

Objectives

Development of methodology and associate software tools in the areas of:

- Reliability of large systems with complex stochastic behavior
- Quantitative Risk Assessment of complex technological systems
- State Identification of Complex Systems
- Health and Environmental Consequence Assessment of alternative Electrical Power generating systems

Recently research and development has been focused in the:

- Methodology Development for the quantified risk assessment of accidents at the workplace with application on 50 different types of accidents.
- Methodology development for the calculation of the dynamic reliability of systems incorporating the interaction of the stochastic behavior of control and safety systems and the dynamic physical phenomena characterizing the processes that these systems control and/or protect.
- Quantification of uncertainties about the models simulating technological systems, physical phenomena and processes.
- Optimization Algorithm development in discrete decision spaces with multiple criteria
- Decision Support System development for risk management as well as emergency response policy selection in major hazard accidents in nuclear and chemical installations, as well as in natural disasters.
- System-state diagnostics using soft computing (artificial neural networks, genetic algorithms, fuzzy expert systems) and novel signal processing techniques (e.g. wavelets).
- The influence of Human Factors in the development. of industrial accident
- The effect of meteorological parameters on energy system design/validation.

Achievements

The laboratory for System Reliability and Industrial Safety (SRISL) was founded in 1988, with initial objective the development of an integrated capability for the quantitative risk assessment of large nuclear and non-nuclear systems. During the last fifteen years the laboratory has contributed to the state-of-the art of system reliability, quantified risk assessment, the development of Decision support systems with multiple criteria and under uncertainty and system diagnostics. Furthermore, the laboratory has developed an integrated methodology and the associated computer tools for the safety analysis and the quantification of uncertainty in installations handling hazardous material.

These achievements were accomplished through the active participation in the framework programmes of the European Commission in the area of Major Industrial Hazards and Risk Assessment (1 project in Framework Programme II, 1 project in Framework Programme III, 3 projects in the Framework Programme IV, 2 projects in Framework Programme V, 2 projects in Framework Programme VI). In these projects SRISL has collaborated with leading European organizations paving the way to the introduction of new risk based approaches to the regulatory framework for installations handling hazardous materials and subject to the SEVESO directive. Such organizations are: the Health and Safety Executive of the UK, The Ministry of Environment and the ministry of Labor of the Netherlands (VROM,

SZW), and the Joint Research Center at Ispra of the EC and a great number of European Universities and Industries.
Based on the developed methodology and the associated tools the SRISL in collaboration with the above and other European research organizations focused its research efforts in problems addressing the support of decisions concerning the management of risk, the land use planning around dangerous sites, and the evaluation of the role of the organizational and management system of a company on the safety of the installations. These two elements constitute the fundamental changes incorporated in the second updated version of the SEVESO directive (SEVESO II).
The SRISL is one of the main consultants of the Greek ministries of Environment and Development in issues concerning the regulation of Greek chemical installations subject to the SEVESO directive and it has reviewed and reassessed the safety cases of half the Greek industry with respect to the external risk, and almost the totality of the Greek industry with respect to the frequency assessment of the major accidents.
In the area of reliability analysis SRISL's work has resulted in a number of methodological developments in the assessment of the reliability of dynamic systems, the mathematical foundation of the Event Tree approach , the influence of the human factor in accident causation and other results published in international scientific journals.

Education

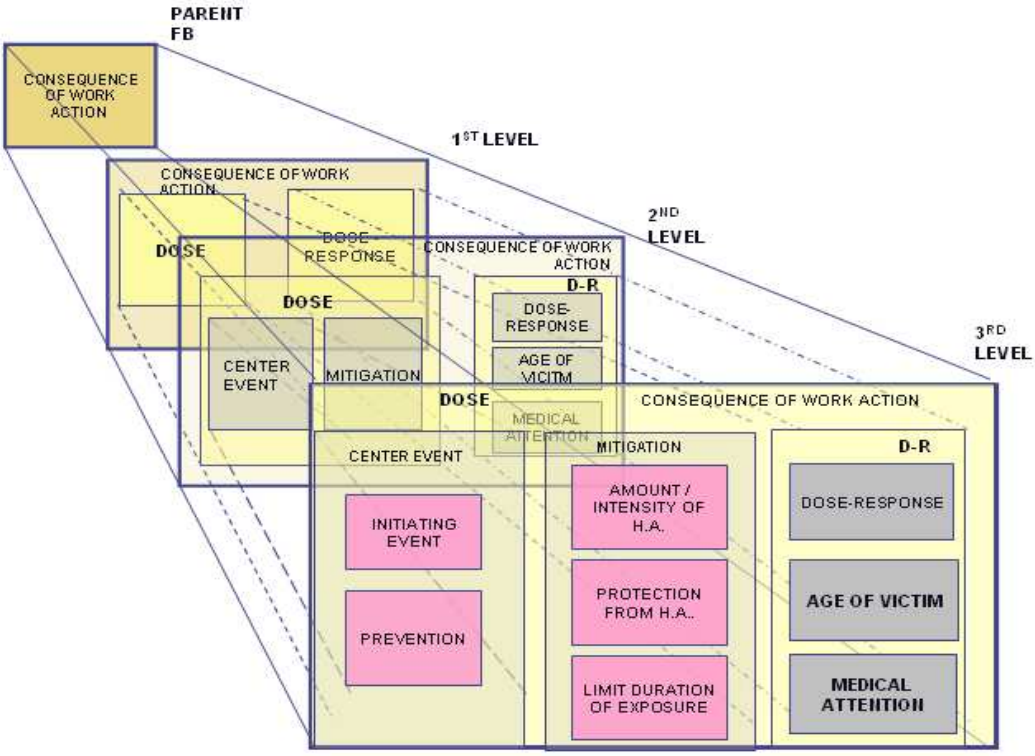
Diploma Theses

Δρ Ζ. Νιβολιανίτου:

1. Χρίστος Αργυρόπουλος, «Προσομοίωση διασποράς τοξικών ρύπων και εκτίμηση επιπτώσεων στο περιβάλλον από πυρκαγιές σε δεξαμενές καυσίμων για την εφαρμογή της οδηγίας SEVESO II», Αθήνα 2006, ΕΜΠ, Τμήμα Χημ.Μηχ.

Δρ Ο. Ν. Ανεζίρη

1. Λάιος Π., «Ανάλυση επικινδυνότητας για την υγεία από τη λειτουργία χώρων υγειονομικής ταφής απορριμμάτων» (ΕΜΠ, Ιούλιος 2006)
2. Δασκαλάκη Ε., «Ανάλυση επικινδυνότητας για το περιβάλλον από τη λειτουργία χώρων υγειονομικής ταφής απορριμμάτων» (ΕΜΠ, Σεπτέμβριος 2006)



SOLAR & OTHER ENERGY SYSTEMS LABORATORY (SESL)

Head: V. Belessiotiς

Personnel

Researchers and Functional Scientific Personnel	3
Other Scientists:	1
Co-operating Researchers:	1
Scholarships:	3
Technicians:	5

The Laboratory started its activities in 1980 and has ever since been pursuing applied research and technology development in the fields of Solar Thermal Energy Utilization & Energy Savings Systems and Thermal Distillation-Desalination. It is equipped with excellent measurement facilities and along with experimental investigations it uses as basic analytical tools the Metrology of Energy Quantities and Numerical Simulation, Computational Fluid Dynamics in particular.
The aforementioned activities, financed to a great extent by third means have had as a result a wide field of technical accomplishments. The Laboratory is organized and has been accredited according to the EN ISO/IEC 17025 standard, having developed a Quality Assurance System for performing tests based on ISO and EN standards

AREAS OF APPLIED RESEARCH

The laboratory conducts mainly applied research and experimental development, arising from the needs of the productive sector, the ties with which have been built through the services offered by the laboratory in a wide field of applications and over a number of years. However, in this effort the laboratory personnel is often faced with the need to answer questions that concern fundamental physical phenomena and expand the current knowledge, especially in the fields of fluid flow, heat/mass transfer and thermodynamics. Therefore, problems are often dealt with at the basic research level, by using suitable analytical methods (modelling and simulation) along with experimental methods.

The specific research areas of SESL are :

- ***Solar collectors and systems***

- Design improvements of solar thermal collectors aiming at higher efficiencies, investigation of new materials for better performance, longer life cycles and better quality.
- New technologies such as those based on heat pipes and Dewar-type evacuated tubes (with water or air as the working fluid), "4th generation" solar collectors using nanofluids as the working fluid.
- New methodologies for the modelling of collectors and systems, development of tools for the integrated design of large-scale solar heating plants
- Solar-air conditioning, cooling technologies utilizing a thermal source (such absorption and desiccant cooling systems).

- ***Metrology of energy quantities***

- Methods-equipment for evaluation of the energy performance, the measurement of thermophysical properties of materials (with emphasis on nanofluids),
- Development-implementation of complex measurement systems and error propagation for complex measuring architectures
- Estimation of uncertainty of results in a generalized-uncertainty environment.

- ***Thermal distillation - desalination***

- System design and the development of new types of stills, coupled with solar collectors and the modelling (simulation and experimental validation) of the systems developed.
- Design of new, more efficient desalination units based on the humidification-dehumidification principle, use of micro-porous membranes.
- Hybrid systems aiming at improvements of overall process efficiency through integration in a multi-source, multi-use environment.

- ***Analysis & design of thermal storage systems***

- Energetic behavior of in-ground storage tanks of non-metallic liner, estimation of heat losses (experimental work and numerical simulation). Temperature fields (inside and around the tank), numerical simulation of hydrodynamic phenomena coupled with ground heat transfer. Static and dynamic (charging-discharging) modes of operation.
- Phase-change materials (PCM) as storage media
- Studies of liner properties of in-ground water tanks, particularly mechanical strength, thermal-insulating and water-tight properties, aiming at long-term reliability under real operating conditions of strong thermal cycling.
- Optimal design of water inlet-outlet systems for main types of commercial storage tanks, using fluid-dynamics and heat-transfer principles.

- ***Mechanical/solar-assisted drying processes & systems***

- Design optimization of hot-air mechanical dryers through the numerical simulation of flow and heat/mass transport phenomena for attainment of uniform drying conditions
- Implementation of large-scale practical applications and pilot-type installations
- Investigation of the optimum drying conditions for various products (drying curves), development of models for the drying process.
- Further promotion of solar energy as a heat source for drying, using solar air collectors

SPECIALIZED SERVICES

ν Efficiency and qualification tests for solar collector and systems according to European and International Standards (EN 12975-2, EN 12976-2, ISO 9806-1, ISO 9806-2, ISO 9459-2) and certification of prediction of annual collector energy output

ν Measurements of optical properties of materials (ASTM E 424, ASTM E 408)

ν Rating and performance tests for non-ducted air conditioners and heat pumps according to international standards (ISO 5151)

ν Performance characterization of stores for solar heating systems (EN 12977-3 standard) and heat exchangers

ν Determination of the thermal resistance of thermal insulation and construction materials (ISO 8302, DIN 52615) and of the density of cellular plastics and rubbers (EN ISO, ISO 2896845)

ν Specialized studies and consulting in the areas of optimal energy design, manufacturing processes for solar collectors and systems, design and development of new products, energy savings, development and organization of specialized laboratories, metrology

1. Modelling of energy systems and processes, particularly by means of fluid flow and heat transfer analysis. Development of relevant design criteria

EDUCATION

Doctoral Dissertations

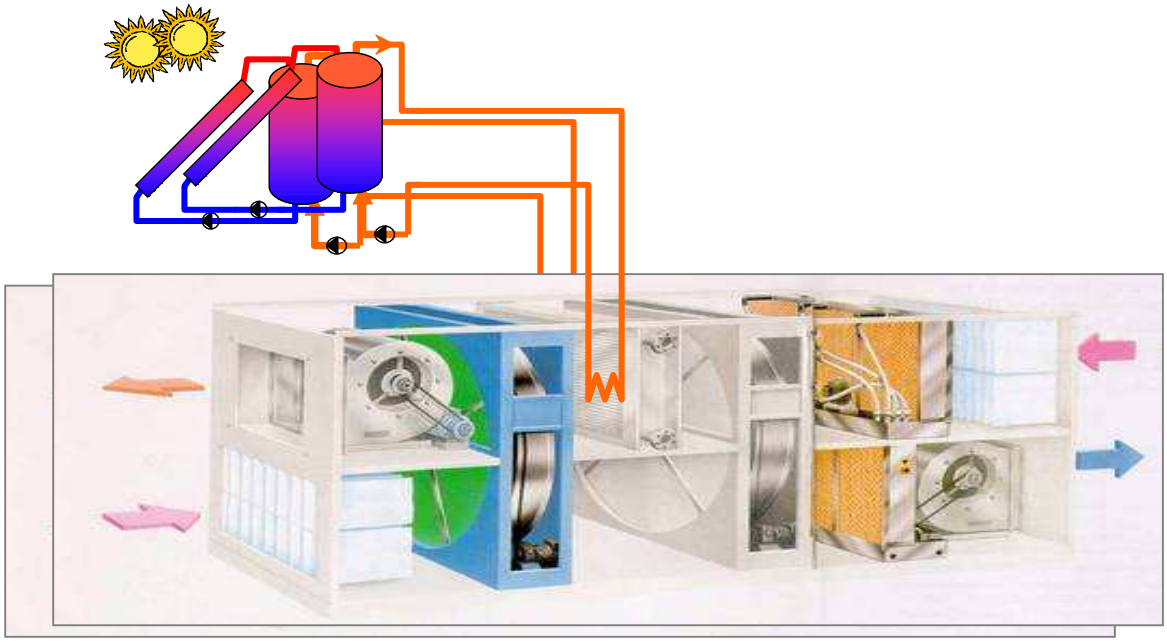
1. Σ. Μπαμπαλής, «Θεωρητική και Πειραματική Διερεύνηση Φαινομένων Μεταφοράς και Μάζας κατά την Ξήρανση Τροφίμων σε Ρεύμα Θερμού Αέρα», Πολυτεχνική Σχολή ΑΠΘ, Τμήμα Μηχανολόγων Μηχανικών, Σεπτέμβριος 2006
2. Β. Μπελεσιώτης, «Θερμο-υδραυλική Προσομοίωση Θερμικών Ηλιακών Εγκαταστάσεων με Ένταξη Διεποχιακής Αποθήκευσης», Πολυτεχνική Σχολή ΑΠΘ, Τμήμα Μηχανολόγων Μηχανικών, Νοέμβριος 2006

Diploma Theses

1. Δ. Αναγνωστόπουλος, "Μεθοδολογία Αξιολόγησης και Χαρακτηρισμού Ηλιακών Δεξαμενών ζεστού νερού μέχρι 2,5 m^3, ΕΜΠ, Τμήμα Μηχανολόγων Μηχανικών, Σεπτέμβριος 2005.

General view of the outdoor measurement and testing facilities

Solar absorption air-conditioning system



Schematic diagram of a solar desiccant air-conditioning system

THERMAL HYDRAULICS AND MULTIPHASE FLOW LABORATORY (THEMLAB)

Head: C. Housiadas

Personnel

Researchers and Functional Scientific Personnel	1
Other Scientists:	1
Co-operating Researchers:	-
Scholarships:	2
Technicians:	1
Post-doc fellows:	1
Graduate students (diploma):	2

Subject

THEMLAB is the newest Laboratory of INTRP. It was created recently (in 2006) with the scope of exploiting the longstanding experience of INT-RP in the field of Thermal–Hydraulics and Multiphase Flows and shape them according to the needs and challenges of current R&D applications requiring similar scientific know-how. THEMLAB conducts basic and applied research covering seemingly distant and diverse topics such as nuclear safety, nanotechnology and health sciences. This is achieved by taking advantage of common underlying physical phenomena: we are developing quite versatile, common methods and corresponding tools for the numerical simulation of multiphase flows. The focus is on dispersed multiphase flows (aerosol flows) and computational fluid mechanics. With such "in-silico" investigations we are able to provide scientific knowledge to a broad range of current applications, in fields like nuclear safety, industrial hygiene, environmental health, aerosol medicine, bio-fluid mechanics.

Activities

The activities of THEMLAB include:

- Reactor Safety
- Aerosol Flows
- Multiphase Systems
- Scientific Computing
- Computational Fluid Dynamics
- Bio-fluid Mechanics
- Fundamental Fluid Mechanics (transition to asymmetry of symmetric flows)

Achievements

THEMLAB is a new Laboratory, whose basic equipment will be computing infrastructure in the form of an advanced computer cluster (CPU farm). At this moment, we are in the phase of setting up such an advanced system, designed to serve the needs of not only the THEMLAB laboratory, but also of the Institute. Important to say that the system will be compatible with the requirements of the grid, anticipating that it will become part of the world grid system. The computer infrastructure will primarily

serve as a computational fluid dynamics (CFD) platform for the needs of the whole Institute. Currently, we are setting up such a computational CFD platform, which, besides in-house developed tools, will be also equipped with state-of-the-art CFD commercial packages (ANSYS-CFX).

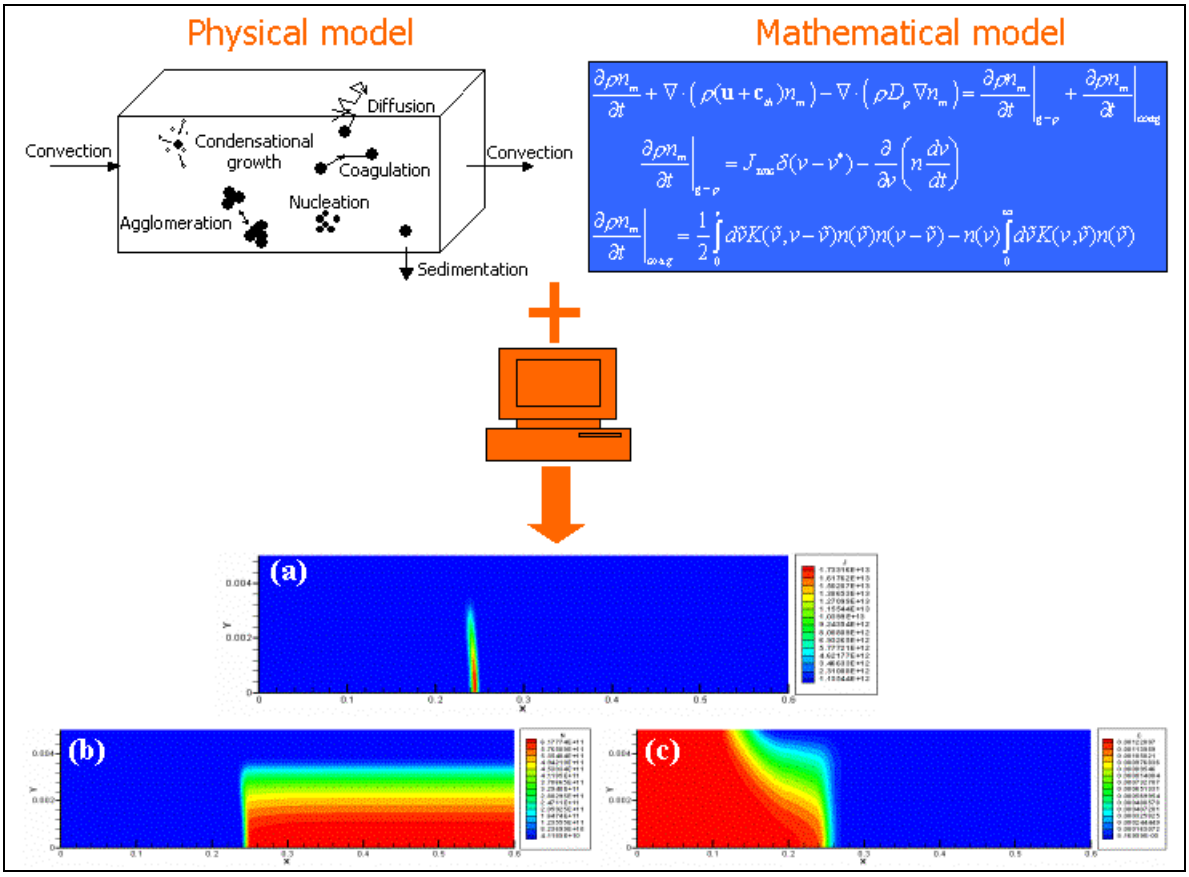
Education

Doctoral Dissertations

1. Χριστίνα Μητσάκου, «Ανάπτυξη αλγορίθμου για τον υπολογισμό της δυναμικής των σωματιδίων στο αναπνευστικό σύστημα» , Φυσικό Τμήμα Παν/μίου Αθηνών (2006)

Diploma Theses

1. Στέλιος Χατζιδάκης, «Υπολογισμοί-μοντελοποίηση εφαρμογών ασφάλεια αντιδραστήρων», ΕΜΠ, Σχολή Μηχανολόγων Μηχανικών (2005)



Numerical simulation of dispersed multiphase flow: (a) nucleation rate, (b) particle concentration, (c) condensable vapour concentration during particle formation (synthesis) in an aerosol reactor.

Facts and Figures 2005 - 2006

4. Personnel over the last ten years

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Researchers and Functional Scientific Personnel	30	27	27	27	25	24	24	26	22	22	24
Co-operating Researchers	1	1	6	6	5	3	4	2	2,25	2,25	4
Technicians	31	30	27	26	23	23	25	25	27	28	30
Under contract	28	28	21	29	33	38	31	30	38	38	22
Administrative	6	6	2	4	6	4	2	2	2	2	3
Other Scientists	5	5	4	5	6	5	15	15	11	11	14
Scholarships	14	14	21	19	11	8	11	11	8	9	14
TOTAL	**115**	**111**	**108**	**116**	**109**	**105**	**112**	**111**	**110,25**	**112,25**	**111**

TABLE I

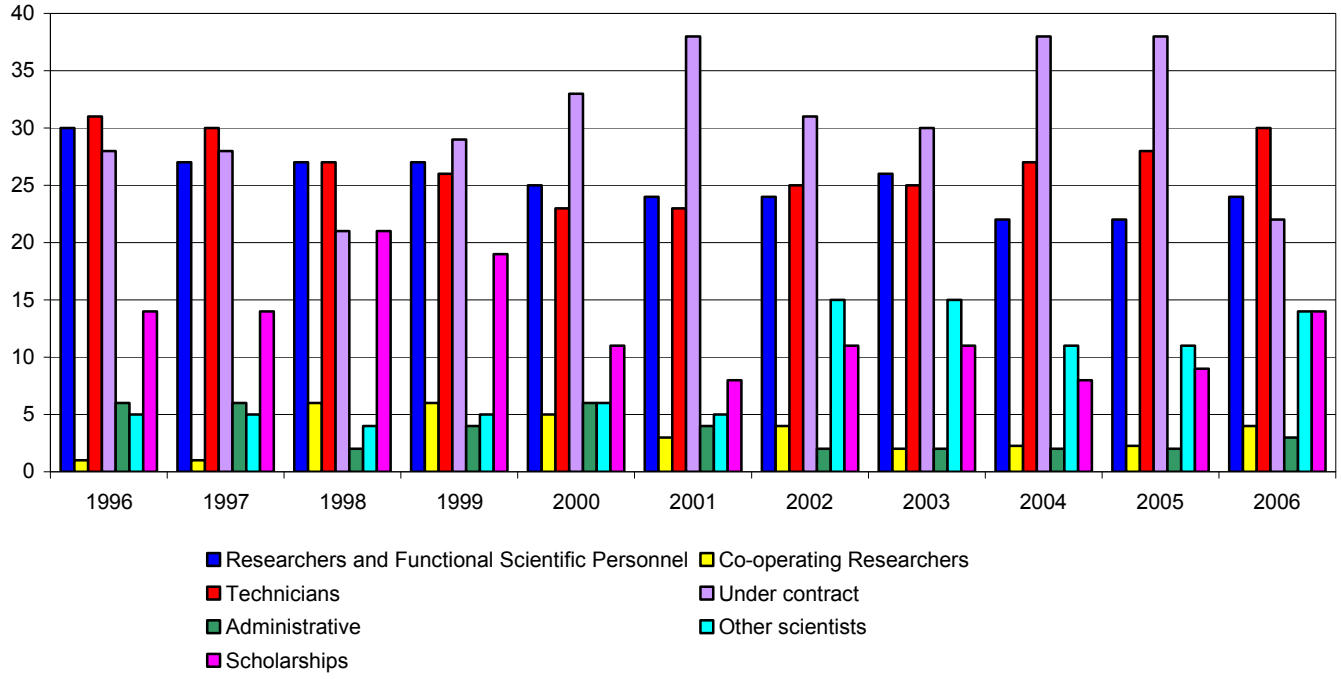


CHART I

5. FUNDING 2005

Laboratories	Funding (in Euro)					
	Competitive Programs	Structural Programs	Provision of Services	I.A.E.A	Matching Funds	**Total**
Nuclear Research Reactor	215.265,00	136.993,00	0	0	51.846,00	**404.104,00**
Environmental Radioactivity	82.000,00	65.000,00	120.000,00	8.000,00	3.000,00	**278.000,00**
Health Physics & Environmental Hygiene	116.350,00	0	265.324,41	0	0	**381.674,41**
Environmental Research	350.372,00	0	50.500,00	0	394.646,00	**795.518,00**
System Reliability & Industrial Safety	198.567,00	0	0	0	0	**198.567,00**
Solar & other Energy Systems	176.509,45	0	138.082,65	0	11.876,68	**326.468,78**
Plasma Physics						
Total	**1.139.063,45**	**201.993,00**	**573.907,06**	**8.000,00**	**461.368,68**	**2.384.332,19**

TABLE II

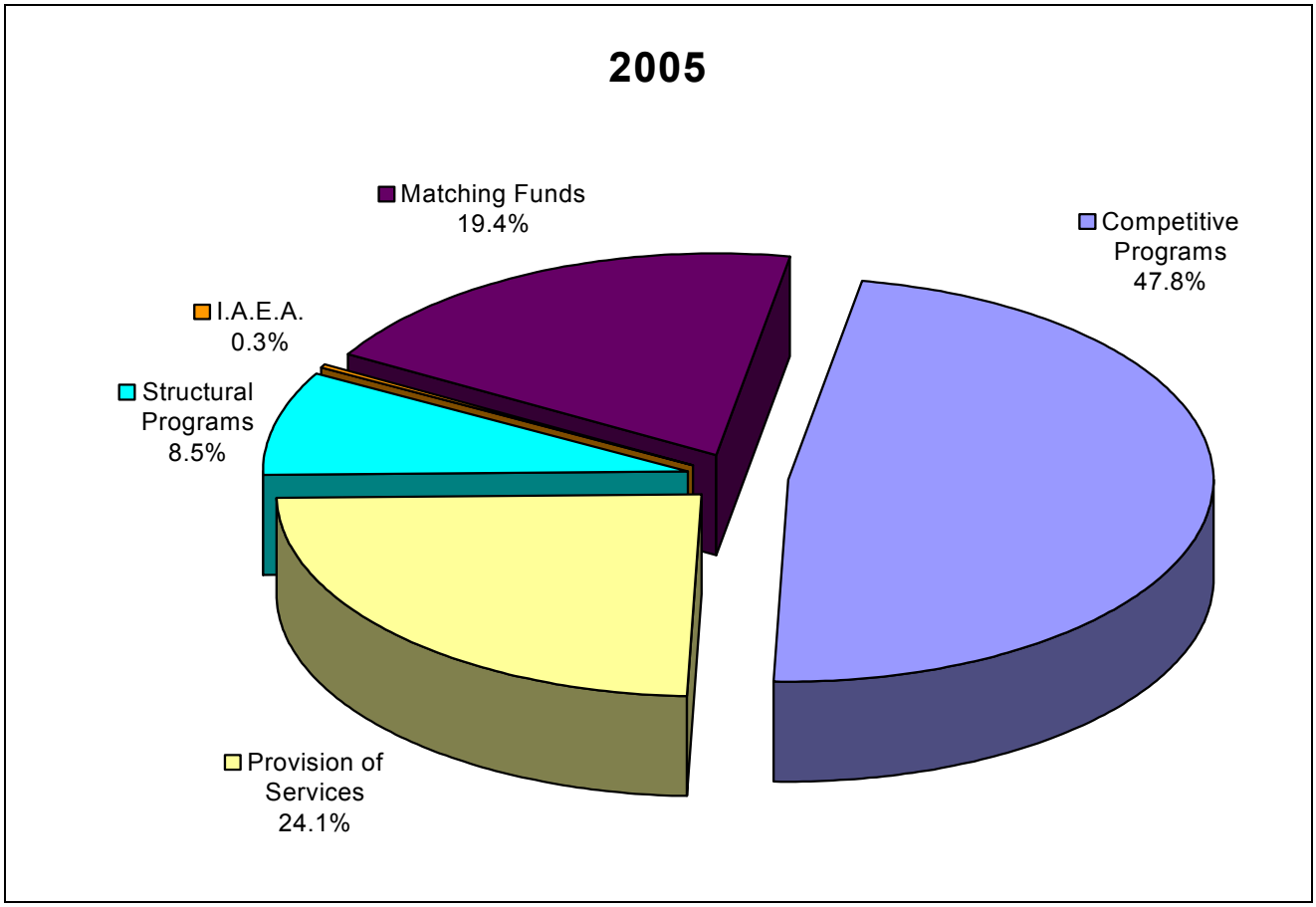


CHART II

FUNDING 2006

Laboratories	Funding (in Euro)					
	Competitive Programs	Structural Programs	Provision of Services	I.A.E.A	Matching Funds	**Total**
Nuclear Research Reactor	155.000,00	650.000,00	0	74.400,00	80.000,00	**959.400,00**
Environmental Radioactivity	32.000,00	55.000,00	95.000,00	5.000,00	3.000,00	**190.000,00**
Health Physics & Environmental Hygiene	57.810,00	0	318.300,00	0	0	**376.110,00**
Environmental Research	472.268,59	0	93.835,50	0	261.902,67	**828.006,76**
System Reliability & Industrial Safety	103.273,00	0	48.950,00	0	11.516,00	**163.739,00**
Solar & other Energy Systems	217.897,00	0	32.982,00	0	9.073,00	**259.952,00**
Plasma Physics						
Thermal-Hydraulics & Multiphase Flow	78.674,00	0	0	0	87,00	**78.761,00**
Total	**1.116.922,59**	**705.000,00**	**589.067,50**	**79.400,00**	**365.587,67**	**2.855.968,76**

TABLE III

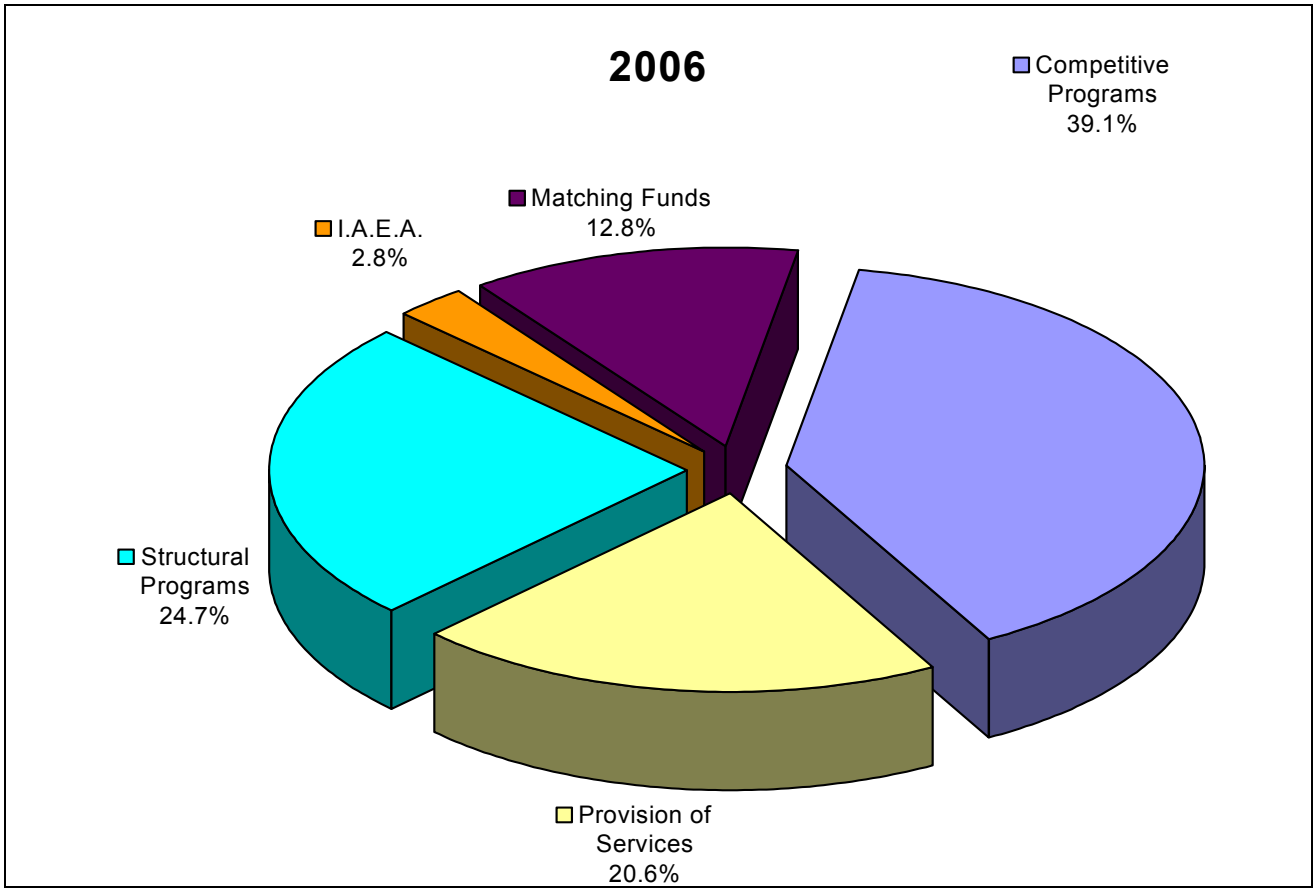


CHART III

FUNDING 1996-2006

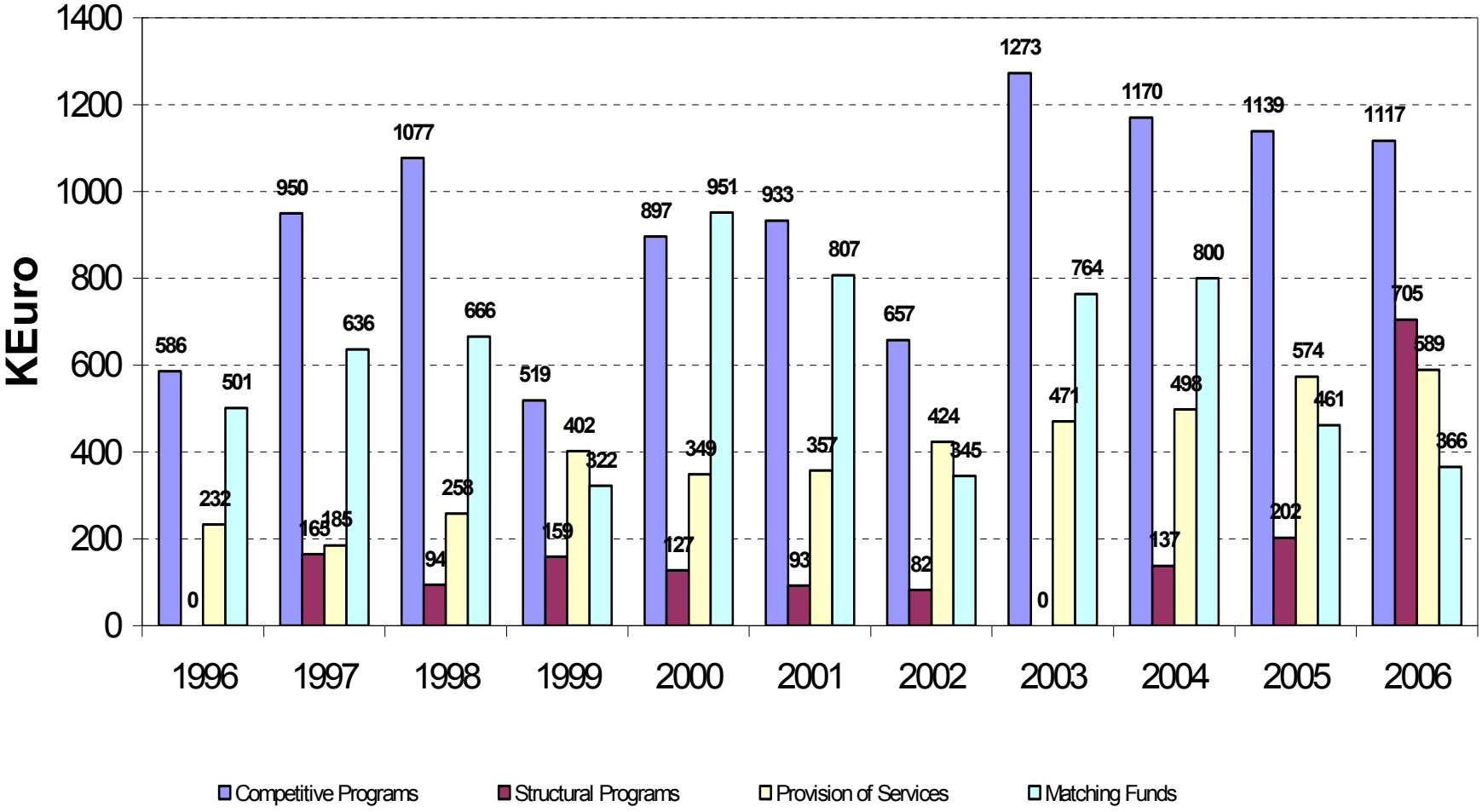


CHART IV

6. Institute Account – Expenditure 2005

CATEGORY	AMOUNT	CATEGORY TOTAL	%
Consumables		**43.712,37**	**31,2**
General Expenses		**14.004,16**	**10,0**
Safety & Reactor Radiation Protection Personnel		**18.309,07**	**13,0**
Administrative Support Personnel		**13.200,00**	**9,4**
Payment for the handling and removal of radioactive waste		**10.000,00**	**7,1**
Employment on contract		**4.000,00**	**2,9**
Work Overtime		**920,57**	**0,6**
Travel			
Education	800,00		
Invitations, Committees	50,00		
Category Total		**850,00**	**0,6**
Infrastructure			
Maintenance		**19.217,51**	**13,7**
Equipment			
Other cost	4.423,23		
Instruments	6.498,00		
Computers and Software	5.177,31		
Category total		**16.098,54**	**11,5**
General total		**140.312,22**	**100%**

Institute Account – Expenditure 2006

CATEGORY	AMOUNT	CATEGORY TOTAL	%
Consumables		**37.686,97**	**20,6**
General Expenses		**17.135,52**	**9,4**
Employment on contract		**24.119,98**	**13,2**
Work Overtime		**5.716.53**	**3,1**
Travel			
Education	6.650,77		
Invitations, Committees	2.731,13		
Category Total		**9.381,90**	**5,1**
Infrastructure			
Maintenance	7.216,16		
Electrical and other works	2.475,20		
Category Total		**9.691,36**	**5,3**
Equipment			
Other cost	24.398,85		
Instruments	33.792,65		
Computers and Software	20.938,73		
Category total		**79.130,23**	**43,3**
General total		**182.862,49**	**100%**

7. PUBLICATIONS 2005

IMPACT FACTOR – 2005

LABORATORY	PUBLICATIONS		IMPACT FACTOR
	Papers (in refereed Scientific Journals)	Papers (in Conference Proceedings)*	
Nuclear Research Reactor	8	13	11,315
Environmental Radioactivity	7	8	13,441
Health Physics & Environmental Hygiene	3	11	13,831
Environmental Research	21	62	21,22
System Reliability & Industrial Safety	2	3	1,404
Solar & Other Energy Systems	3	5	2,429
Plasma Physics	-	-	
Total	**44**	**102**	

* *1 of them is counted by two laboratories*

TABLE IV

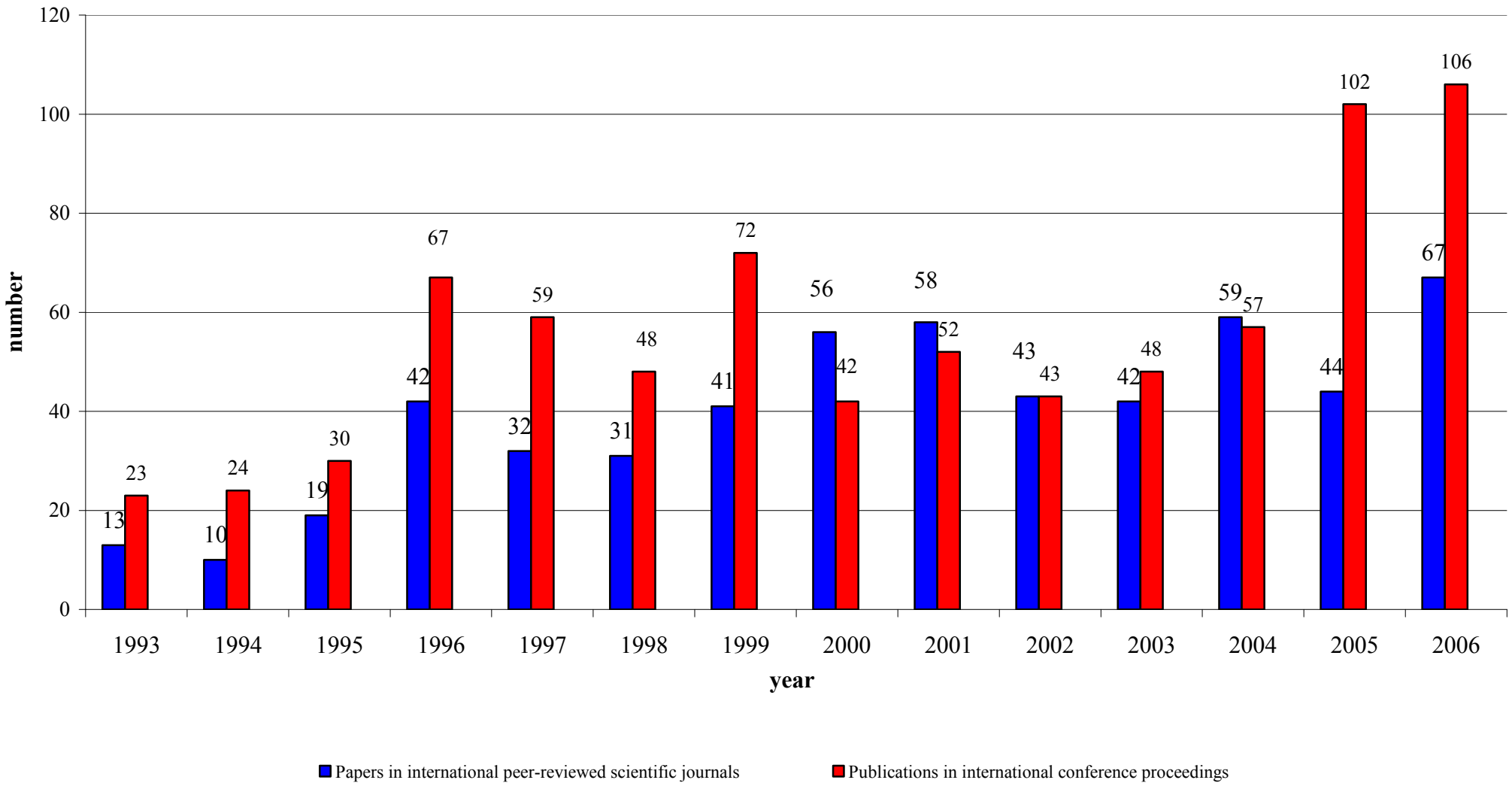
PUBLICATIONS 2006

IMPACT FACTOR – 2005

LABORATORY	PUBLICATIONS		IMPACT FACTOR
	Papers (in refereed Scientific Journals)*	Papers (in Conference Proceedings)**	
Nuclear Research Reactor	12	21	12,491
Environmental Radioactivity	7	9	13,382
Health Physics & Environmental Hygiene	6	20	13,60
Environmental Research	29	32	29,052
System Reliability & Industrial Safety	6	16	3,322
Solar & Other Energy Systems	2	2	1,481
Plasma Physics	-	-	
Thermal-Hydraulic & Multiphase Flow	5	6	7,483
Total	**67**	**106**	

* *2 of them are counted by three laboratories and 6 of them by two laboratories*
** *2 of them are counted by three laboratories and 3 of them by two laboratories*

TABLE V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Papers in international peer-reviewed scientific journals
Publications in international conference proceedings

CHART V

PUBLICATIONS 2005-2006

1. Nuclear Research Reactor Laboratory (NRRL)

1. PEER-REVIEWED JOURNALS

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5. M. Gjoka, K. Mergia, D. Niarchos and M. Többens, “Structural investigation of rare-earth Fe-Co-V intermetallic compounds”, 19th International Workshop on Rare Earth Permanent Magnets and Their Applications, China, August 29 – September 2, 2006

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16. L.K. Keppas, N.K. Anifantis, D.E. Katsareas, A.G. Youtsos, "Residual Stress Prediction in Letterbox-type Repair Welds", Proceedings of a Special Symposium held within the 16th European Conference of fracture – ECF16, A.G. Youtsos (Ed.), Alexandroupolis, Greece, 3-7 July 2006, pp. 27-39, ISBN 978-1-4020-5328-3

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2. Catsiki V.A. and Florou H., 2005. Study on the behavior of heavy metals and ^{137}Cs in an estuarine ecosystem using Mytilus galloprovincialis as a bioindicator species: The case of Thermaikos gulf Greece. Journal of Environmental Radioactivity. 86 (2006) pp: 31-44.

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6. "Consequence analysis of an open fire incident in a pesticide storage plant"(D.A. Kefalas, M.N. Christolis, Z. Nivolianitou and N.C. Markatos) Journal of Loss Prevention in the Process Industries, Volume 19, Issue 1, January 2006, Pages 78-88

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2. "Quantified Risk Assessment for plants producing and storing explosives" (Papazoglou I. A., et al), *"Advances in Safety and Reliability" Kolowrocki (ed) Taylor & Francis Group ,* Vol 1, 2005, pp 1513-1520

3. "Calculations of Proliferation Resistance for Generation III Nuclear Energy Systems" (M. Yue, L. Cheng, I. A. Papazoglou, M.A. Azarm, and R. A. Bari), GLOBAL 2005 International Conference Nuclear Energy Systems for Future Geberation and Global Sustainability, October 9-13, 2005 Tsukuba Japan.

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5. "Logical models for quantification of occupational risk: falling from mobile ladders "(I.A. Papazoglou, O. Aneziris, J. Post, H. Baksteen, B.J.M. Ale, J.I.H Oh, L. J. Bellamy, M.L. Mud, A.Hale & L.Goossens, A. Bloemhoff) *Proceedings of the 8th International Conference on Probabilistic Safety Assessment and Management May 14-18, 2006, New Orleans, Louisiana, USA, PSAM-0058, ISBN: 0-7918-0244-2 (ASME 2006)*

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18. "Contact with falling objects-lifting operation, excluding cranes, WORM "Occupational Risk Model"", Aneziris O. N., Papazoglou I.A.,2006.
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2. Ημερίδα στα πλαίσια του Ευρωπαϊκού Προγράμματος Pre Emergencies: «Ανταλλαγή απόψεων σε θέματα επικοινωνίας και δράσης εθελοντικών και θεσμοθετημένων ομάδων σε καταστάσεις έκτακτης ανάγκης.", ΕΚΕΦΕ «ΔΗΜΟΚΡΙΤΟΣ», 26/10/2006, Ζ. Νιβολιανίτου, Β.Συνοδινού

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2. Babalis S.J., Papanicolaou E. and Belessiotis V., "The effect of alternating air-flow direction on the drying kinetics and moisture diffusivity in an agricultural tunnel dryer", *Transactions of the Int. Assoc. of Mech Engrs*. (IASME), vol. 2(9), pp. 1783-1791, 2005.
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2. Ε. Μαθιουλάκης, Β. Μπελεσιώτης, Η Baeysian ανάλυση στη Μετρολογία και στην εκτίμηση των αβεβαιοτήτων, Metrologia 2005, 1ο Τακτικό Εθνικό Συνέδριο Μετρολογίας, Αθήνα , 11-12 Νοεμβρίου 2005.

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1. Η. Παπανικολάου, Z. Wang , Β. Μπελεσιώτης, Μελέτη των αεροδυναμικών και ενεργειακών χαρακτηριστικών συλλέκτη αέρα με σωλήνες κενού διπλού τοιχώματος 8ο Εθνικό Συνέδριο του ΙΗΤ για τις "Ήπιες μορφές ενέργειας", Θεσσαλονίκη 29-31 Μαρτίου 2006, (υπό εκτύπωση).

7. Thermal Hydraulics and Multiphase Flow Laboratory (THEMLAB)

2006

1. PEER-REVIEWED JOURNALS

1. Eleftheriadis K, Colbeck I, Housiadas C, Lazaridis M, Mihalopoulos N, Mitsakou C, Smolík J, Ždímal V, Size distribution, composition and origin of the submicron aerosol in the marine boundary layer during the eastern mediterranean "Sub-aero" experiment, Atmos. Environ., 40, 6245-6260, 2006. (IF 2.724)

2. Lazaridis M, Eleftheriadis K, Smolik J, Colbeck I, Kallos G, Drossinos Y, Zdimal V, Vecera Z, Mihalopoulos N, Mikuska P, Bryant C, Housiadas C, Spiridaki A, Havranek V, Dynamics of fine particles and photo-oxidants in the Eastern Mediterranean, Atmos. Environ., 40, 6214-6228, 2006. (IF 2.724)

3. Drossinos, Y. and Housiadas, C., Aerosol Flows, In: The Multiphase Flow Handbook (ed. C. Crowe), Chapter 6, CRC Press - Taylor & Francis, Boca Raton, FL, 2006.

4. P. Neofytou and S. Tsangaris, "Flow effects of blood constitutive equations on 3D models of vascular anomalies", International Journal for Numerical Methods in Fluids, 51, 489-510, 2006. (IF 0.767)

5. P. Neofytou, "Transition to asymmetry of generalised Newtonian fluid flows through a symmetric sudden expansion", Journal of Non-Newtonian Fluid Mechanics; 133, 132-140, 2006. (IF 1.268)

6. Mitsakou, C, Housiadas, C, Eleftheriadis, K, Vratolis, S, Helmis, C, Asimakopoulos, D., "Lung deposition of fine and ultrafine particles outdoors and indoors during a cooking event and a no activity period", Indoor Air, in press. (0.978)

7. P. Neofytou, "Revision of the characteristics-based scheme for incompressible flows", Journal of Computational Physics, in press. (2.132)

2. PEER-REVIEWED CONFERENCE PROCEEDINGS

1. P. Neofytou, S. Tsangaris and M. Kyriakidis, "Endovascular wall pressure-forces in a progressively enlarged aneurysm model", Proc. of the 5th World Congress of Biomechanics, Munich, Germany, 29 July – 4 August, 2006.

2. Eleftheriadis K, Vratolis S, Housiadas C, Smolík J, Ždímal V, Schwarz J, Wagner Z, Lazaridis M, Ondracek J, Hussein T, Kephalopoulos S, Drossinos Y, Modal structure of the fine urban aerosol in four European cities, 7th International Aerosol Conference, St. Paul, Minnesota, September 10-15, 2006

3. Vratolis S, Mitsakou C, Eleftheriadis K, Karanasiou A, Housiadas C, Lazaridis M, Gravimetric and optical PM10 Measurements in an Industrial workplace and the impact of the measurement uncertainty on the calculated inhaled dose, Proceedings of the International Scientific Conference "Protection and Restoration of the Environment VIII", Chania, Greece, July 3-7, 2006

4. Messoloras S, Mergia K, Housiadas C, Savidou A, Stamatelatos IE, Youtsos AG, Problems Expected to be Encountered in the Decommissioning Planning of a Small MTR in a Non-nuclear Country, Proceedings of the International Conference on "Lessons Learned from Decommissioning of Nuclear Facilities and the Safe Termination of Nuclear Activities", Athens, December 11-15, 2006

5. Karanasiou A, Eleftheriadis K, Vratolis S, Zarbas P, Mihalopoulos N, Mitsakou C, Housiadas C, Lazaridis M, Ondracek J, Dzumbova L, Size distributions of inorganic species and their inhaled dose in the industrial workplace aerosol, Proceedings of the International Scientific Conference "Protection and Restoration of the Environment VIII", Chania, Greece, July 3-7, 2006

6. Fløisand I, Laupsa H, Broday D, Bøhler T, Holländer W, Lützenkirchen S, Housiadas C, Stubos T, McInnes H, Calculations of personal exposure to particulate matter in urban areas, Proceedings of the 28th NATO/CCMS International Technical Meeting on Air Pollution Modelling and its Application, Leipzig, Germany, May 15-19, 2006

8. SCIENTIFIC AND OTHER PROJECTS

Nuclear Research Reactor Laboratory

1. General Secretariat of Research & Technology, Co-operatives for Research and Technological Development in Sectors of National Priority: Technology Development for Optimising Air Quality in Industrial Buildings: Characterisation of Air Quality in Industrial Buildings – Mechanisms Controlling the Indoor/Outdoor Particulate Matter Chemical Characteristics and their Effects to Human Exposure and Inhaled Dose (INDOOR-HEALTH, 2003-2006).
2. General Secretariat of Research & Technology, Bilateral (Hellenic Rep., Czech Rep.) S&T cooperation project: Aerosol Nucleation Studies by Means of Diffusion Chambers and Atmospheric Measurements of Nucleation Events (2003-2006).
3. EU, FI6O-CT-2004-509065 (SARNET): Network of Excellence for a Sustainable Integration of European Research on Severe Accident Phenomenology (2004-2008).
4. Fusion Technology Programme
5. IAEA Techical Co-operation Project GRE/1/040 "Development of a Regional Neutron Scattering Centre", 2003 - 2005
6. Integrated Project EXTREMAT "New Materials for Extreme Environments", 1/12/2004 -30/11/2009

Environmental Radioactivity Laboratory

1. GSRT:Research on Indoor Particulate Matter Pollution in Industrial Facilities. Period 2003-2006 (Total 750,000 Euro)
In Co-op with THEM-LAB

2. GSRT: Regional operational programme for Attika:
"Development of a fine particulate matter mapping system over the Atthens urban area and the stimation of public exposure in Attica" (2006-2008) (Total 986000 €)
In Co-op with THEM-LAB and EREL

3. GSRT: Upgrade of Environmental Technology Srvices from the Institute of Nuclear Technology& Radiation Protection "AKMON" 2005-2008 (Total 275359€)
In Co-op with Research Reactor Lab and EREL

4. GSRT: Environmental Research Infrastructure
Co-operation of Institute of Physical Chemistry and INT-RP (Total 1.772.500 €)

Health Physics & Environmental Hygiene Laboratory

Projects funded by the European Union (EU), General Secretariat for Research and Technology (GSRT), Hellenic Institute of Hygiene and Work Safety, and Specialized Services offered by the Laboratory.

1. Contract E675
Project: Biodosimetry of ionizing radiation and cytogenetic studies in preleukemic diseases.
Duration: 1999-2005
Total funding: 990000 €

2. Contract E1148
Project: Development of new methods for biomonitoring of workers exposed to chemical genotoxic agents.
Duration: 2003-2005
Total funding: 58694,60 €

3. Contract E1056
Project: The role of Intercellular communication and DNA double strand breaks in the induction of bystander effects.
Duration: 2003-2006
Total funding: 261100 €

Environmental Research Laboratory

1. ENVITRACER - Development of Environmentally Friendly Tracer Technology for Improved Reservoir Description (ENK6-CT-2002-00602) (starting date 1-11/02, duration 42 months); (Total NCSR "D" Budget: 498,574 EURO, EC Funding: 50%).

2. NoE-HYSAFE - Safety of Hydrogen as an Energy Carrier, (SES6-CT-2004-502630), (1/3/04-28/2/09); (Total NCSR "D" Budget 314,394 EURO, EC Funding 55%).

3. IP-STORHY - Hydrogen Storage Systems for Automotive Application, (SES6-CT-2004-502667), (1/3/04-31/8/08); (Total NCSR "D" Budget 252,300 EURO, EC Funding: 50%)

4. IP-EURANOS - European Approach to nuclear and radiological emergency management and rehabilitation strategies (FI6R-CT-2004-508843) (1/4/04-31/3/09) (Total NCSR "D" Budget 170108 EURO, EC Funding:50%).

5. MARIE CURIE Grant - RODOS/METADM - RODOS System Meteorological and Atmospheric Dispersion Module functionality enhancement by introduction of numerically efficient algorithms, (516492 (FI6R)) (15/9/2005, duration: 6 months) (Total NCSR "D" Budget 32,649 EURO, EC Funding 100%).

6. STREP - HYAPPROVAL – Handbook for Approval of Hydrogen Refueling Stations, (019813) (1/10/2005-30/9/2007) (Total NCSR "D" Budget 90,003EURO, EC Funding 43,002EURO).

7. CA - ENGINE – Enhanced geothermal innovative network for Europe (019760) (1/11/2005, duration: 30 months) (Total NCSR "D" Budget 38,400 EURO, EC Funding 100%)

8. STREP - TESTNET Towards European Sectorial Testing Networks for Environmental Technologies (018311) (1/9/2005 – 31/8/2008) (Total NCSR "D" Budget 104,220 EURO, EC Funding 50%).

9. IP-NESSHY – Novel Efficient Solid Storage for Hydrogen (SES6-CT 2005-518271) (1/1/2006-31/12/2010) (Total NCSR "D" Budget 1,413,000 EURO, EC Funding 889,000)

10. STREP -FP6, HYPER Installation Permitting Guidance for Hydrogen and Fuel Cells Stationary Applications, 039028 (1/11/06-30/10/08) (Total NCSR "D" Budget 83200 EURO, EC Funding 50%)

11. ΑΚΜΩΝ - ΕΠΑΝ (Μέτρο 4.2, Δράση 4.2.2) Αναβάθμιση παροχής περιβαλλοντικών υπηρεσιών από το ΙΠΤΑ (04ΑΚΜΩΝ66) (19/5/2005 – 16/11/2007) (Χρηματοδότηση από ΓΓΕΤ 74,000 EURO)

12. ΠΙΣΤΟΠΟΙΗΣΗ - ΕΠΑΝ (Μέτρο 1.2 'ΕΘΝΙΚΟ ΣΥΣΤΗΜΑ ΠΟΙΟΤΗΤΑΣ', Δράση 1.2.2 ΠΙΣΤΟΠΟΙΗΣΗ) Ενίσχυση της υφισταμένης υποδομής του εργαστηρίου Περιβαλλοντικών Ερευνών (ΕΠΕΡ) του Ινστιτούτου Πυρηνικής Τεχνολογίας – Ακτινοπροστασίας του ΕΚΕΦΕ «ΔΗΜΟΚΡΙΤΟΣ» για την παροχή υπηρεσιών δοκιμών (Κωδ ΟΠΣ 102250) (19/9/2005 – 18/9/2007) (Χρηματοδότηση από ΥΠΑΝ 180,000 EURO)

13. ΕΛΛΗΝΟΣΛΟΒΕΝΙΚΗ ΔΙΑΚΡΑΤΙΚΗ Ε&Τ ΣΥΝΕΡΓΑΣΙΑ Νέα Διαμεταλλικά υλικά στερεάς κατάστασης για απορρόφηση υδρογόνου και ιδιαίτεροι χαρακτηρισμοί (Κωδ ΓΓΕΤ 043-γ) (1/10/2005-29/3/2007) (Χρηματοδότηση από ΓΓΕΤ 11,700 EURO)

14. PICADA-Photocatalytic innovative coverings applications for depollution assessment (G1RD-CT-2001-00669) (1/1/2002-31/12/2005) (Total NCSR "D" Budget: 381,651 EURO, EC Funding: 50%)

15. OSCAR-Optimised Expert System for Conducting Environmental Assessment of Urban Road Traffic (EVK4-CT2002-00083) (1/9/02-31/08/05) (Total NCSR "D" Budget: 216,000 EURO, EC Funding: 50%)

16. MOREOIL-Evaluation of the miscible gas injection in Oil Reservoirs by Monitoring the Asphaltenes Concentration (NNE5-2001-250) (1/3/2002-31/8/2005) (Total NCSR "D" Budget: 435,000 EURO, EC Funding: 35%)

17. METROPOLIS- Metrology in Support to Precautionary Sciences and Sustainable Development Policies (No: G6RT-CT-2002-05095) (1/7/02-30/6/05) (Total NCSR "D" Budget: 5,400 EURO, EC Funding: 100% 5,400 EURO)

18. EESD Innovative and sustainable sub-surface exploitation of natural resources (ENK6-CT2002-20694) (1/12/02-30/11/05) (Total NCSR "D" Budget: 11,400 EURO, EC Funding: 100%)

19. HYSTORY - Hydrogen Storage in Hydrides for Safe Energy Systems, (ENK6-CT-2002-00600), (starting date 1-11/02, duration 36 months); (Total NCSR "D" Budget: 262,688 EURO, EC Funding: 50%)

20. 02 PRAXE 42 Commercialization of the 3-D environmental fluid mechanics software package ADREA-HF, DELTA-B (16/9/03-15/3/05) (Funding from GSRT 44,000EURO)

System Reliability and Industrial Safety Laboratory

1. **Concerted Action on Brownfield and Economic Regeneration Network: "CABERNET**", contract No EVK4-CT-2001-20004 (17.000 €).
2. **PRISM:** development of a network of industries and research centers for dissemination of information concerning human factors and practical safety rules for the industry. GRT-CT-2001-05029 (8.000€)
3. **Reliability assessment of large technological systems,** N.C.S.R. "DEMOKRITOS".
4. **S2S A Gateway to process safety** G1RT-CT-2002-05094 (84.000€)
5. **WORM "Occupational Risk Model", (RIVM, Netherlands)** (€272.000)
6. **Safety Studies of SEVESO II Installations (145.000€), Ministry of Development, Greece**
7. **VIRTHUALIS "Virtual reality and human factors", (FP6-IP, DG Research, 2005-2009)** (€350.000)
8. **PRE-EMERGENCIES (FP6, DG Environment, 2006-2007)** (€50.000)

Solar and Other Energy Systems Laboratory

Τίτλος	**Δράση / Χρηματοδότηση**	**Διάρκεια**	**Προϋπολογισμός Συνολικός/Εργαστηρίου**
Παροχή εξειδικευμένων επιστημονικών και τεχνολογικών υπηρεσιών και προϊόντων	/ ΙΔΙΩΤΕΣ	03 - 09	40.000 / 450.000
Παροχή Διαπιστευμένων Δοκιμών & Βελτιστοποίηση Προϊόντων ΑΠΕ	4.2.2 /ΓΓΕΤ	03 - 07	452.580
Παροχή εξειδικευμένων Υπηρεσιών στον τομέα ΑΠΕ, στα πλαίσια υλοποίησης του Προγράμματος ΑΚΜΩΝ	4.2.2 /ΙΔΙΩΤΕΣ	03 - 08	452.580
Ενσωμάτωση Θερμικών Ηλιακών σε Κτίρια	ΕΠΑΝ / ΥΠΑΝ-ΙΔΙΩΤΕΣ	03-07	1.401.000 / 293.000
Ηλιακό Σύστημα TRITON	ΕΠΑΝ / ΥΠΑΝ-ΙΔΙΩΤΕΣ	03-07	1.684.525 / 50.000
PROTEAS PV System	ENERGY-FP5 / EE	03-06	1.916.685 / 110.434
Ηλιακοί Συλλέκτες Σωλήνων Κενού τύπου Δοχείου Dewar και ενσωμάτωσή τους σε Στέγες	ΕΠΑΝ / ΥΠΑΝ CHINA-GREECE : Joint Research and Technology Programmes	03-05	12.327 / 12.327
Σχεδιασμός και βελτιστοποίηση συστημάτων ηλιακών συλλεκτών αέρα ως πηγή θερμότητας σε εγκαταστάσεις μηχανικής ξήρανσης	ΕΠΑΝ / ΥΠΑΝ CHINA-GREECE : Joint Research and Technology Programmes	05-07	11.740 / 11.740
ADIRA: Autonomous desalination system for sea & brackish water desalination	MEDA / EE	03-08	2.729.259 / 240.255
NEGST: New generation of solar thermal systems	FP6 / EE	04-07	1.365.531 / 30.720
Autonomous, Low Visual Impact Solar Hot Water System	Διακρατική Συνεργασία ΕΛΛΑΔΑ – ΤΥΝΗΣΙΑ 2006-2008	06-08	23.740 / 15.740
SolarKeymark-II - Large open EU market for solar thermal products	Intelligent Energy – Europe	06-08	784.688 / 47.160
Ανάπτυξη και ενεργειακή βελτιστοποίηση αυτόνομου ξηραντηρίου γεωργικών προϊόντων με χρήση ηλιακής ενέργειας	ΠΕΝΕΔ 2003 (ΕΠΑΝ / Μ 8.3 / ΙΙΙ ΚΠΣ)	05-08	43.758 / 43.758