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May 16, 2002

Professor José Carvalho Soares
Instituto Tecnológico e Nuclear
Estrada Nac. 10 Apartado 21
2686-953 Sacavém
Portugal

Dear Professor Soares:

Enclosed is the **2002 Report of the IAB**. It has been approved by all members of the IAB and represents our evaluation of the progress and status of ITN at this time.

On behalf of the IBA, I wish to thank you and all the staff of ITN who have been so open and frank in discussions as they made it possible for us to offer our suggestions for further improvements. We appreciated the opportunity to offer you our advice and, also, the opportunity to visit Lisbon and other areas of Portugal in connection with our visits as Portugal is a beautiful country with a citizenry notable for friendliness and hospitality.

We wish all of you in ITN continued happiness and success in the future.

Sincerely,

(a)

Gregory R. Choppin
R.O. Lawton Distinguished
Professor of Chemistry (Em.)

cc: Members of IAB.

**Review Report
of
Instituto Tecnológico e Nuclear
by
International Advisory Board
March 6-8, 2002**

Introduction

The IAB thanks the Director General and Staff of ITN for the hospitality shown to the IAB during the Review visit. Particularly valuable was the willingness of the personnel of ITN to engage in frank discussions with the IAB on the success and the problems of the ITN in the 2001 - 2002 period. We applaud the successes and hope that this Report helps ITN to move to resolution of the problems.

The IAB notes that many of its recommendations and suggestions were followed, and is confident that the suggestions/recommendations that were not followed were given serious consideration prior to rejection. The IAB is aware of the fact that its role is advisory and factors we may not appreciate can cause some of our advice to be inapplicable. The IAB appreciates very much the fact that the Director General replied extensively in writing to the IAB recommendations.

The 2001 Annual Progress Report

The IAB congratulates ITN on the quality of the Annual Progress Report for 2001 and notes continued improvement of the Reports over the last several years. The scientific activities are well described and provide a good summary of the work of the Institute scientists. As this Report is an important document for distribution outside of the Institute, critical remarks on certain issues should be considered carefully before inclusion in the Report as they may be misunderstood. The chapter ITN Global Funding and Human Resources would be more informative if there were separate listing of the institutional funds and those acquired through projects. The funding of the different Sectors of the ITN should be given and its distribution over the main items (such as personnel, new instrumentation, administrative and operational activities) provided. A list of personnel and instrumentation is given but such lists for the separate Sectors would be useful information.

ITN Web Page

The ITN has a well-organized web page in which a much useful information on the Institute is given. The IAB suggested that a scientist be identified as the web page organizer who would be responsible for updating regularly the web information for the entire Institute.

This Review Process

The Review Process for this meeting did not follow the detailed review of the Sectors of earlier reviews. Rather, the Director General provided the IAB with a 10 page assessment of the status, the progress and the problems of ITN as the Directive Board ended its second mandate on December 31, 2001. This was a very useful statement. Unfortunately the IAB did not have the time nor opportunity during the 3 day review to address many of the issues in the assessment. We agree with parts of the assessment, disagree with others and did not receive adequate information on others to reach firm conclusions.

Mission Statement and Strategic Plan

The ITN still lacks a formally-approved Mission Statement, although the Director General has stated his approval of the Mission Statement that the IAB proposed in its Spring 2001 Report. We urge efforts to have the Ministry formally approve this Mission Statement. Many research groups have moved significantly to redirect their research to have acceptable agreement with this Mission and we support the Director General's effort to have all groups of ITN fit, in a broad sense, within the Mission Statement of ITN.

To ensure understanding, the proposed Mission Statement is restated here:

"The IAB suggests the following elements in the ITN Mission Statement: The ITN has as its primary task to carry out research and to provide expertise, training and services in the field of nuclear and radiation science for Portugal. This includes safety aspects such as radiation dosimetry, safety of nuclear instalments and nuclear fuel, safe handling of radioisotopes, and safety of installation emitting x-rays. The utilization of the Research Reactor and the ^{60}Co gamma ray irradiation facility are part of the mission. The R and D in the Sectors should be directed to furthering the use of nuclear and radiation technology for the good of Portugal in societal, industrial, medical, etc. areas.

The ITN can have as a complementary task to provide a number of facilities for experimental research for the scientific community in Portugal which are beyond the capacity of a single university. The nuclear facilities of ITN are unique in Portugal, with specialized equipment that exceeds the ability of a university to acquire and maintain. A mission of ITN should be to make these facilities available to university (and private laboratory) researchers, including technical help and laboratory space for these external users (particularly those from universities). ITN has to provide a modern and updated research infrastructure, including trained scientists, around these facilities. Typical examples would be the ion beam laboratory with a Van de Graaff accelerator and its high fluence ion implanter and, possibly, a small cyclotron for nuclear medicine".

To complement the Mission Statement, ITN needs a long term (5 - 15 year) Strategic Plan to guide the Director General and the Sector Heads to set priorities based on the goal of what ITN should be in 10-15 years. To reach that goal, a tactical plan must be established that states how ITN staff must proceed to reach the long-term goals.

Major Concerns of the IAB

ITN Structure and Management

The structure and management of ITN remains one of the major concerns for the IAB and this topic took much of the discussion time during the three day evaluation visit. The IAB regrets that problems of the internal managerial organization seem to have increased rather than diminished in the 2001 - 2002 period. The Directive Board is now one person (the Director General), the Scientific Committee has ceased functioning and two ITN sectors (Physics and Chemistry) have presently no heads nor formal internal coordination. Although the IAB is aware that the existing legal regulations for personnel management in Portuguese government institutions like ITN appear to make it difficult to have efficient human resources management, the IAB is very concerned about the lack of internal management structures in ITN. A concern is that, in such circumstances, the Director General may not obtain sufficient input from the staff to be able to manage and direct the Institute in an optimal way.

The IAB reiterates its recommendation that the 4 sector heads be more involved in the responsibilities of the day-to-day running of ITN, either as members of a Directive Advisory Group or as a separate board that

meets weekly or biweekly with the Director General to exchange information in both directions. Even if the Sector Heads do not ways share the opinion of the Director General, and irrespective of the decision-making powers of the Director General, the IAB believes such regular meetings would provide more transparency to the management of the ITN and ease tension in ITN between the DB and the Sectors.

Apart from this internal management structure, some members of the IAB suggest that an external "board of supervisors" might be beneficial for ITN. In other countries, institutions like ITN often have such a small board consisting of business leaders, university professors or heads of important government institutions. They meet typically 3 to 4 times every year and evaluate the budgetary and personnel situation of the institute upon which they have either decisive or advisory powers. The name "Directive Board" could be used for such a managerial group.

The IAB supports the suggestions of the Director General to organize a Board of Researchers composed of the research group leaders. Such a Board, like the Board of Sector Heads would promote better discussion and understanding of the Mission of ITN and its operational policies.

The IAB is concerned that there are long-term problems in administration-staff relations in ITN that do not seem to be getting solved. The change in the Ministry and the end of the directive mandate are limes for changes in policy and organization and allow opportunities for imaginative solutions for the human relations problems which persist in ITN.

Adding New Scientits and Promotions

The IAB is concerned about the existing legal procedures for job openings and promotions (i.e., the existing jury-system) which appears to limit drastically an efficient personnel management. The IAB feels that a job opening should start with a clear description of the profile needed, and that the subsequent procedure should be based uniquely on a quality assessment against this profile. Fair standards should be used for internal promotions. These should take into account all aspects of the function description and be targeted to fair promotion chances of the members of the staff irrespective of the sector in which they are functioning. In the case of job descriptions that involve service functions, the evaluations should not be based on scientific criteria alone, but should take into consideration the specific services provided. The IAB suggests that the Director General present the difficulties with the present legal procedures in discussions with national authorities in order to arrive at efficient personnel management procedures, which are internationally accepted.

Cobalt-60 Irradiation Source

The decrease of the radioactivity level of the gamma rays of the cobalt source makes its continuing value a concern. Its lower activity has led users to turn more often to other such installations out of the country in which higher level irradiations can be done. It is possible that this kind of installation can be managed in the near future by industry to optimize the conditions for competitive commercial use. We propose that ITN investigate a transition from the present situation to an industrial consortium. This solution should utilize the knowledge of the researchers and technicians of IIN. Such an evolution is possible only if the number of industrial partners is sufficiently high to guarantee profitable use of the irradiation source.

ICP~N1S Instrumentation

In its September 2000 and March 2001 reports, the IAB advised the acquisition of a high resolution ICP-MS instrument for elemental trace analysis and accurate isotope ratio measurements. The IAB is concerned that

no concrete action was taken for the acquisition of such an instrument. There is an unresolved discussion on where. In the ITN, such an instrument would be installed (DRPNS or Chemistry). The IAB urges the management to actively promote preparation of the proposal that is now being finalized by the Chemistry Sector and to resolve any remaining problems with the application for a large instrument grant. The choice that has been made in the Chemistry Sector for the acquisition of a multi-collector instrument is the correct one. The instrument needs adequate housing, including the provision of a clean room. The personnel in the Chemistry Sector are able to run this type of instrumentation, but one person should be sent abroad for training with the specific instrument to be acquired prior to installation. When a laser ablation source is acquired as any accessory, the instrument will complement the microbe analytical activities of the Physics Sector. The elemental analysis capability of the ICP-MS instrument will enlarge the trace element analysis potential which is now very heavily based on the use of neutron activation analysis. Overall, measures should be taken so that this instrumentation is open for use by the entire ITN community.

ITN Medical Cyclotron

In his written reply to the previous IAB report, the Director General expressed his strong opposition to the "medical cyclotron" proposal. The IAB feels, however, that the arguments brought forward by the Director General are not entirely convincing. Although it is beyond the expertise of the IAB to make a firm statement about the viability of a medical cyclotron in ITN, the IAB has noticed that there are examples abroad where a medical cyclotron in a nuclear research center delivers radiopharmaceuticals for nuclear medicine to nearby hospitals.

The IAB, therefore, suggests again that the Director General appoint a commission of experts to work out a feasible study for such a project. This commission should contain experts from existing facilities in Europe as well as experts from the medical community in Lisbon. They should advise whether such a facility in ITN for the metropolitan area is viable or not. It must be recognized that to be successful, such a facility must be jointly supported by ITN and the medical society of Lisbon. The IAB notes that, after such a study, Chile is installing such a medical cyclotron (1.5M EURO) for fluorine and carbon isotopes for PET use as well as a number of longer lived radioisotopes for use in hospitals in Santiago.

Sectors Review

Nuclear Solid State Physics

The IAB is pleased that both the Van de Graaff accelerator and the high fluence implanter are intensively used. This can lead to an impressive scientific output in collaboration with research groups both inside and outside of Portugal.

In view of the fact that the demands for beam time for scientifically sound proposals exceed the possibilities of the present set-up, the IAB supports the plan of the group to submit a proposal, in collaboration with other Portuguese institutions, to expand this fully used facility through the acquisition of a tandem Van de Graaff (estimated cost: 2.5M EURO) accelerator. Such a facility would increase the available beam time, and also expand the scientific possibilities through higher beam energies and heavier ions at these energies.

The retirement of the present leader (MFdS) puts an extra burden on the scientists in this team who have to manage the complex infrastructure while conducting high level scientific research. A new group leader is

needed as soon as possible and the possibility of an outside choice should be seriously considered.

Condensed Matter Group. High Temperature X-ray Facility

In the High Temperature Materials Laboratory within the Condensed Matter Group an intense 18 kW X-ray source with a high-resolution diffractometer is operated. A heavy Eulerian cradle carries an in situ high temperature furnace.

This is a fine example of activity by A. Sequeira who achieved an excellent installation. The material has been financed through grants from the National Science Foundation, FCT, seconded by financial support by ITN. The complete new instrument has been constructed and installed within two years.

The laboratory is now in full operation. The learn of one full time scientist and one graduate student has developed a number of very fruitful corporations with researchers within and outside of Portugal on diverse scientific questions. This resulted in an impressive number (34) of publications of high scientific standard for the year 2001. This activity deserves strong support.

Reactor

The 1 MW research reactor RPI is technically in a healthy state. Good progress has been made in training new operators. In January 2002 J. Marques was appointed as the new Head of the Reactor Sector. With the present fuel, the reactor can be operated until 2006 after which date it will need a new LEU fuel loading. The decision whether to continue or to cease reactor operation beyond 2006 has to be taken soon, preferably within the year 2002, in order to prepare financing and purchase of the new uranium in 2003 for delivery in 2006.

That the reactor has been used only modestly plays a dominant role in such a decision. Until recently it served only for irradiation purposes (CNAAs and isotope production) which alone may not justify prolongation of its operation. Continued operation of RPI should be justified mainly by the use of its thermal neutron beams and neutron scattering research activity. In Portugal there exists a small, but well recognized group of scientists from different universities who regularly perform neutron scattering experiments in several facilities outside the country. In order to maintain and further develop such activities. The installation of three or four neutron scattering instruments at RPI would be very useful. The competence of some researchers of ITN in instrument design and neutron scattering is well-recognized. ITN should become the nucleus of research activity in this field for the country. Such a base would allow training of students and preparation for research at high flux sources abroad as well as technical development. This could also be a useful facility for Spanish groups as there is no similar facility in Spain.

We welcome recent activities at the reactor such as the irradiation facility for tests of electronic Circuits designed for CERN detectors or the new installation for in situ channelling studies. Two neutron scattering instruments are now visible on the floor. The diffractometer DIDE is installed and the small angle scattering instrument EPA is presently being assembled in the reactor hall. The IAB notes, however, that despite some noticeable progress achieved during the last year, the installation of these instruments has taken an excessive length of time.

To make DIDE operational a few improvements are necessary. The detector is suffering from electronic parasites. This problem has to be solved at the level of the instrument, i.e., by proper grounding and shielding of the detector assembly and its associated electronics. In addition a systematic search for the main sparking sources might help. The floor needs to be smoothed to allow necessary movement of the detector. After these

changes DIDE should be commissioned to collect routine data. A series of further improvements is recommended. The graphite filter needs to be thicker to properly suppress higher orders in the monochromatic beam. The instrument's intensity can be improved by purchasing the missing graphite monochromators. Finally, adequate sample environment equipment should be designed and purchased. The proposal to install a cryo-refrigerator (routinely operated in the chemistry department) is sound and clearly supported.

As all the cost-intensive elements of the spectrometers exist and most of the technical solutions are well established, IAB recommends that the financial complement necessary for the regular use of the instruments be allocated as soon as possible. In view of the pending decision on the future operation of the reactor, we recommend strongly that the value of neutron scattering be demonstrated convincingly. For this, both instruments (or, at a minimum, the diffractometer DIDE) should be in operation by summer 2002. We support the plan to organize a workshop or a school after that date for potential users in Portugal.

Chemistry

This report does not discuss the research of single groups within the Chemistry Sector since the scientific output is high. The IAB is satisfied that the research in these groups is of a high quality with a reasonable average number of publications in reputable journals. Most, not all, of the research is considered as matching to an acceptable extent, the broad provisional mission statement for ITN proposed by the IAB in 2001.

However as in past years, problems related to structure, organization, competencies and responsibilities remain unsolved, although some improvements have occurred. The problem of scattered or non-available resources, the previously recognized problems with the definition of research largest and the apparent lack of clearly defined leadership still persist. Due to the lack of proper strategic guidelines, the general orientation of the research is too broad and is derived from a survival strategy; i.e., the research is overly defined by what allows the scientific staff to obtain funding from external sources rather than what is of prime importance to the mission of the Chemistry Sector. It is recommended that the research activities of the Sector be directed and focused to a larger extent on those topics that are defined as relevant for the ITN and for Portuguese science. The highest requirement is to transform the Chemistry Sector in the future into a well-recognized centre of excellence providing added value to the overall research community in Portugal. The research, thus, needs to be better focused. The goals defined within the Chemistry Sector do not represent a satisfying basis to achieve this goal and clear guidelines are needed from the Institute's management.

It is appreciated by the IAB that the sections in the Chemistry Sector have made efforts to re-orient some research activities to better fit within the provisional mission statement of ITN. There has been significant improvements in terms of the number of projects the total external funding and the available staff (especially in graduate students).

Changes include the elimination of the "PARIS group", originally consisting of a single person. This ITN researcher could be integrated in the DPRSN sector. The groups now have well defined heads, although one group has three rotating heads. Three out of the five group leaders form a "Board of Sector Heads". Although the situation represents an improvement of the status at the time of last evaluation in March 2001, this transitional situation is not satisfactory for the long term optimal operation of the Chemistry Sector. Departments of comparable size in other National Laboratories are usually managed by a single director. The IAB has and, again, strongly recommends appointment of a single sector head. The DB is urged to follow this recommendation with highest priority by, if desired, national and international advertisements. Possible improvements in the Chemistry Sector can be expected to accelerate with a single Head in the Chemistry Sector. No new positions have been opened since 1995 which leads to an ageing staff. Nevertheless, the first position to

be opened must be that of the Sector Head.

A clear and timely perspective for promotion of those individuals that are successful *de facto* leaders of independent research groups is necessary. This recommendation remains a central issue in order for the Chemistry Sector to develop and to orient the high scientific potential of the whole sector under the mission statement.

We appreciated that the DB followed some recommendations from the last report in terms of equipment for the Chemistry Sector. That the DB has invested financially in the Chemistry Sector is an initial step to further improve the experimental possibilities. Investments have been made to assist the Sector to fit the mission of ITN. In particular we note the installation of the luminescence-dating laboratory. Furthermore, the catalysis laboratory has achieved operation and the FT-ICR/MS laboratory was adapted to handle transuranium elements. A new radiopharmaceutical laboratory was installed as well and the DB also co-financed some instrumentation dedicated to biological applications. The DB of ITN has supported the groups which are accepted as acting within the provisional mission statement. As stated by the DB, the situation in terms of budget is favourable at the moment. Continuance of this strategy of acquiring new equipment in the Chemistry Sector is recommended in order to complement and improve the capabilities of the researchers.

Updating of older instrumentation cannot continue to be financed exclusively with external research funds. Institutional funds should be reserved in the yearly budget for general purpose equipment in the Chemistry Sectors. Some of the research infrastructure of the Chemistry Sector is outdated and not in-line with existing scientific standards. Urgent actions for the replacement of small and medium scale laboratory equipment should be taken. In particular, attention is needed for the replacement of the X-ray diffraction and IR-VIS spectroscopy equipment. A document from the group leaders to the DB presents an analysis of the situation at present. It is strongly recommended that the present sector heads in Chemistry together with the group leaders, revise this document to differentiate between what is desirable and what is urgently needed in the near future to continue the level of good scientific research. To overcome problems of priorities, the implementation of clear structures and dedication of distinct competencies, a single Director of the Sector is crucial.

Department of Radiological Protection and Nuclear Safety

The IAB notes that, despite the recent opening and filling of new posts for DRPNS, there has been a continuing decline in staffing levels in this Department at a time of increasing workload for essential national radiological services. This apparent anomaly arises largely from the peculiarities and inefficiencies of the Jury system and of continuing staff losses by retirement, etc. The net result is that the current staffing level is around 60% that pertaining in the mid-1990s. Essential radiological services, such as maintenance of national radiation standards for X-ray and radiotherapy units throughout Portugal and radiometry monitoring of food, drinking water and environmental samples, now depend on a single DRPNS scientist approaching retirement. Since the IAB's last visit, a Mission to Portugal by the International Atomic Energy Agency reported as follows on radiological service staffing at DRPNS - "This Department is totally understaffed for the heavy workload. Understaffing could lead to serious safety problems. As safety problems would be, potentially, of national significance, the IAB repeats more emphatically its previous urgent recommendation that the statutory radiological responsibilities of DRPNS be properly supported by addition of an appropriate number of staff. The IAB also repeats its advice that would seem helpful and fair, and, indeed, would encourage initiative and productivity, if a reasonable fraction of the considerable radiological service income for DRPSN would be returned to the Department to be used in the first instance, to permit recruitment of short-term contract staff to help fill the currently very serious gaps in expertise and capacity. In addition, to ensure continuity of

fundamental expertise in the laboratories of DRPNS, the IAB also strongly recommends that the technical staff of the Department be augmented by appointing the best of the 9 licentiate and 10 non-licentiate Fellows and Interns who have been trained at DRPNS under the special Framework Program for the "Reinforcement of Radiological Protection Skills" initiated 3 years ago by the Science and Technology Foundation. As the program title implies, the objective and commitment was to ensure a robust and continuing radiological expertise. However, no such appointments have been made and Fellows/Interns, after several years of training, have begun to be lost from the system. This seems a serious waste of the major financial and training investments made under this program. The IAB considers that the retention of these highly trained young technical staff at DRPNS is a matter of importance and urgency.

Almost alone among the sectors of ITN, DRPNS has a clearly defined mandate according to national decree. In addition to the essential service functions associated with meeting national and international radiological protection obligations the primary mandate of DRPNS is "to carry out scientific research and training in the areas of radiological protection and nuclear safety". The staffing decline has, however, increasingly forced the remaining resources of the Department to focus on satisfying the essential service demands and thus, the levels of research activity, publication rates etc. are now unsatisfactorily low. The IAB supports the need for a healthy research/service balance within DRPNS. Clearly, the IAB's recommendations for increased staffing levels and transfer of budgetary control of some percentage of the external funds are reinforced by the need to provide appropriate additional research-related resources.

In view of the currently high fraction of service work applying to the Departmental workload, the IAB considers it essential that the promotion criteria applying to DRPNS personnel should relate to staff performance relative to clearly defined, agreed on and realistic job descriptions. Now, they are unfairly weighted by the research output criteria, such as numbers of research publications, which are routinely used in promotion evaluation in sectors solely or largely responsible for research mandates only.

The radiological measurements made in DRPNS continue to be carried out under laboratory, conditions so poor that the results may not be nationally or internationally acceptable for accreditation. The IAB has previously urged the rapid planning and construction of a new, suitably equipped DRPNS laboratory building, the IAB was pleased to learn from the Directive Board that "the new building for the Department has the highest priority in the program of Modernization of the Infrastructures of ITN for 2002". As this is a matter of major national significance, the IAB continues to urge rapid, positive action.

Finally, the IAB supports continued national and international actions, the latter in collaboration with the International Atomic Energy Agency and the European Union, to rationalize, harmonize and bring to international standards Portugal's entire infrastructure for radiation protection and nuclear safety, including its legislative and administrative bases and its system for notification, authorization and enforcement. The September 2001 IAEA Mission Report makes a number of recommendations relating to DRPNS; the IAB, in supporting these, believes that by pursuing the development of a modern, rational and effective national infrastructure within Portugal, the long-term status and structure of DRPNS will be further defined in a positive, sound and coordinated manner.

Final Comments

The IAB recognizes that serious problems persist that could hamper the progress of ITN to be of increased value to the citizens of Portugal. However, it is important to state clearly that the IAN is convinced of the devotion of the ITN staff, from the Director General to the research scientists and to the chemical and

technical workers to making ITN a major, national research institute. Members of these have strongly opposed opinions on how to achieve this goal. We urge all members of ITN to seek to reach acceptable compromises that will allow all members to work together in a trusting open fashion to achieve their common goal.

With the end of this mandate period, our association with ITN is finished. We thank ITN for the opportunity we have had to offer our advice. We wish ITN continued evolution to become internationally recognised nuclear laboratory, serving Portugal in important research in nuclear science and technology.

Attachment A - ITN Review 2002

Schedule

Date	Hour	Name	
Wednesday, March 6 th	3:00 P	Fernando Carvalho	Discussion
	4:00 P	Isabel_Santos	Discussion
Thursday, March 7 th	10:00 A	Physics	Visit
	10:00 A	Chemistry	Visit
	1:30 P	Jose Marques	Discussion
	2:00 P	Pedro Vaz	Discussion
	2:30 P	Antonio Pires de Matos	Discussion
Friday, March 8 th	9:00 A		Writing
	10:00 A		Talking
	11:00-12:00 A		Writing
	1:00 P		Talking
	2:00 P		Writing
	4:00 P		Discussion of Report with Prof. Soares

Attachment B - ITN Review 2002

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