SUBJECT REVIEW REPORT

DEPARTMENT OF NUCLEAR SCIENCE

FACULTY OF SCIENCE
UNIVERSITY OF COLOMBO

24th to 26th April 2007

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1. SUBJECT REVIEW PROCESS

Subject review process formulated by the University Grants Commission evaluates quality of education within a specific subject or discipline. It is focused on the quality of the student learning experience and on student achievement. It has been designed to evaluate the quality of both undergraduate and postgraduate programmes offered by academic departments of the Sri Lankan Universities.

This report describes the outcome of a review carried out to evaluate the quality of the academic programmes and related issues in the Department of Nuclear Science of the Faculty of Science of the University of Colombo, Sri Lanka. In this exercise the following aspects were examined and evaluated.

1. Curriculum Design, Content and Review
2. Teaching, Learning and Assessment Methods
3. Quality of Students, Student Progress and Achievements
4. The Extent and Use of Student Feedback
5. Postgraduate Studies
6. Peer Observations
7. Skills Development
8. Academic Guidance and Counselling

2. BRIEF HISTORY OF THE UNIVERSITY, FACULTY AND THE DEPARTMENT

University of Colombo was established in 1978 by the Universities Act No. 16 of 1978. Though it was formally established 1978, it was strongly linked to the University of Ceylon, which inherits a proud and long history that runs back to 1942. As a result of a recommendation made by Sir Walter Buchenen Riddell, Chairman of the University Grants Commission, United Kingdom, and University of Ceylon was moved to a new site in Peradeniya in 1952. Although the University moved to Peradeniya in stages, the Faculty of Science continued its teaching activities in Colombo together with several other faculties. In 1967, Faculties that continued their teaching activities in Colombo became the new University of Colombo. With the establishment of University of Sri Lanka in 1972, University of Colombo became one of its five campuses. Once again it became an autonomous university in 1978 with the implementation of universities Act no. 16 of 1978. The University of Colombo has six faculties; Medicine, Arts, Science, Law, Management Studies and Commerce and Graduate Studies. The university also has two affiliated colleges namely the College for Indigenous Medicine and Spirali College for fine arts and a School for Computer Science.

The Vision and Mission of the University

Vision Statement

The University of Colombo as metropolitan national university with historic links to the first University College, strives to be a centre of excellence of regional and international repute that will create new knowledge and sustain a culture of service and commitment to national development and democratic values in a plural society.

Mission Statement

To be a centre of excellence in teaching and research, with commitment to producing men and women of high ethical standards and social responsibility who are capable of creative,

analytical and independent thinking and facilitate the creation and dissemination of knowledge through partnerships between staff, students and relevant sectors of the society.

The Faculty of Science of the University, which was in existence since beginning of University College days, has the following Vision and Mission.

Vision of the Faculty of Science

To be a centre of excellence of scientific and technological excellence nationally and internationally.

Mission of the Faculty of Science

- *To develop honest, adaptable productive citizens with multidisciplinary knowledge, creative thinking and analytical skills with a high degree of civic conscientiousness;*
- *To articulate and promote interaction with public and private sector and society at large, with the view to contributing towards the development of the nation;*
- *To institute mechanisms for partnership programmes for improving resources and infrastructure facilities*.

At present the Faculty of Science has little over 1500 students, 88 academic staff members 113 non-academic staff members. Present annual intake of students is 600. The Faculty of Science has seven academic departments namely Chemistry, Mathematics, Nuclear Science, Physics, Plant Sciences, Statistics and Zoology. The faculty departments offer general (3 year) and special (4 year) degrees.

Department of Nuclear Science

The Department of Nuclear Science (DNS) inaugurated in 2003 was the evolutionary product of the Radio Isotope Centre (RIC) that was established in 1961 at the same site. The RIC was originally established to provide training requirements and atomic energy services for the country. Since the initiation of Atomic Energy Authority (AEA) in 1969, the RIC became the office and service centre for the AEA. However, since the development and establishment of the AEA in new buildings away from the site of RIC in year 2000, the Faculty of Science recognized the need for the continuation of academic activities in nuclear science and hence proposed a new department, i.e. the DNS and this was inaugurated in 2003. It is also the only academic department catering for nuclear sciences in the Sri Lankan university system.

In Sri Lanka nuclear technology is used in medical, agricultural and industrial sectors to improve the quality of life. However, Sri Lanka has insufficient number of trained personnel to deal with technical and radiation safety issues. Nuclear Science is a science that deals with ionizing radiations emitted from atoms and nuclei. It helps develop nuclear techniques and skills to make precise experimental measurements, devices and instruments that can be used for applications in other branches of science, medicine, agriculture and modern technological world.

Students

Each year approximately 360 students are admitted to the Faculty of Science for the Physical Science and Biological Science streams. The DNS offers optional courses for the third year students. Details are given in Annex 1. At present the contribution of the DNS for the general degree program is approximately 5%. The DNS has offered such optional undergraduate courses at least since 1988 as evidenced by the results book available in the department.

Figure 1. Dr S Kulatunga, Head of Department making a presentation on Self-Evaluation

Staff & Facilities

The DNS currently has an academic cadre of 4. This includes one professor, one associate professor and two senior lecturers. Additional staff involved in teaching includes 1 temporary demonstrator and 1 scientific assistant. The non academic staff of the DNS constitute of 4 technical officers, 1 lab attendant, 1 labourer and 1 clerical staff member.

This department is located in a single-storey building having an area of 500 square meters. There is one seminar room in the DNS which can accommodate about 25 students. The seminar room is equipped with a white board, an overhead projector, a multimedia projector and a computer.

The DNS has a sample preparation laboratory and a counting laboratory to conduct undergraduate and postgraduate laboratory course units. The DNS also has a dark room facility to carry out film processing in industrial radiography and facilities to store radioisotopes. It also has facilities to conduct basic nuclear science experiments assisted by High resolution gamma spectroscopy, Alpha spectroscopy and Neutron activation analysis. There is also a well equipped Library on site and access to internet via two terminals.

During weekends these laboratories are also used to conduct laboratory course units of M.Sc. programs and extension courses of the DNS.

3. AIMS AND LEARNING OUTCOMES

3.1. Aims

The DNS, falling in line with the vision of the University and the Faculty, intends to provide through its degree programs

a. High quality learning experience so as to expose students to recent advances in knowledge and techniques, particularly in the applications of radiation in agriculture, medicine and industry

b. Training in understanding of fundamental concepts, problem solving, independent thinking and reasoning & analysis

c. Training in scientific research, self-studying and application of such training in real world situations

d. Skills in the use of instrumentation and equipment through laboratory, workshop practice and research exposure

e. Skills in computing and Information & Communications Technology (ICT), writing of reports and presentations

3.2. Learning Outcomes

On successful completion of the general degree course units offered by the DNS, the students are expected to have:

a. A basic knowledge in fundamental principles of ionizing radiation, ability to use them in problem solving and apply them in the fields of agriculture, medicine and industry;

b. An ability to use nuclear techniques in investigations and analyses and make use of recent advances in technological developments related to Nuclear Science;

c. Ability to decide a suitable nuclear technique, instrumentation for an experimental investigation and safe and proper handling of radiation sources and instrumentation in research and other areas;

d. Competence in use of information technology and computer software and hardware;

e. Ability to apply their theoretical and experimental knowledge and training for real world problems.

In order for students to achieve the outcomes specified above, the DNS offers through its programs learning experience that enables students to:

a. Work in an academically and socially conducive environment;

b. Study in areas where the students have interest and talent by offering a choice of course units that allows them to gradually develop their knowledge, skills and understanding;

c. Interact with highly qualified staff who are committed to teaching and to develop promising graduates useful for the country's needs and suitable for higher studies;

d. Develop their experimental skills using areas which the department is equipped with;

e. Undertake a final year research project that suits the interest of the student by offering projects covering a diverse range of topics;

f. Have a manageable workload within university guidelines.

The DNS currently provides course units in nuclear science and related subjects for the B Sc General Degree program. Details of the course units are given in the Annex 1.

4. FINDINGS OF THE REVIEW TEAM

4.1. Curriculum Design, Content and Review

The Faculty of Science has gone through a major curriculum revision in 2002. At this revision in order to achieve a greater diversity and flexibility the number of subject combinations was increased, English was chosen as the medium of instruction and Computer/IT courses were introduced to all B Sc degree programs. In addition, for the undergraduate performance evaluation, a Grade Point Average (GPA) based system was also introduced. Since 2002 there had been one minor revision of curriculum in 2006 based on student feedback.

Thus, the course units designed by the DNS was based on the credit system practiced by the Faculty and are distributed within the two semesters in each academic year. Content in a theory course unit varies from 1 credit (15 hrs of lectures) to 3 credits (45 hrs of lectures). The content also includes laboratory course units. At present, the DNS offers only optional course units in the third year.

Academic staff members of the DNS also contribute to conduct courses in Environmental Science (Department of Zoology), Medical Physics (Department of Physics) and Nuclear Pharmacy (Department of Chemistry).

The Review Team observed that the DNS continues to improve the usage of computers in teaching and learning activities particularly in the laboratory. We feel that this is an important measure in the development of analytical techniques in nuclear science. However, lack of advanced computer and nuclear instruments hinder the development.

The DNS participates in the Faculty Quality management program through Curriculum Development and Evaluation Committee (CDEC). The Head of DNS and another staff member are represented in CDEC.

The Review Team judges the Curriculum Design, Content & Review of the DNS as SATISFACTORY.

4.2. Teaching, Learning and Assessment Methods

The DNS has highly and diversely qualified and skilled staff to conduct a range of teaching and learning activities relevant to nuclear science.

The course units offered by the DNS consist of lectures, practicals and tutorials encouraging student-centred learning and staff-student interaction. Practical course units allow students to learn experimental methods and transferable skills while strengthening the subject specific knowledge. For classroom teaching, the staffs use black/white boards, visual aids and handouts. Whenever possible, lecture demonstrations are used.

Figure 2. Undergraduate students following a lecture delivered by Prof. R Hewamanna

The students' progress in understanding the course contents covered through theory course units is supplemented through tutorials prepared by the lecturer associated with the course unit. In general, tutorial classes are conducted by demonstrators other than the lecturer who teaches a particular subject course unit.

Laboratory courses have been designed for students to acquire hands-on experience, transferable skills and further improvement of knowledge that they gain through their lectures.

In the laboratory classes students carry out their practicals in pairs with the guidance of the laboratory demonstrators. For self preparation prior to the practical, an instruction sheet is provided. The duration of one practical is three hours. Each pair of students carries out approximately 8-12 such practicals per semester. However, the Review Team feels that the laboratory environment need to be improved in the context of temperature and humidify regulation to protect sophisticated instruments as well as to provide a conducive educational environment.

Assessment Methods

The DNS mainly uses end semester evaluation for student assessment. However, mid semester evaluations have been conducted in Health Physics mainly as a formative examination. End semester examination usually carried 70% of the total mark for theory component of the course unit. The remaining 30% has been allocated as a form of continuous assessment for the practical component of that course unit. There was no end semester

examination as such for practical classes. This continuous assessment of the practical component was carried out by a demonstrator and later scrutinised by a senior lecturer.

In order to ensure the clarity of questions and the standard of the question papers the questions were moderated by an external examiner who also served as a second examiner when marking answer scripts.

Figure 3. An introductory lesson on laboratory use conducted by Mr UD Ratnayake (Senior technical officer) for undergraduate students

In relation to the Teaching, Learning and Assessment Methods the judgment of the Review Team is SATISFACTORY.

4.3. Quality of Students, including Student Progress and Achievements

Student Profile

Students for various degree programs are selected by the UGC based on their Z-score. Those seeking to study in the Faculty of Science of the University of Colombo have shown good performance at the A/L examination (see Table 1).

Student Achievement

The overall performance of the students following the optional courses in nuclear science is good. The reviewers had an opportunity to attend a seminar presentation by one final year student and noted that the presentation was very good. Annex 2 and Annex 3 show the progress of the students who followed course units offered by the DNS.

Table 1 The advance level performance of students

University/ program	Intake per Year	Average Z score
Physical Sciences		
Colombo	**240**	**1.7283**
Peradeniya	250	1.4307
Kelaniya	245	1.3834
Sri J'Pura	170	1.3910
Ruhuna	210	1.2401
Jaffna	250	1.2549
Biological Sciences		
Colombo	**125**	**1.8978**
Peradeniya	100	1.6015
Kelaniya	165	1.6074
Sri J'Pura	80	1.5850
Ruhuna	130	1.4499
Jaffna	100	1.1474

Source: UGC Statistics 2004

The Quality of Students, Student Progress and Achievements in the DNS could be judged as GOOD.

4.4. Extent and Use of Student Feedback, Qualitative and Quantitative

The revision of curricula was based upon informal feedback received from students, academics and graduates on a qualitative basis. These suggestions were taken into consideration during relevant discussions at the meetings of the departmental committee. However, a mechanism to receive quantitative feedback was introduced to the Faculty only recently. As an initial step, the faculty has prepared a course evaluation form to be given to students by the lecturer of each course unit. However, the reviewers feel that quantitative feedbacks should be formally processed and analysed.

It is the view of the Review Team that the Extent and Use of Student Feedback by the members of the staff of the DNS can be judged as SATISFACTORY.

4.5. Postgraduate Studies

Taught Courses

The DNS started an M Sc degree program in Nuclear Science in 1982. To date, 32 students have successfully completed the M Sc program and 6 students are currently doing their research projects. There had been 10 dropouts, 6 failures and 1 who went missing.

Applications were called in 2005 and 2006 for an M Sc program in Medical Physics but it could not be started due to insufficient number of applicants (minimum required is 10 to meet the expenses). These M Sc programs consist of 24 credits of theory course units and 6 credits of research component of 6 month duration. At least one supervisor is assigned to each

postgraduate student studying for M Sc degrees. Usually, students are allowed to select supervisors relevant to their field of studies.

The conductances of M Sc and Diploma programs have been irregular. One main reason for this has been the inadequate number of applicants to fulfil the budgetary requirements. The minimum student number needed to meet expenses is 10. However, the DNS has not changed their strategies necessary to improve the situation. This does not seem a problem of the quality of the course but inadequate marketing.

The Review Team observed that the undergraduate students are not well informed about the postgraduate programmes conducted by the DNS. There is a need also the candidates to be aware of the career paths before they embark on these postgraduate courses.

Research Degrees

At present one student is following an M Phil degree program. This student is satisfied with her progress and is nearing completion.

Research activities are mainly self-funded. Presently, all students who are reading for their postgraduate degrees are staff members of private or government institutions. These students thus receive their salaries from institutions to which they are attached and carry out postgraduate research in this department part time or while on study leave.

However, completion and write up of research have led to delays in the completion of M Sc courses and hence the number of students completing the degree per year is very low.

The Review Team commends the commitment of the DNS for postgraduate taught courses and research projects. It is likely that these avenues can be strengthened by promotion and provision of career guidance.

Non-Degree Diploma Program

Last year, the DNS has conducted a Diploma program on Radiation Protection to the radiographers employed in the Ministry of Health or other hospitals. This diploma course consisted of 180 hours of lectures (12 credits) spread over 6 months conducted on a part-time basis. The reviewers interviewed 5 students who have completed the Radiation Protection Diploma. These students were quite satisfied with the knowledge and skills received through this course. However, they were unaware of how best this could be used for their promotion or career development.

It is the view of the Review Team that the status of Postgraduate Studies of the DNS can be judged as GOOD.

4.6. Peer Observation

Currently, direct peer observation in teaching is not in practice at the DNS. However, there are several mechanisms of indirect peer observation implemented in the department. For example, the moderations and examination of question papers by an external examiner is once such instance.

In the opinion of the Review Team Peer Observation could be judged as SATISFACTORY.

4.7. Skills Development

Skills development starts mainly through laboratory course units. Writing of laboratory reports, facing viva examinations and thesis writing and oral presentation of research projects help students improve their writing and communicative skills. After the completion of their

degree program, a few graduates are hired by the department for at least one year as demonstrators. This gives an opportunity for them to improve their practical skills and theoretical knowledge.

The Review Team judges the Skills Development at the DNS as GOOD.

4.8. Academic Guidance and Counselling

The Faculty has appointed staff members for academic guidance and counselling through student counsellors. The Faculty Handbook published annually gives additional general information. Prof. P. Mahawatte from the DNS was an academic counselor in the academic year 2006/2007. At present she is on sabbatical leave.

A meeting with the current faculty counselors was not considered appropriate by the faculty administration with regard to the subject review of the DNS. However, there is informal student assistance available within the department.

The Review Team judges the Academic Guidance and Counseling as SATISFACTORY.

5. CONCLUSIONS

The DNS provides the undergraduate students entering the Faculty of Science a unique opportunity to master a subject area with a promising future career. However, inadequate marketing and awareness programs have rendered these valuable courses relatively unknown. A similar scenario is operational in the offer of postgraduate courses and enhanced marketing is necessary for the recruitment of more students. The DNS is encouraged to improve its financial administration and strategies to obtain external grants for the uplift of facilities and the demand for courses. The proposed special degree program can be considered a golden opportunity for the department to pursue above developments utilizing its staff trained under new frontiers of Nuclear Medical Science.

Curriculum Design, Content and Review

Strengths/Good Practices

The collective approach in course designing and a concept for revision is healthy. This was evident by the revision carried out in 2006 and also planning that has taken place for the special degree from year 2004 onwards. The Review Team was pleased to note that the proposed special degree course on Nuclear Medical Science is due to be commenced from year 2007/8. This would enhance departmental image and also attract more students to follow courses offered by the department.

Weaknesses

The undergraduate courses offered are only optional and only commences in the third year. Thus, the number of students selecting these courses through their interest alone is low. Most students seem to select these courses as a strategy to complete the minimum required number of credits to complete their general degree. The lack of adequate marketing of the courses in the first and second year may also be contributing to low interest among students to follow nuclear science affiliated courses.

There are no specific objectives or learning outcomes listed for each course unit in the department. Thus, the new students are unable to comprehend the course outline simply by reading the published material by the department.

There is also a fear among students, as mentioned by both students and staff to enter the DNS as it is related to "Nuclear" work. Although, this laboratory is considered to be of low risk, inadequate facilities and orderliness in the laboratories may have contributed to this. It is necessary for the department to publicize that it is a C1 laboratory and conform to its standards (see Annex 8). For example, there were not sufficient radioactive warning labels displayed, no shower, no eye wash facility, no safety instruction on display, inadequate number of gloves, lead spectacles, lab coats etc. These were evident during the practical classes observed by the reviewers. The reviewers emphasize the need of a radioactivity warning system in this laboratory although this is considered to be of a low risk C1 laboratory. It is worth comparing the safety measures in similar modern laboratory since this laboratory has more than 40 years old setup. In this regard the department/university can seek the assistance from the International Atomic Energy Agency (IAEA) through the Atomic Energy Authority (AEA), Sri Lanka.

Figure 4. A practical class for undergraduates conducted within the laboratory

The Review Team feels that there is room for the improvement of the test methods and techniques presently used in the department laboratory. This can be achieved by improving the relationship with AEA and working as partners and also comparing with the test methods, techniques and procedures used in similar laboratories elsewhere particularly in developing countries.

Teaching, Learning and Assessment Methods

Strengths/Good Practices

Friendly staff of the DNS assist students enhance the teaching and learning process.

The social harmony amongst academic staff and non-academic staff members both academic and non academic is conducive for development. The diversity of specialization of both academic and non academic staff is an asset for this department to pursue its objectives to the highest level of achievement.

Weaknesses

Inadequate facilities such as library material and free access to databases may hinder student centered self learning skills. Although a library is available in the DNS itself, students admitted that they hardly use this library for their learning. Instead, they use 6-7 books available in the main library of the faculty.

Not using students' feedback effectively through quantitative analysis may not be productive as trends cannot be identified. The DNS should attempt to process the feedback data meaningfully.

Having no strong commitment to conduct mid-semester evaluations and formative evaluations could be considered a reason for poor performance by some students. This is because the students cannot gauge their performance against the standards expected from them and teachers cannot judge the level of instruction before the end semester examination. In addition, the lectures do not receive a subjective assessment of the students' capabilities before the end of the course, hence rectifications cannot be applied. This was evident from the difficulties ensued by the DNS in tracing any mid-semester examinations or marks offered.

Quality of Students, Including Student Progress and Achievements

Strengths/Good Practices

The students' entering the optional course seems to improve their attachment to the subject with time. This could be a reflection of good teaching practices adopted by the DNS. Thus, students' entering the program seems to develop a positive attitude towards self learning.

Weaknesses

The staff themselves admitted that it is often the weaker students who end up taking optional courses in nuclear science and they often originate from the biological stream. This could be due to inadequate efforts of the department in marketing the courses in the 1st year – as also confirmed by the students interviewed.

The students admitted to the fact that they have no idea how these courses would help them in their future careers. This could also be a negative factor that is in operation amongst the students when selecting courses from nuclear science.

Figure 5. The mini-workshop hosted within the laboratory itself

Extent and use of Student Feedback, Qualitative and Quantitative

Strengths/Good Practices

There seems a genuine department interest to obtain students' feedback.

Weaknesses

The DNS gets student feedback on course materials in a formal manner too. However, such feedback has not been subject to proper processing and analysis.

Four female students of the bio-stream following the optional courses offered by the DNS and 3 male students following similar courses in Physical Science stream were interviewed. All students expressed satisfaction for selecting the courses but were of very poor understanding as to its value for the future in relation to career development. All students agreed that they selected nuclear science optional courses just because of either senior's advice or just to obtain credits.

Students proposed that more information of these courses at 1st or 2nd year would have been useful and that they would like to see these subjects are offered from 1st or 2nd year also. Furthermore, they also mentioned that there was no career guidance from the department in the first year. However, they praised the departmental members for explaining when they voluntarily visited the DNS to obtain more information.

Postgraduate Studies

Strengths/Good Practices

There is genuine interest amongst departmental academic as well as the non academic staff in promoting postgraduate studies and research. This is strengthened by the favorable feedback received by the Review Team from most ex-postgraduate students. Similar opinion was given by the radiographers who underwent part-time training in the DNS for their diploma.

Weaknesses

The DNS needs to focus more on the advertisement and marketing of its courses and also ensuring that their postgraduate degrees are recognized for promotion etc at least in the government institutions of Sri Lanka. Thus, there is a need to lobby. Establishment of an alumni network may help the DNS achieve this task efficiently to enhance demand for the postgraduate courses.

There is also a need for the DNS to look for more external grants to fund additional developments, sustenance, new achievements and even patenting their designs and research. The DNS received its last external grant in 1999. Ensuring the quality of laboratory and its test procedures are important to ensure quality, confidence of clients and the demand for its service functions.

Peer Observation

Strengths/Good Practices

There is no direct peer observation. However, the departmental harmony may be contributing to indirect peer observation. This was however difficult to substantiate by any documentary evidence.

Weaknesses

Peer observations are not recorded. Thus, there is no consistency.

Skills Development

Strengths/Good Practices

Almost all academic and non academics staff has undergone substantial training in diverse fields of relevance for nuclear science home and abroad.

Weaknesses

However more exposure and training opportunities in modern techniques in nuclear science are needed for the staff. This may hinder the popularity of the courses amongst the students.

Academic Guidance and Counselling

Strengths/Good Practices

Professor P Mahawatte from the department was an academic advisor in the academic year 2006/2007. At present she is on sabbatical leave. However, there is informal student counseling available within the department.

Weaknesses

There is no evidence to support any formal academic guidance being offered by the department regarding undergraduate or postgraduate courses of the department or for career development other than the information available in the faculty hand book and the website.

This is reflected by the fact that students selected courses offered by the DNS as a fill-gap measure for credits.

Based on the observations made during the visit by the Review Team and discussed above, the eight aspects were judged as follows:

Aspect Reviewed	Judgment Given
Curriculum Design, Content and Review	Satisfactory
Teaching, Learning and Assessment Methods	Satisfactory
Quality of Students including Student Progress and Achievements	Good
Extent and Use of Student feedback, Qualitative and Quantitative	Satisfactory
Postgraduate Studies	Good
Peer Observation	Satisfactory
Skills Development	Good
Academic Guidance and Counselling	Satisfactory

The overall judgment is suspended

Figure 6. The Review Team presenting its findings to all staff of the department

6. RECOMMENDATIONS

Based on observations during this visit, the Review Team wishes to make the following recommendations.

1. The Review Team was pleased that the academic and technical staff members of the DNS were enthusiastic in developing the department. The technical staff also showed their concern about the progress of the students and their readiness to help the students. The DNS has recognized the need for curriculum revision. The DNS need to capitalise on this harmonious environment to expand and improve their undergraduate and postgraduate academic programs.
2. In order to improve the overall academic standards of the DNS, the Review Team recommends the use of formal student's feedback effectively. There is also a need to elaborate and upgrade course guidelines, with the inclusion of aims and learning outcomes for each course unit in a more specify manner relevant to the course unit offered.
3. The Review Team also strongly encourages the DNS to expand their undergraduate programs as government funding, cadre etc. are often linked to the number of undergraduate courses and students.
4. The Review Team would like to encourage the DNS to obtain formal certifications, national or international as appropriate, to ensure quality of their equipment and laboratories.
5. The reviewers wish to promote the DNS to consider implementation of mid-semester examinations and evaluations for all undergraduate courses offered.
6. There is a need to encourage students to use the academic material available within the department. A formal provision for undergraduate access for departmental library material etc may need to be established.
7. The DNS should advertise on its strengths, performance of their past students both undergraduate and postgraduate, teacher achievements and trends through the means of leaflets, displayed material etc to encourage student enthusiasm.
8. The Review Team strongly suggests initiation of a society related to nuclear science and an alumni network of its past students both undergraduate and postgraduate to enhance its academic performance and advertisement.
9. The staff members both academic and non academic should be encouraged to apply for external grants and submit their innovations for national and international competitions, for patenting etc.
10. The DNS need to actively lobby and seek national recognition for their postgraduate degrees offered at least in the national institutions for recruitment and promotion.
11. The Review Team would like to propose that postgraduate courses be offered regularly, annually, irrespective of the number of applicants. This is essential for the establishment of credibility and promotion. The DNS can seek internal and external funding or develop a separate ledger account for the said courses to bridge the budgetary constraints when the number of applicants is insufficient to meet the expenses. The DNS is promoted to incorporate strategies to ensure that postgraduate students complete their degrees within a stipulated period.

12. There is need for the DNS to establish a better financial administration structure to ensure maximal benefit would return to the department through its fee levying external services provided for external clients.
13. As a measure to enhance quality, peer observation needs to be formalised and recorded.
14. The Review Team also recommends upgrading safety standards within its laboratories and its working environment. Funding for this may be obtained through internal and external grants. It would be advisory for the faculty to consider additional grants to improve IT and laboratory facilities of the DNS irrespective of the number of undergraduate students following its optional courses until this infant department is grown to its feet. The ground space of the DNS and facilities available for staff and students needs to be improved. Laboratory environment should be conducive for studies. Air conditioning is a must. The DNS may consider displaying laboratory safety instructions, disciplinary procedures in a more prominent manner and also publicly display procedure to follow, for example, in a radiation accident.
15. Attention is encouraged to both safety and security in safety assessments. Some measures designed to provide safety such as use of locks and radiation detectors will also provide a degree of security against the fear of 'nuclear work'. Similarly measures designed to prevent unauthorized access to sources will contribute to their safety by reducing the likelihood of misuse.
16. Further, the following suggestions will further strengthen the standards of the laboratory setting. (a) Measures to regularly monitor the implementation of the safety regime (by inspection and audit) to provide ongoing assurance that the required safety level is being maintained. Schedules and procedures for the periodic examination, maintenance, inspection and testing of safety-related components of the labs and processing equipment, including alarms and monitoring system. (b) Measures to control access to the facility such as access control, monitoring, alarms and the use of a barrier. (c) The emergency plan, especially the ability of the emergency response to limit and mitigate the effect of postulated incidents and accidents.
17. The QA programme that applies to the operation of the facility and how the results of the safety assessment are reflected in the record-keeping required by the QA program.
18. The Review Team also feels that the expansion of laboratory space and also improving the setting of the mini electronic workshop necessary for equipment repair would be conducive for sustainability and expansion of its services.
19. The Review Team wishes to emphasise that there is a need to enhance marketing of the courses offered by the department for its expansion and development.
20. It is recommended to utilise the provisions available for financial autonomy within the university administration to enhance its service commitment and its quality. This is also required for its sustainable development
21. The working relationship with Atomic Energy Authority needs to be re-established to its past glory.
22. The DNS is encouraged to promote research students and staff to apply for external grants.

7. ACKNOWLEDGEMENTS

The Review Team would sincerely thank the Head of the DNS Dr Sunil Kulatunga, Prof. R. Hewamanna and Dr. C .S. Sumithrarachchi for their enthusiastic participating in this review process, making arrangement for all necessary meetings and facilities and hospitality. The reviewers also wish to extend their appreciation to the QA Specialist of Quality Assurance and Accreditation Council of UGC Prof Collin Peiris, the Dean, Faculty of Science and the Vice Chancellor, University of Colombo for this opportunity provided.

8. ANNEXURES

Annex 1. Course Units offered by the Department of Nuclear Science for General Degree Students

Year	Semester	Course No.	Course	Credits	Stream	
					Bio	Physical
3	1	NS 3005	Radiobiology	2	O	--
		NS 3017	Applied Nuclear Science	3	--	O
	2	NS 3006	Nuclear Techniques in Biology	2	O	--
		NS 3008	Nuclear Techniques II	1	O	O
		NS 3018	Health Physics and Radiation Protection	3	--	O

Annex 2. Undergraduate Students' Progress (New System)

Year	Course unit	A	B	C	D	F	Ab	Total
2006 New System	NS 3001	0	0	4	8	0	3	15
	NS 3002	0	0	0	6	3	3	12
	NS 3003	0	1	4	0	0	0	5
	NS 3004	1	3	1	0	0	0	5
	NS 3005	2	1	8	6	2	1	20
	NS 3007	10	3	0	0	0	0	13

Annex 3. Undergraduate Students' Progress (Old System)

Year	Course Unit	A	B	C	D	E	Ab	Total
2006	NSP 3102 (Repeat)	0	0	1	0	1	2	4
2005	NSB 3101	0	6	17	0	0	2	25
	NSP 3102	2	7	17	10	1	2	39
	NSB 3103	0	11	3	4	1	0	19
	NSP 3104	0	4	7	9	0	2	22
2004	NSB 3101	4	17	12	0	0	0	33
	NSP 3102	1	7	8	2	0	0	18
	NSB 3103	0	3	4	0	0	2	9
	NSP 3104	0	7	1	0	1	0	9
2003	NSP 3102	0	14	11	0	2	2	29
	NSB 3103	0	0	11	2	1	1	15
	NSP 3104	3	10	6	0	2	1	22

2002	NSB 3101	1	2	6	1	0	0	10
	NSP 3102	2	7	6	0	0	1	16
	NSB 3103	2	8	6	3	0	2	21
	NSP 3104	0	4	4	1	0	0	9

Annex 4. Course Units offered by the Department of Nuclear Science for the Proposed Special Degree starting 2007/2008

Year	Semester	Course No.	Course	Credits	Degree NMS
3	1	NS 3005	Radiobiology	2	X
		NS 3010	Human Anatomy	3	X
		NS 3012	Systematic Human Pathology	3	X
		NS 3015	Instrumentation	2	X
		NS 3017	Applied Nuclear Science	3	X
		CH 3071	Pharmaceuticals	2	X
	2	NS 3011	Human Anatomy Practical	1	X
		NS 3013	Nuclear Medicine I	3	X
		NS 3014	Nuclear Medicine II	3	X
		NS 3016	Quality Assurance	2	X
		NS 3018	Health Physics and Radiation Protection	3	X
		*	Elective (3rd year course unit)	3	X
4	1	NS 4001	Computed Tomography Imaging and MRI	3	X
		NS 4002	Medical Ethics and Professional issues	1	X
		NS 4003	Digital Image Processing	3	X
		NS 4004	Nuclear Medicine III	3	X
		NS 4005	Clinical Education	1	X
		NS 4006	Seminar and Essay	3	X
	2	NS 4007	Research Project	8	X
		NS 4008	Clinical Practice I	4	X
		NS 4009	Clinical Practice II	4	X

Annex 5. Agenda of the Review Visit

Day 1: 24th April 2007

0800 – 0900 Private meeting with Prof Collin Peiris, QAA Chairman
0900 – 0930 Discuss the agenda for the visit
0930 – 1000 Meeting the Head of Dept and Dean
1000 – 1315 Presentation of self evaluation report with discussion
1315 – 1400 Lunch
1400 – 1530 Observing Departmental facilities and laboratories
1530 – 1630 Meeting with Department academic staff
1730 – 2000 Meeting of Reviewers and draft report writing (In Hotel)

Day 2: 25th April 2007

0915 – 1030 Meeting with technical staff and other non academic staff
1030 – 1100 Inspecting documents
1100 – 1200 Observing lecture
1200 – 1230 Meeting undergraduate students
1230 – 1245 Observation of student presentation
1245 – 1345 Lunch
1345 – 1430 Observation of an introductory practical demonstration
1430 – 1500 Inspecting documents
1500 – 1600 Meeting postgraduate students
1730 – 1845 Meeting Prof Colin Peiris and Dr. J. L. Rathnasekara at their office
2100 – 2300 Meeting of Reviewers and draft report writing (In Hotel)

Day 3: 26th April 2007

0900 – 0930 Informal meeting with head of department
0930 – 1115 Reviewers meeting and preparation of draft report
1115 – 1215 Presentation of summary report and discussion
1215 – 1245 Lunch and departure

Annex 6. List of Persons Met by the Review Team

Administrative staff
Dean, Faculty of Science

Academic Staff

Dr. S. Kulatunga	Head of the Department / Senior Lecturer Grade 1
Prof. R. Hewamanna.	Professor (Joined 1976)
Dr. C .S. Sumithrarachchi	Senior Lecturer

Academic Support Staff

Mrs. M.D.S. Pushparani	Scientific Assistant (Joined 1996)

Non Academic Staff

Mr. U.D. Ratnayake	Sen. Staff Technical Officer (Joined 1974)

Mr. C.S. Abeygunawardena	Staff Technical Officer gr.11 (Joined 1986)
Mr. D.G. Sunil Shantha	Staff Technical Officer gr.11 (joined 1986, special training in radiation protection, computer maintenance)
Mrs. K. Damayanthi Perera	Clerk 1 (Joined 1989)

Postgraduate students
Several M Sc Students

Radiation protection diploma students
Ms MDK Edussuriya
Mr Aruna Pushpakumara and several others

Annex 7. List of Documents Inspected

- M Sc Thesis – CSH Vithanaarachchi 2003
- M Sc Thesis – SMA Wasantha Anuruddha 2004
- M Sc Thesis – KPI Kumara Kadadunna 2005
- Mid Semester and End semester examination papers and markings and external examiner remarks
- Laboratory standardization test results
- Mid and End Semester Examination papers, mark sheets etc.

Annex 8. Criteria for Grading Laboratories Using Unsealed Radioisotopes

CRITERIA FOR GRADING LABORATORIES USING UNSEALED RADIOISOTOPES

GENERAL: SHIELDING (AGAINST GAMMA RADIATION) AND AVAILABILITY OF QUALIFIED AND TRAINED MANPOWER AS REQUIRED SHALL BE ENSURED AS APPROPRIATE

TYPE-I (SIMPLE)

- A simple chemical laboratory with good ventilation
- Two rooms, one for handling and one for counting
- Contamination Monitor
- Ordinary storage (with security)
- Sink – ordinary
- Table surface to be covered with smooth non-absorbent material
- Remote handling tongs
- Propipettes / Remote pipettes
- Foot operated dustbins

TYPE-II (MEDIUM)

- Three rooms/more – storage, preparation and one/more handling rooms
- Special table, floor and wall surfaces
- Proper ventilation
- Storage safe – concrete/steel/lead
- Stainless steel sink (elbow/foot operated tap)
- Fume-hood with special exhaust system
- Contamination Monitor & Radiation Surveymeter
- Personnel Monitoring Badges
- Planned radioactive waste disposal methods
- Face mask, Glove box, Surgical gloves
- Remote handling tongs
- Propipettes / Remote pipettes
- Foot operated dustbins

TYPE-III (STRINGENT)

Large-scale laboratory – multiroom complex with clear segregation of areas based on use, scale and type of operation with the radioisotopes, the actual facilities required by the user will be determined. A general list is given below

- Special table, floor and wall surfaces
- Proper ventilation
- Storage safe – concrete/steel/lead
- Stainless steel sink (elbow/foot operated tap)
- Fume-hood with absolute filter incorporated near the junction of hood and ventilation duct
- Contamination Monitor & Radiation Surveymeter
- Air/Alarm monitor
- Foot, Hand and clothing monitor
- Pocket monitor
- Whole Body Counter
- Personnel Monitoring Badges
- Bio-assay
- Dilution & Distribution room
- Decontamination room
- Respirators
- Shoe barrier
- Master-Slave manipulator
- Planned radioactive waste disposal methods
- Foot operated dustbins

CLASSIFICATION OF RESEARCH INSTITUTIONS USING UNSEALED SOURCES

GROUP OF RADIONUCLIDE *	PRESCRIBED LIMIT FOR HANDLING RADIONUCLIDES		
	TYPE – I	TYPE - II	TYPE - III
I	≤ 5 μCi	≤ 5 mCi	> 5 mCi
II	≤ 50 μCi	≤ 50 mCi	> 50 mCi
III & IV	≤ 500 μCi	≤ 500 mCi	> 500 mCi

* Group classification according to radio-toxicity