

## THE NUCLEAR SKILLS STUDY

*The supply and demand of skills for the application of nuclear and radiological technology over the next 10-15 years*

### INFORMATION PAPER FOR THE NUCLEAR SAFETY ADVISORY COMMITTEE

5 July 2002

#### BACKGROUND

A paper was presented to NuSAC on 7 March 2002 describing the Nuclear Skills Study. The paper articulated the concern that a skill shortage is developing that could hinder the ability of the nuclear industry to operate and, perhaps more importantly, hinder its ability to manage its liabilities. The paper went on to describe the objective of the skills study; that is, ultimately, to stimulate initiatives, involving industry, academia, educators, professional institutions and Government, to assure that sufficient skilled people are available to satisfy the future demands of the UK nuclear industry.

It was reported that two reviews were to be conducted to provide a foundation for future work:

- A Skills Audit, to quantify the skilled population today.
- A Foresight study, to consider the pressures that the skill sector may encounter, and hence inform those formulating a strategy to avert a skill shortage.

Those reviews are now complete and a report of the conclusions reached is in preparation. It is aimed to publish that report in late June / July 2002, which will contain a series of recommendations to underpin an action plan to address the situation.

This brief provides a progress report for the July 2002 meeting of NuSAC in advance of publication the full report. The full report will be presented to NuSAC at the November 2002 meeting.

#### NUCLEAR AND RADIOLOGICAL SKILLS

The study has considering the skills required to apply nuclear and radiological technology. The skill sector therefore encompasses organisations that apply nuclear and radiological technology as a primary purpose (power generation, health, defence, and liabilities<sup>1</sup>) and also those that apply radiological technology as a secondary purpose (eg non-destructive examination, pharmaceuticals etc).

The audit has identified a current population of approximately 135,000 skilled people, of which around 64% are primary users and 36% secondary users.

SKILLED POPULATION	Population	%
TOTAL	135,000	
PRIMARY USERS	86,400	64%
SECONDARY USERS	48,600	36%

<sup>1</sup> Liabilities encompass the fields of decommissioning, waste management and environmental remediation.

Of the primary users, a distinction can be made between the health sub-sector and power generation, defence and liabilities sub-sector, the proportion of people in these sub-sectors being:

<b>PRIMARY USERS</b>	<b>Population</b>	<b>%</b>
<b>HEALTH</b>	30,000	22%
<b>POWER, DEFENCE, LIABILITIES</b>	56,400	42%

Evidence from other UK engineering and physical science based skill sectors, and from overseas nuclear sectors (principally the USA, Germany and Sweden), gave rise to an anticipation that the skill sector would exhibit a distinct age skew towards the older age groups. However, the skills audit has not confirmed this suspicion, the age profiles of the primary users and the power generation, defence and liabilities sub-sector being shown at Figure 1. One reason for this is believed to be re-organisations and downsizing in recent years resulting in early retirements from the skill sector from the older age groups. On the evidence of the skills audit and foresight study, a major skill shortage does not exist today, but a number of 'hot spots' do exist and there are worrying trends for the future.

## **CURRENT 'HOT SPOTS' AND FUTURE TRENDS**

### **HOT SPOTS**

The current 'hot spots' include:

#### **POSTGRADUATE EDUCATION**

- A dichotomy exists in relation to postgraduate education. In the formative years of the nuclear program there was enthusiasm for the new technology and a drive for education excellence; hence appropriate courses were established. However, the technology has now matured and the industry operates in a more liberalised regime, resulting in questioning of whether postgraduate education is an essential requirement or an unnecessary overhead. In the health sector, a Masters qualification is the required competence level in order to practice; hence the requirement for postgraduate education is enforced by regulation, but such a requirement does not exist in the power and decommissioning sectors. Postgraduate education is not valued to the same degree as in former times and is often in competition with in-house training; hence, as identified by the NII survey of nuclear education in the United Kingdom<sup>2</sup>, the viability of postgraduate education is under threat.

#### **REGULATORS**

- The age profile of NII inspectors exhibits a definite age skew, as shown in Fig 1. One reason for this is that, by necessity, an entry requirement for the NII is to have experience of working in the nuclear industry; hence new recruits are unlikely to be below the age of 30 to 35.

#### **CONTROL AND INSTRUMENTATION ENGINEERS AND TECHNICIANS**

- Control and Instrumentation is key to all process-engineering technologies; hence there is a high national, and international, demand for C&I engineers and technicians. The nuclear sector must therefore compete for such skilled people resulting in pressures on satisfying demand.

<sup>2</sup> Nuclear Education and Research In British Universities. NII. Apr 02

### HEALTH PHYSICISTS

- A shortage of health physicists has been reported by the industry since its inception, however, evidence suggests that an adequate number of skilled people exist in the skill sector but many have progressed from practitioner to manager in order to develop their career. The root cause of this issue is career development plans that encourage people to leave their specialisation, a phenomenon that applies to many disciplines.

### RADIOCHEMISTS

- Until recently, only a few people recognised the demand for radiochemists and as a result skilled people were not emerging as a matter of course from either chemistry or physics faculties. BNFL, and their support for the Manchester radiochemistry department, has corrected this in part, but the question remains about what is required: a focal point upon which radiochemistry research is concentrated or a centre of excellence supporting satellite departments that achieves diversity across the research sector?

### MEDICAL PHYSICISTS

- Medical physics suffers from poor relative status and pay resulting in skill losses to other sectors, principally the financial sector. The financial and insurance sectors have a demand for people with high quality mathematical modelling skills and have the ability to pay high salaries for those skills. The pressure to transfer to the financial sector is compounded by poor relative status of medical physicists in relation to medical doctors.

### MATHEMATICAL MODELLERS

- As with medical physics, the financial and insurance sectors have a demand for people with high quality mathematical modelling skills and the ability to pay high salaries for those skills; hence there is a loss of those skills to the finance sector.

### PROJECT MANAGEMENT

- A decreasing number of people have both the skills to project manage a major development and an appropriate appreciation of nuclear issues.

### KEY CORPORATE CAPABILITIES

- A number of corporate capabilities exist in only limited numbers, nationally and internationally, eg the design and manufacture of nucleonic detectors and the manufacture of large pressure vessels.

### FUTURE TRENDS

The projected retirements from the skill sector can be considered as a crude guide to the anticipated recruitment demands over the next 15 years. The following trends have been identified:

RETIREMENTS	5 years	10 years	15 years
HEALTH	3,700	6,600	9,600
POWER, DEFENCE, LIABILITIES	6,400	14,500	22,600
TOTAL	10,100	21,100	32,200

The skills audit also considered the ratio of degree qualified to none degree qualified people in the sector, which, when applied to the above figures, provides an indication of the number of graduates and non-graduates needed to maintain the skill sector at its current size.

<b>POWER, DEFENCE, LIABILITIES</b>	<b>%</b>	<b>5 years</b>	<b>10 years</b>	<b>15 years</b>
<b>GRADUATES</b>	42%	2,675	6,000	9,500
<b>TECHNOLOGISTS</b>	47%	3,000	6,800	10,500
<b>OTHERS</b>	11%	700	1,660	2,600
<b>TOTAL RETIREMENTS</b>		<b>6,400</b>	<b>14,500</b>	<b>22,600</b>

The above figures are a guide to what may be required, not projections of what will be required, the actual requirement being dependent on many other factors including growth or decline in the skill sector or external demands which may attract people out of the skill sector. The significant factor is the order of magnitude of skilled people needed over the next 15 years, and the recruitment environment that exists from which to draw those people.

### **UNPOPULARITY OF ENGINEERING AND PHYSICAL SCIENCES**

Engineering and physical sciences are unpopular fields of study, both academic and vocational, and it is from this pool of students that the nuclear sector must recruit. Unless this trend is reversed, the nuclear sector will face the challenge of recruiting from a diminishing pool of potential recruits.

The general unpopularity of engineering and physical science has been recognised in the recent review conducted for the Treasury by Sir Gareth Roberts<sup>3</sup>, which identified that:

“The ‘disconnect’ between the strengthening demand for graduates (particularly in highly numerate subjects) on the one hand, and the declining numbers of mathematics, engineering and physical science graduates on the other, is starting to result in skills shortages.”

The IAEA have also recognised this issue, as identified at a recent IAEA conference on managing nuclear knowledge<sup>4</sup>:

“There is a general difficulty in attracting young people into the field of nuclear engineering and physical sciences: the courses seem too difficult; upon graduation the jobs are uninteresting and the pay is too low, and there is a view that only the ‘least attractive’ people go into these fields. It was also pointed out that “before we can educate new people in this field, we must first attract them to the field; and engineers themselves are lousy marketers!”

These concerns were endorsed by the views expressed in the foresight study. The study identified that minor skills shortages exist today, the greatest shortages being in the areas of science, technology and regulation, but it was anticipated that these shortages would increase in coming years and would also extend into the areas of operations and management. The foresight exercise identified several issues, but three recurrent themes were:

#### **POOR COMMUNICATION**

- The importance of communication in encouraging people into the skill sector and encouraging the wider public to take a rational view of the application of nuclear and radiological technology. In particular it was emphasised that the media and

<sup>3</sup> SET for success: The supply of people with science, technology, engineering and mathematics skills. The report of Sir Gareth Roberts’ Review. April 2002

<sup>4</sup> Meeting of Senior Officials on Managing Nuclear Knowledge. 17-19 June 2002. International Atomic Energy Agency, Vienna International Centre, Austria.

public raise emotional concerns to which the nuclear and radiological sector invariably counter with logic, but rational argument often cannot counter emotional fears.

#### **POOR CO-ORDINATION**

- The potential for skills shortages is generally recognised and several initiatives exist to address the problem, but these tend to be uncoordinated, hence their collective effect is not as great as it should be.

#### **APPARENT INDECISION**

- Indecision in an industry will discourage recruitment and many policies under consideration will appear to potential recruits as indecision, eg 'keep the nuclear power option open' or 'implement safe-store and defer decommissioning'.

### **FUTURE PROGRAMME**

The future program must focus on three strategic issues:

#### **PROMOTION OF ENGINEERING AND PHYSICAL SCIENCE**

- Promotion of engineering and physical science in general, and of nuclear and radiological technology in particular, to encourage recruitment into the skill sector.

#### **UNDERPINNING OF ESSENTIAL LEARNING PATHWAYS**

- Definition and underpinning of the essential learning pathways needed to develop the skills required to apply nuclear and radiological technology.

#### **UNDERPINNING OF EDUCATION INSTITUTIONS**

- Measures to underpin the education and training establishments needed to support the above learning pathways.

Three closely linked functions, but with subtly different aims, are training, education and research. In addressing the required learning pathways and educational institutions a distinction must be made between these three functions and measures taken to ensure a correct balance is maintained. This distinction can be considered thus:

#### **TRAINING**

- The development of skills to enable people to perform predictable tasks. Training tends to be vocational in nature.

#### **EDUCATION**

- The development of an individual's fundamental understanding of a discipline. Education tends to be academic in nature.

#### **RESEARCH**

- The advancement of fundamental understanding of a discipline. Research tends to be academic in nature.

A COVERDALE

Project Manager – Nuclear Skills Study  
Department of Trade and Industry

20 June 2002

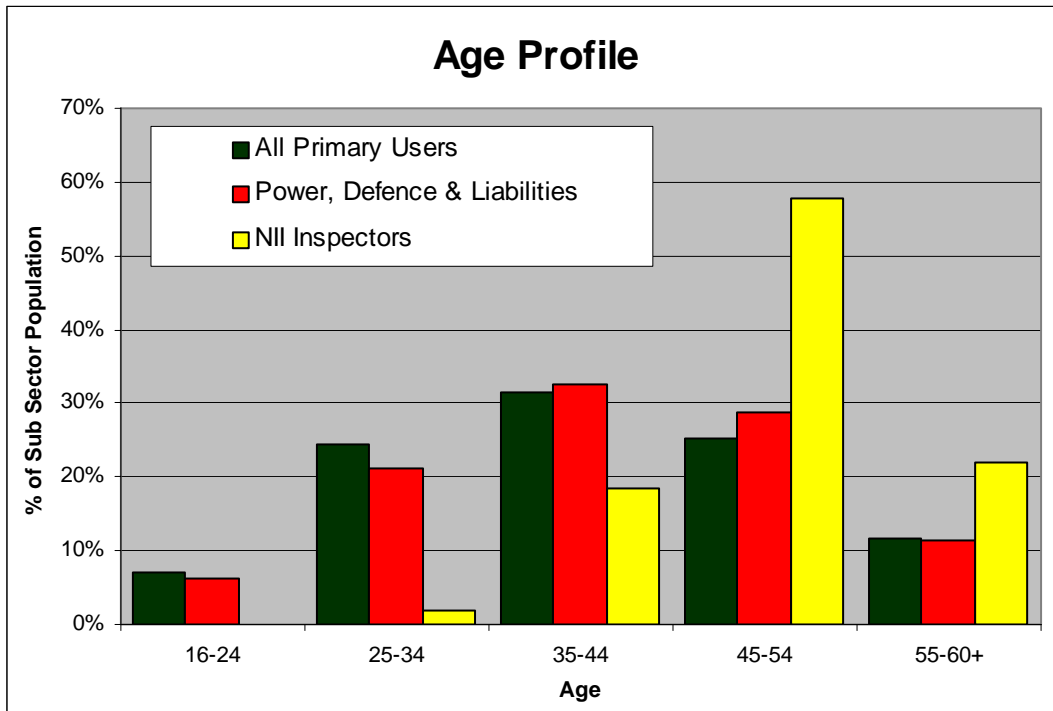


Figure 1: Age Profile

**NOTE:**

The age profiles are shown as percentages of the sub-sector population, ie:

- The profile of 'all primary users' is percentages of the sub-sector population of 86,400.
- The profile of 'power, defence & liabilities' is percentages of the sub-sector population of 56,400.
- The profile of 'NII Inspectors' is percentages of the sub-sector population of 168.