Final Report

CONSULTING SERVICES BY ENVIRONMENTAL RESOURCES MANAGEMENT

The Environment Council:
BNFL National Stakeholder Dialogue

West Cumbria: *Socio-economic Study – 2003 Update*

August 2003

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ERM

FINAL REPORT

The Environment Council

Socio-Economic Study: *West Cumbria - 2003 Update*

August 2003

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Date: 1 August 2003 _____

EXECUTIVE SUMMARY

1. This report sets out the economic and social impacts of future business scenarios for BNFL's Sellafield site on the economy of West Cumbria. This report, which has been prepared by ERM Economics, is an update of a 2001 report of the same name and has been prepared on behalf of the BNFL National Stakeholder Dialogue.

2. A Socio-economic Steering Group has supervised ERM's research. Members have been drawn from a broad group of stakeholders including BNFL, local authorities, green pressure groups, trade unions and the North West Development Agency. In addition, the members of the steering group have acted as representatives of the Business Futures Working Group (BFWG). BFWG is one of a number of sub-groups of the national stakeholder dialogue process established to examine specific issues(1). ERM has reported to the Socio-economic Steering Group, then to BFWG, and finally to the stakeholder dialogue Main Group.

3. The future business scenarios examined in this report have been produced by BFWG, and are intended to reflect predicted upper, lower and median levels of activity on site. ERM has then used these scenarios to illustrate the economic and social impacts that BNFL Sellafield (and associated local plants) has on West Cumbria.

4. BNFL Sellafield is located in West Cumbria, one of the more remote regions in England. The area suffers from a number of adverse social and economic trends that provides the context for understanding the impacts of future business scenarios for the plant. As with the rest of the UK, West Cumbria has an ageing but stable population. However, this stability masks a decline in the number of young workers relative to the UK, suggesting that young people leave Cumbria, possibly for higher education, but do not return.

5. Employment in the study area has declined steadily over the past two decades, except for the peak attributed to the construction of THORP in the late 1980s and early 1990s. This decline is partly associated with a long-term decline in industrial employment, and has affected male more than female employment, which has actually grown. Past experience has shown employment trends in West Cumbria to be heavily influenced by BNFL activity, with construction employment in the area being particularly sensitive to BNFL investments.

6. The decline in employment in West Cumbria has led to the area having unemployment levels that are persistently above levels for the North West and the UK. The occupational status of employees and average gross weekly

(1) See www.the-environment-council.org.uk for details of the membership of dialogue and the socio-economic steering group, and for copies of previous reports.

earnings are also lower when compared with the UK average. West Cumbria also has a lower rate of new business formation than the UK.

7. The social characteristics of the area reflect the relative decline of the local economy. Analysis by Cumbria County Council has demonstrated that the West of the county, and Copeland in particular, suffers from high levels of deprivation.

8. Educational attainment in Cumbria is poor by national standards, with less than half as many employees with a degree level qualification (or higher) as the national average. Performance is also poor at other higher levels of attainment.

9. The public's perception of the area reflects both the history of industrial decline and the high quality of the landscape. The area is also widely perceived as inaccessible.

10. All the future business scenarios at Sellafield will involve a loss of employment over the next 25 years. In order to gauge the likely response of the economy to these employment losses we have undertaken:

- an international literature review of the impacts of employment losses in the nuclear and other industries; and
- detailed economic modelling of the impacts of the scenarios on the local economy.

11. The literature shows that large firms contribute to the local economy in terms of expenditure and income, as well as employment. Investment and employment decisions have regional impacts on employment and income, and indirectly affect population and migration that, in turn, affect factors such as house prices and skill levels. Examples from the UK's coalfields show that pit closures had highly undesirable impacts on the local male labour force, with employment and economic activity decreasing significantly at a local and county level. At the county level, employment and economic activity as well as real household income dropped at the time of closure, but increased or returned to previous levels, usually after two to three years. However, this is not the case at local levels where high levels of unemployment persist for longer. Out-migration and commuting help local economies to adjust to employment shocks, but the process of adjustment can be painful and incomplete with large social costs, such as higher unemployment and crime and poorer health, being typical.

12. The nuclear industry is extremely complex and the Sellafield site is no exception. Feedback and constraints between the various plants and processes mean that detailed scenarios of future operations can only be produced by experts with an in-depth knowledge of the Sellafield site.

13. The scenarios developed for this study should be regarded as bounding the lower and upper possibilities of future Sellafield activity, rather than precise forecasts of future activity. They are:

- SF1 (Minimum and Maximum) – "Stop Now and Prepare for Closure." This scenario represents an early end to reprocessing, with variants relating to the level of plutonium (Pu) immobilisation.

- SF2 – "Current Business Plan." This scenario represents Sellafield operations as currently planned for in the currently approved business plan.

- SF2a (Minimum and Maximum) – "Current Plan with Accelerated Retrievals and Decommissioning." This scenario represents the Current Business Plan but with waste retrieval and decommissioning activity brought forward as much as is possible, regardless of cost.

14. To provide baseline information on the economic impacts of Sellafield three surveys were undertaken of site employees, BNFL suppliers and other businesses in West Cumbria.

15. In early 2003 Sellafield employed approximately 12,000 BNFL, Agency and Contractor staff. The average age of staff was 42 and the average length of service was 14 years. Almost half of respondents stated that they live in West Cumbria because of Sellafield, and almost a fifth moved to the area to work at the site. The families of workers are often highly dependent upon the site, with almost a fifth of respondents having a partner or spouse who work on site, and more than a quarter having relatives outside their household working at Sellafield.

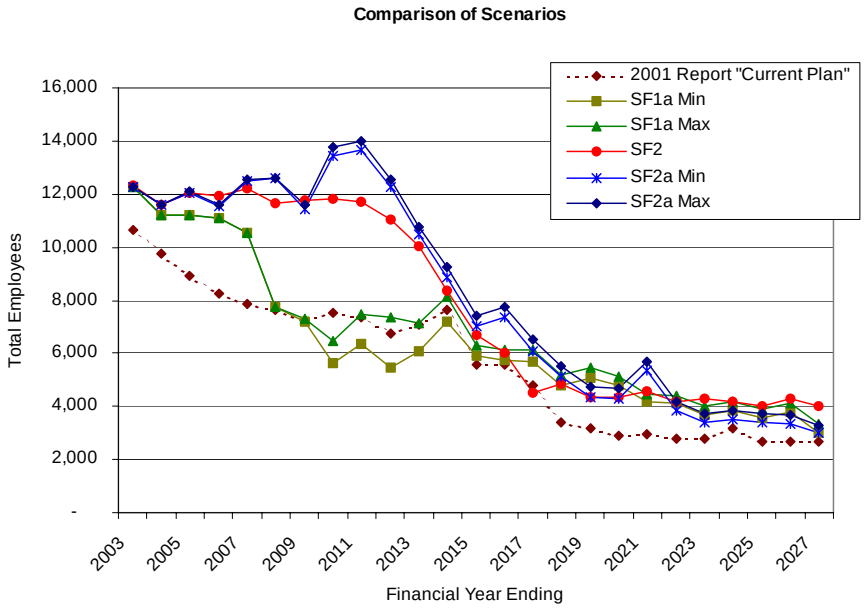
16. The relatively high wages offered by the company mean that employees have proportionately higher expenditures on leisure pursuits, with workers spending almost twice the proportion of their incomes than the national average on going out (to pubs, restaurants and other entertainment) and holidays.

17. Surveys of suppliers found that over 40 percent depended upon BNFL for half or more of their turnover in West Cumbria. The surveys also found that many businesses also supply BNFL indirectly, with almost 40 percent identifying other customers who have BNFL as a customer. Not surprisingly, BNFL's suppliers indicated that their turnover and employment would be sensitive to changes in the scale of activity on site.

18. A similar picture was found with other local businesses that do not supply BNFL directly. ERM interviewed a variety of leisure, retail, transport and other businesses. The great majority reported that the expenditure by BNFL workers and suppliers was an important factor in their turnover, and impacted on their ability to generate new employment. This was reflected by poor levels of business when uncertainty emerged about the future of the plant. However, a small number of businesses also mentioned that the benefits and conditions offered by BNFL made it difficult for them to recruit and retain skilled staff locally.

19. The outlook for on-site employment at Sellafield is one of long-term decline. Under the "Current Plan" and "Current Plan with Accelerated Retrievals and Decommissioning" employment remains steady until about 2012, and then declines rapidly to a third of previous levels (about 4,000) by 2018. Under the "Stop Now and Prepare for Closure" scenario the employment decline starts much sooner but is smoother. This decline will have marked knock-on effects in the local economy, as every five jobs on site support another job in West Cumbria. This is a high local multiplier effect, but one that is not surprising given the relative isolation of West Cumbria, the high incomes of the workforce and the efforts made by BNFL to use local suppliers. *Figure 1* compares employment for each of the scenarios used in this study.

Figure 1 ***On-site Employment Under Each Scenario***



20. *Figure 1* also illustrates the employment projected under the "2001 Current Plan Scenario" in the 2001 report. As can be seen, the forecasts have changed considerably. This is principally because:

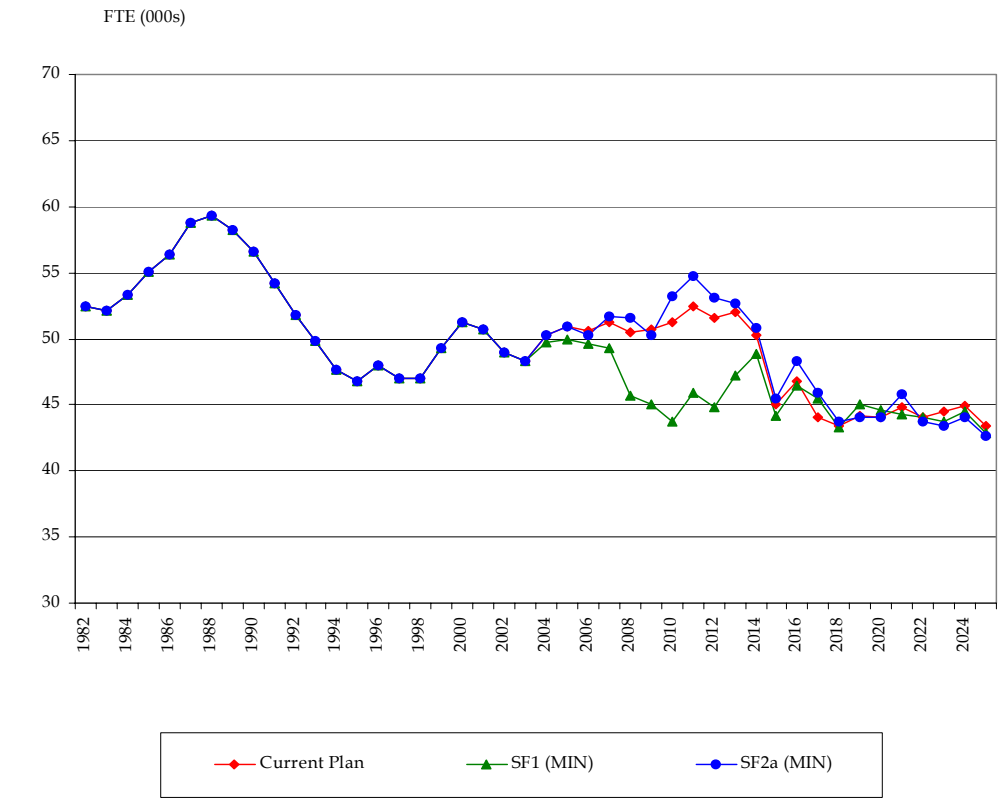
- The 2001 report was based on econometric modelling undertaken using year 2000 data. These data were supplied before the impacts of the NII Team Inspection report were fully evident. One of the main impacts of this report was to increase staffing levels across the Sellafield site. Also, assumed staff efficiencies in the 2000 data are not currently factored into BNFL business planning.
- Magnox station lifetimes have been shortened, which reduces future workloads for Magnox fuel reprocessing, and the Calder Hall power station on site has been closed ahead of schedule.
- The construction and labour requirements of many of the decommissioning facilities are now much better understood. Many of

these blocks were developed from scratch in a short space of time for the 2001 report, and continued development since then (in part linked to detailed preparatory work for the Nuclear Decommissioning Agency) has substantially improved knowledge about requirements.

- There has been an in-depth review of long-term asset management requirements since 2000, which has highlighted the need for major refurbishment and maintenance activity (such as replacing aging roofs on buildings) going into the future.

21. The objective of this study has been to provide comparative data between the scenarios. The analysis shows that the differences between scenarios are greatest in the short- to medium-term. Over the longer-term employment levels converge under the four scenarios. There is a major loss of construction employment in the next few years in all scenarios. For full time employees it is significant that nearly 20 per cent of current BNFL employees are aged 50 years old or older, and this should help any adjustment that takes place over the coming years. However, the management of employment decline at Sellafield will be a key issue for the local economy in coming years. *Figure 2* illustrates forecast employment in West Cumbria by scenario.

Figure 2 ***Employment in West Cumbria by Scenario***



22. The West Cumbrian economy has adjusted to large shifts in employment in the past, especially during the mid-to-late 1980s, when the completion of THORP

corresponded with a general slowdown in the national and local economies. Excluding Sellafield, West Cumbria could still function as an economy, with about 35,000 full-time equivalent employees in industries including the public sector, retail and tourism. There could, however, be significant problems in terms of social and economic adjustment. Without compensating employment creation projects, the decline in employment will have adverse social consequences, for example on health and crime and, therefore, should be avoided for both economic and social reasons to the maximum extent possible. These adverse social consequences have been quantified where possible.

23. There are a number of committed and potential projects that could help protect the employment base in West Cumbria. These projects will be particularly valuable in the event of a rundown in employment at Sellafield. The projects are varied, including:

- initiatives related to the nuclear industry, including the forthcoming establishment of the Nuclear Decommissioning Agency's new headquarters in West Cumbria and BNFL's own local economic development funding;
- other energy sector investments, such as new wind farms;
- improvements to transport and communications, such as further upgrades to the A595; and
- other public sector investments, and in particular the regeneration spending by West Lakes Renaissance, the new Urban Regeneration Company for West Cumbria, the local authorities' own regeneration activities and the new Rural Regeneration Company.

24. The initiatives could generate several thousand construction and permanent jobs over the next five years. However, it is likely that West Cumbria will continue to experience employment decline, partly as a result of long-term economic trends that have hit the area disproportionately hard, and partly as a result of a decline in activities at BNFL. This employment decline will not all manifest itself in unemployment because of an ageing population, the out-migration of young workers and a decline in economic activity rates. The increase in unemployment has, however, been modelled and is presented.

25. Securing new investments to create additional employment opportunities will require forward planning to ensure increased and continued funding for regeneration of the West Cumbrian economy from regional and national government.

CONTENTS

1 INTRODUCTION

1.1 BACKGROUND TO THE STUDY

This report has been prepared by ERM Economics and sets out the economic impacts of future business scenarios at BNFL's Sellafield plant in West Cumbria(1). The study area is illustrated in *Figure 1.1*. This report is an update of the 2001 report of the same name. In 2000 the Environment Council, as a part of BNFL's National Stakeholder Dialogue process, appointed ERM on behalf of a diverse stakeholder group including BNFL, trade unions, local authorities and representatives of environmental campaign groups. In keeping with the spirit of the stakeholder dialogue process, ERM's study team reported to the Socio-economic Sub-group, and work plans and outputs were reviewed and agreed collaboratively. This report presents an update of the 2001 report, but uses more up-to-date scenarios for the future operation of Sellafield, and benefits from more recent estimates of capital spend, procurement and staffing implied by these scenarios.

The objective of the research was to provide participants in BNFL's National Stakeholder Dialogue with accurate and accessible information on the economic impacts of the scenarios under consideration. This information will then be considered in a broader framework, which addresses other issues such as safety and environmental impacts(2).

The future business scenarios adopted in this updated report have been produced by the Business Futures Working Group of the National Stakeholder Dialogue (3), and are intended to be indicative of potential upper, lower and median band levels of activity on site. Therefore, whilst the scenarios have been peer reviewed by both the socio-economic steering group and "Green Experts" within the stakeholder dialogue, they should be seen as means of illustrating the likely social and economic impacts of Sellafield given different types and levels of activity.

1.2 AIMS AND STRUCTURE OF THIS REPORT

This report sets out the findings of the study for review by stakeholders and includes:

- an analysis of baseline socio-economic conditions in West Cumbria and a comparison of West Cumbria with the North West and the UK (*Section 2*);

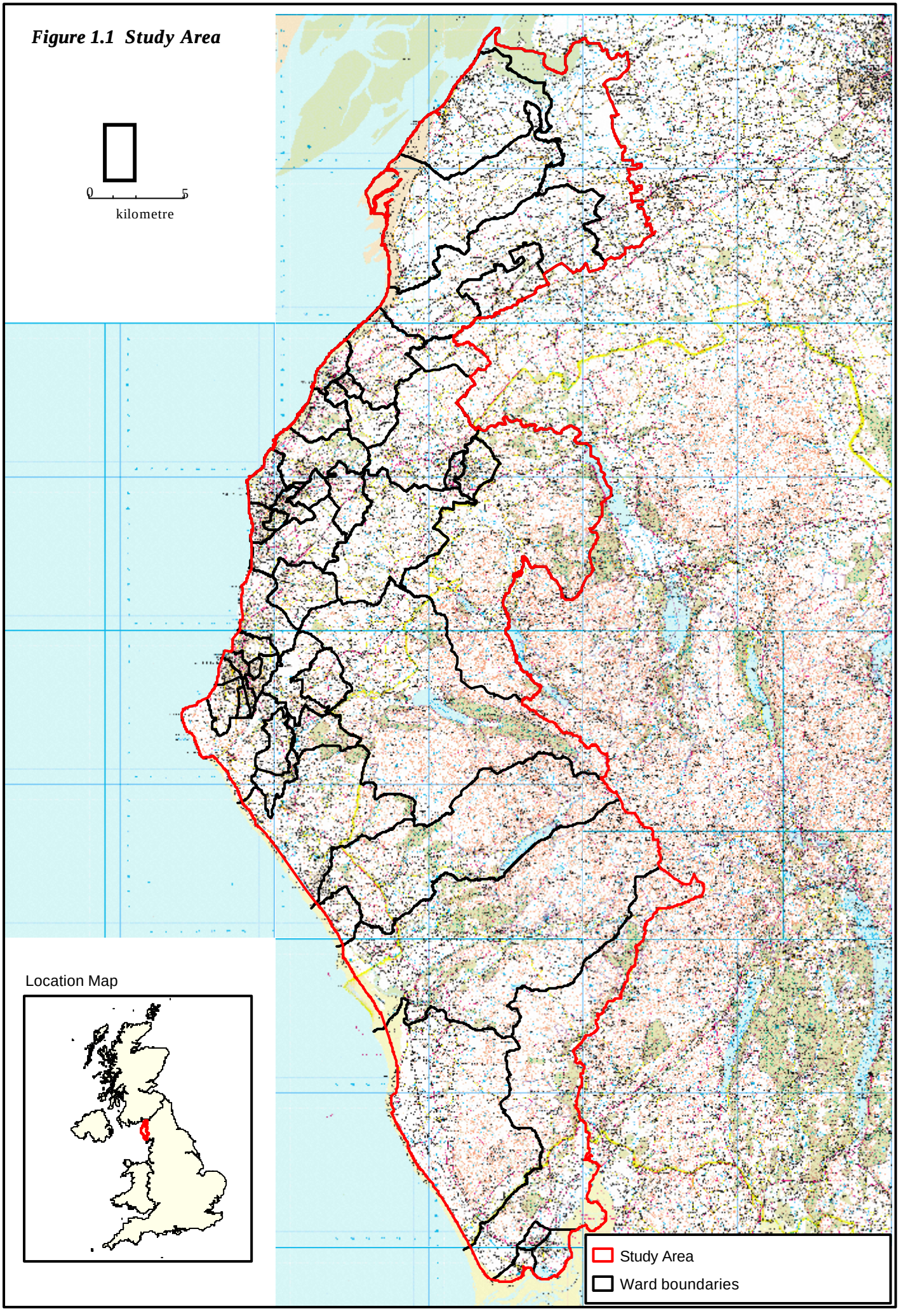
(1) Given the scale and complexity of the task, the analysis has been restricted to quantifying the socio-economic impacts of BNFL's Sellafield plant. However, the approach adopted for this study would be replicable at other BNFL locations should the need arise. To give an indication of relatively scale of impact, Annex B presents employment levels at other BNFL stations as a percentage of both local TTWA employment and unemployment.
(2) It should be noted that ERM was not asked to comment on broader economic development goals for the region, which was addressed through a separate study entitled "New Visions for West Cumbria and Furness."
(3) The scenarios used in the 2001 report were developed by the Plutonium and Spent Fuel Management Options working groups.

- an overview of the nuclear fuel cycle and BNFL's role within it (*Section 3*);
- experiences from other locations where major employment impacts, both positive and negative, have been experienced *(Section 4);*
- results from surveys of employees, BNFL suppliers and other local businesses (*Section 5*);
- results from the econometric modelling undertaken by Business Strategies to determine local economic impacts (*Section 6*); and
- the conclusions of a review of committed and potential future employment generating investments in West Cumbria that could help to offset the impacts of any future employment losses at Sellafield.

In addition, annexes present supplementary data and information:

- the findings of a literature review of the impacts of changes in employment on health and crime (*Annex A*);
- a summary of the levels of employment at other BNFL locations around the UK and the relative importance of this employment to local economies (*Annex B*);
- a bibliography (*Annex C*); and
- a glossary of key terms used (*Annex D*).

Figure 1.1 Study Area



2 SOCIO-ECONOMIC BASELINE CONDITIONS

2.1 INTRODUCTION

This chapter provides an introduction to the demographic, economic, social and environmental characteristics of the study area. The study area is defined as the Workington and Whitehaven Travel to Work Areas and takes in the borough of Copeland and the western part of the borough of Allerdale from Crummock to the coastal district of Workington and north through the wards of Ellen, Aspatria, Tarns, Waver and Silloth. The Eastern part of Allerdale, including Keswick and the Lake District National Park, is outside of the study area. Where it is not possible to provide data for the study area, data for a wider area (eg district or county) is used as a proxy.

This socio-economic baseline has been updated where possible to reflect changes that have taken place in the local economy since the West Cumbria Socio-Economic Study was initially prepared in 2001. In this section and elsewhere, we make use of forecasts prepared by *Experien* Business Strategies based on National Statistics to extrapolate data up to 2000. Revised census data at local level are not yet available and on investigation it became apparent that significant work would be required to update Business Strategies' original forecasts even by one year. These data (which are presented in *Figure 2.1* through to *Figure 2.7*) have not therefore been updated.

Section 2.2 focuses on population and the demographic structure of the area, presenting data to indicate absolute and relative changes that have taken place since 1982. *Section 2.3* then examines the local economy, drawing on time series employment data to highlight the key structural changes that have occurred in the West Cumbria economy from the early 1980s to 2000.

The issues of unemployment, business and investment are addressed in turn, before *Section 2.4* presents an examination of social issues in the study area. This includes sub-sections on health, housing, and education, where a description of the main characteristics of the study area is presented and comparisons are made with regional and national information. Finally, *Section 2.5* presents a brief review of the environment and infrastructure of the study area.

2.2 DEMOGRAPHY IN WEST CUMBRIA

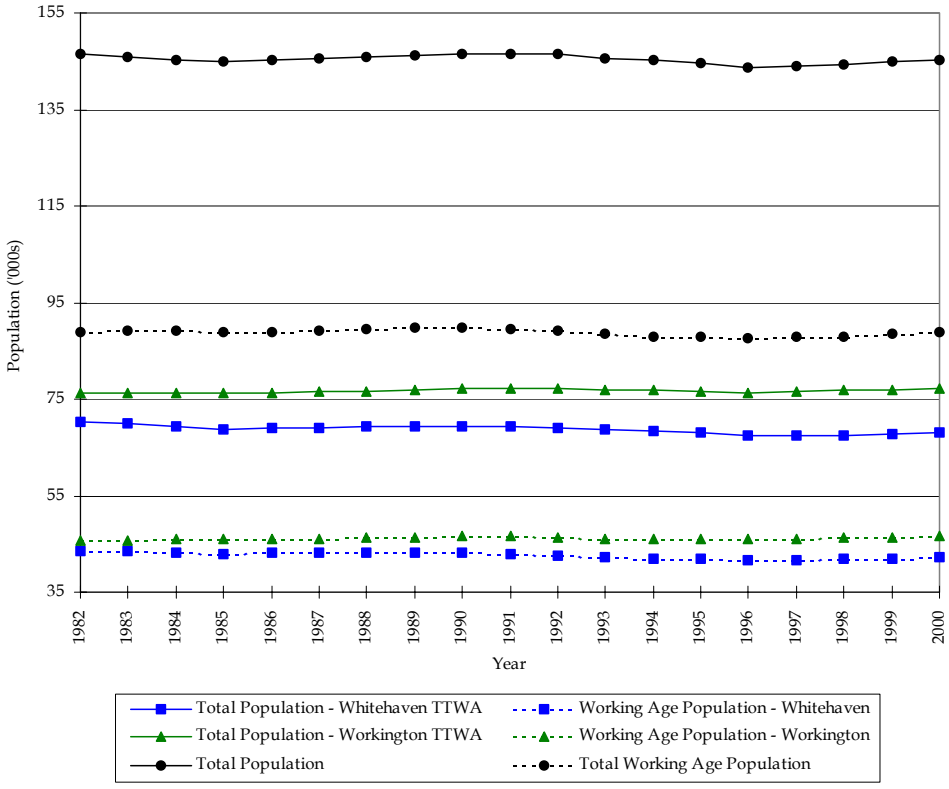
Cumbria remains one of the most sparsely populated counties in England despite the long-term growth in population. Within the county, there are significant variations in population density, ranging from Eden, which has the lowest population density, to Barrow-in-Furness, which has the highest.

Between 1982 and 2000 the total population of the Workington and Whitehaven Travel to Work Areas (TTWAs) remained relatively constant,

fluctuating in the 144,000 – 146,000 range. *Experien* Business Strategies, basing their estimate on National Statistics figures, estimated the total population of the area to be around 145,227 persons in 2000. The population distribution within the two TTWAs remained fairly constant, though in gender terms there was a small relative decline in the number of females.

As in the rest of the North West and UK, available data shows the demographic picture to be characterised by an ageing population. *Figure 2.1* shows that there are increasing numbers of people in the working age group – which was also the largest age group in the area (although it also had the widest age range). The over 65 age group (the second largest single group and also a wide age range) grew too, reflecting the national trend. This growth is attributable to the increasing number of men, though there were still more women in this age group. The number of women aged over 65 did not change significantly between 1990 and 2000.

Figure 2.1 Study Area Population and Age Distribution, 1982 - 2000



Source: National Statistics
Note: Figures from 1995 onwards are estimates

In the younger age groups the data indicates a declining population over the period 1982 - 2000, both among the 16-19 year old age group and the 20-24 year old group. The largest fall was in the number of female 20-24 year olds. Between 1986 and 1998 absolute numbers in this category fell by 43 percent, while for males the fall was 36 percent. Both of these figures, and especially that for females, were higher than the England and Wales reductions of 27 and 26 percent for females and males respectively.

The result of this decline in the number of young people is that the proportion of 20-24 year olds in the population of the Whitehaven and Workington TTWA, at five percent, was lower than both the UK average of 6.1 percent and the North West average of six percent (1997 figures, ONS 1999a). For 16-19 year olds, it was lower still: the UK average of 6.1 percent (and North West average of six percent) compares with the Whitehaven and Workington TTWA's figure of 4.4 percent.

Data for 1999 and 2000 indicate that the steady drop in the absolute numbers of people in these age groups had ceased, with population levels stabilising or showing small increases.

2.3 THE ECONOMY: EMPLOYMENT AND BUSINESS

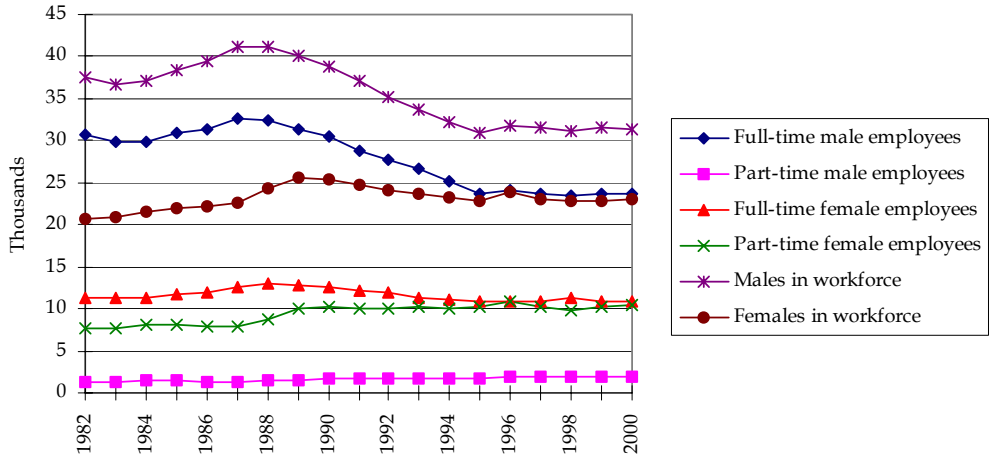
2.3.1 Employment

Introduction

Average total employment in the study area in 2000 was 54,290 (Business Strategies forecasts, unpublished, based on National Statistics data). Of the total, some 86 percent were employees and the remainder self-employed. This was close to the national ratio (87:13) reported by ONS (1999a) but is slightly higher than the North West average. Self-employment is often regarded as a measure of entrepreneurship, so these figures suggest that the study area is close to the regional and national average.

Figure 2.2 shows the numbers of people employed between 1982 and 2000 by employment type. Part-time workers were well represented in the study area, comprising some 26.3 percent of employees. This was slightly higher than the UK average of 24.6 percent (ONS 1999b) and higher still than the North West average of 24 percent. Within the study area, there was a significant shift towards part-time employment between 1982 and 2000, which at the beginning of he period represented only around 17.5 percent of employees.

Figure 2.2 ***Total Employment by Type, 1982 - 2000***



Source: National Statistics

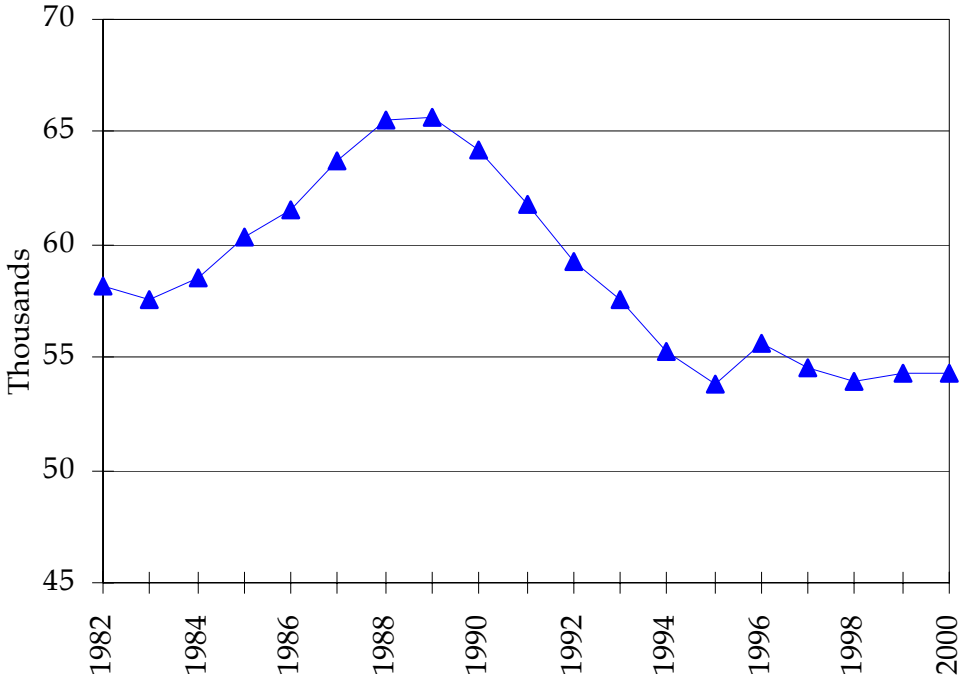
The figure indicates that the number of females in employment rose in absolute terms during the period (over 2,200 jobs). Over the same period there was a net loss of female full-time jobs, meaning that all of these new jobs were either part-time (97 percent) or self-employed (3 percent). At the beginning of the period, females made up 35 percent of all employment. By 2000, some 42 percent of all employees were female (ONS/Business Strategies), a proportion that was slightly lower than the national and North West average of 46 percent (ONS 1999a).

The seven percent increase in the proportion of women in the work place occurred not just because more women were participating in the labour market. *Figure 2.2* clearly shows that there was also a decline in male employment, and especially in full-time male employment. This was particularly so between 1988 and 1995.

2.3.2 Structural Changes in Employment

A review of employment trends in the Workington and Whitehaven TTWAs between 1982 and 2000 reveals two clear phases in the development of the local economy. The first phase, from 1982 to 1989, was a period of significant economic expansion characterised by strong employment growth. With the onset of the recession in the early 1990s, a second phase of economic activity began in which employment began to decline significantly. In 1996 falls in employment were reversed, and with the exception of 1997 and 1998, employment stabilised after that. This pattern is clearly illustrated by *Figure 2.3* below, which shows total full-time and part-time employees and self-employed jobs.

Figure 2.3 Total Employment in Study Area (Employed and Self-employed), 1982 - 2000



Source: National Statistics

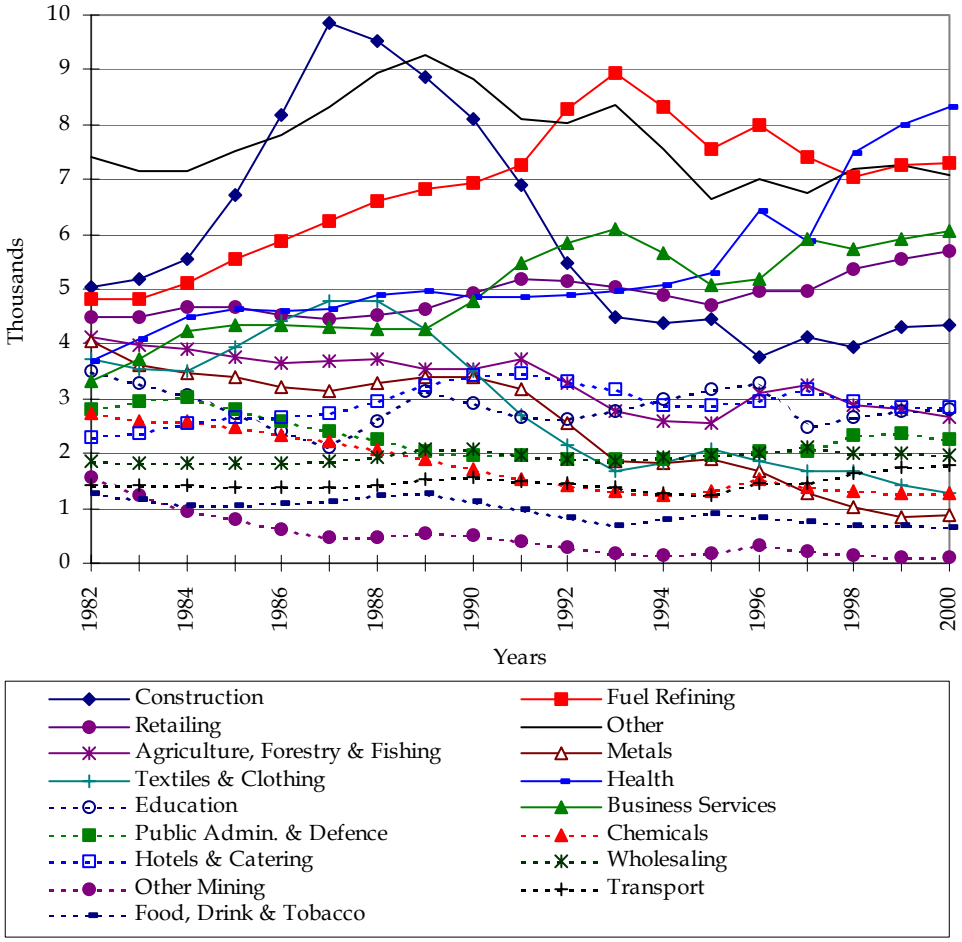
Local Economic Expansion, 1982 - 1989

Figure 2.3 shows that some 7,500 jobs were added to the labour force in the period 1982 - 1989. Changes in employment structure for the whole of the period from 1982 to 2000 are shown in *Figure 2.4*, which presents employment by selected economic activity.

The figure illustrates that during the 1982 - 1989 period, one sector in particular, construction, experienced spectacular growth. A look at the data by area shows that this rapid growth in construction employment was driven mostly by activity in the Whitehaven TTWA between 1983 and 1987. This reflects the increase in activity at the BNFL plant in Sellafield while work on the THORP reprocessing plant took place. Also experiencing strong growth during the 1980s (from some 4,800 jobs in 1982 to over 6,800 in 1989) was the fuel refining sector, which includes BNFL's activities. Other areas experiencing notable growth during the 1980s were hotels and catering, health and (at least until 1988), textiles.

Though this period was a time of significant growth in some sectors, the "total employment by type" data shown in *Figure 2.2* indicates that part-time working increased. The same data shows us that the number of women in the workforce during this time increased much more rapidly than the numbers of men.

Figure 2.4 Changes in Employment Structure, 1982 - 2000



Source: National Statistics

It is clear from the data that though there was rapid growth in the (male dominated) construction and fuel refining sectors this was not paralleled by large numbers of men joining the labour force. What may have happened is that full-time male employees in declining industries, of which steel, chemicals, mining and public administration/defence were the principal ones, simply switched to new jobs elsewhere.

Structural Change and the Decline in Employment: 1989 - 2000

By 1990 the labour force comprised around 25,600 females and 40,100 males. With the onset of the recession in the early 1990s these figures began to decline significantly. Every year between 1990 and 1995 employment fell, with the main casualty being full-time jobs, which in absolute terms fell by over 8,300 from 1989 to 1995, a reduction of nearly 20 percent. At the same time, over 2,000 self-employed jobs were lost. Only the number of part-time jobs remained stable.

Reflecting the national and regional picture, the data indicates that full-time jobs in the study area are characterised by high levels of male participation. This meant that the decline in full-time jobs affected a greater number of men

than women. By 1995 around one in ten working women had lost their jobs while approximately one in five working men had lost theirs.

The temporary boom in the local construction industry, which had reached its peak in 1987, ended with the completion of BNFL's major projects and by 1992 construction had returned to its pre-THORP levels of employment. The end of the construction boom may have also contributed to decline in the metals sector. On a declining trend through the 1980s, metals continued to decline into the 1990s after staging a partial recovery in 1988 and 1989. Between 1990 and 1993 the metals sector lost 45 percent of its workforce. Textiles and clothing also lost nearly two thirds of its workforce between 1988 and 1993, making only a temporary recovery in 1994 and 1995.

In conclusion, the number of full-time jobs lost over the 18 year period beginning in 1982 was some 7,500. To some extent, new part-time jobs may have compensated for this decline. Over the period, there was a net gain in part-time jobs of 3,400 in the study area, and by 2000, the decline in full-time jobs appeared to have stopped.

The Economy in 2000

In employment terms, the economy of the study area was characterised by dependency on the fuel refining and health sectors for nearly a quarter of all employment (these sectors represented some 13.4 percent and 10.6 percent of employment respectively). Other key sectors in order of size by employment are retail, construction, business services, hotels and catering, education and agriculture, forestry and fishing.

There is empirical evidence supporting a shift since 1982 from a manufacturing to services. However within the business service sector there were declines in specific areas of activity such as banking, insurance and communication, which have been contrary to trends witnessed nationally and in the North West. The table below shows sectoral changes in employment in the study area from 1982 - 2000.

Table 2.1 Employment by Largest Sectors, 1982 - 2000

Ranking by	1982		2000	
Employment	Industrial Sector	Employment	Industrial Sector	Employment
1	Construction	5,027	Fuel Refining	7,291
2	Fuel Refining	4,803	Health	5,746
3	Retail	4,500	Retail	5,704
4	Agriculture	4,126	Construction	3,911
5	Metals	4,045	Business Services	3,484
6	Textiles	3,735	Hotel/Catering	2,838
7	Health	3,682	Education	2,809
8	Education	3,521	Agriculture	2,661

Source: Business Strategies based on National Statistics data, unpublished

Notes: (a) See *Section 6* of this report for employment dependent upon Sellafield site activity
(b) It is likely that the large changes in health and education employment are a result of classification errors by the returning local authority. It is not possible to verify this though as returns are confidential

Of the eight largest sectors in 1982, the table illustrates that six remained in the top eight by 2000: fuel refining, health, retail, construction, education and agriculture. A review of the situation in the first quarter of 2003 suggests that many of these sectors are still doing well, at least at county level. The construction sector is coping with high demand in the domestic property, public and civil engineering project sectors. Parts of the service sector (including many retail operations) are also continuing to trade successfully.

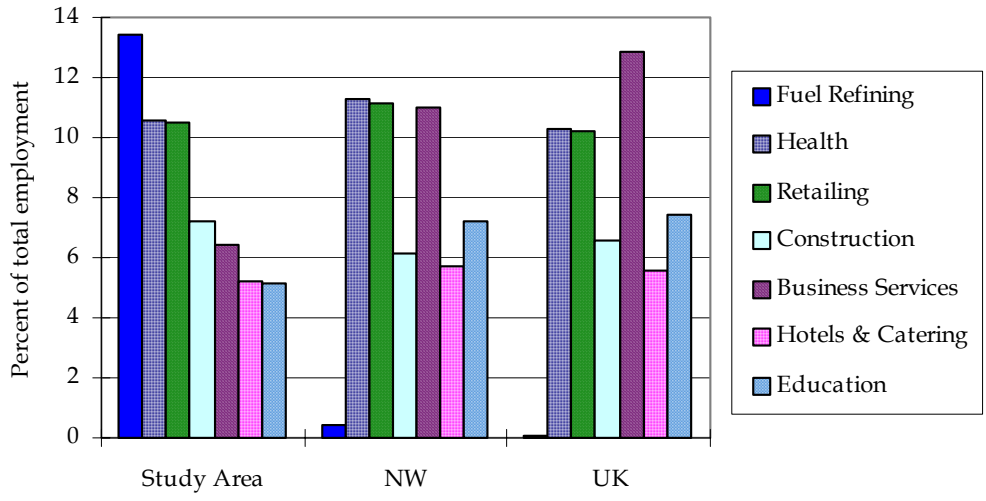
Turning to the national and regional picture, with the exception of fuel refining, the area's main activities are similar to those in the North West and UK as a whole. *Figure 2.5* shows the seven most important economic sectors in the study area, according to the proportion of the total workforce that they employ. For comparative purposes, these sectors are also shown for the North West and UK.

The main difference (apart from fuel refining) is in business services, where the study area appears underrepresented. What is also notable is that each of the other six main economic activities in the study area are also the main activities in the UK and the North West, though the order of importance varies.

Skill Base

Disaggregated data is available by ward showing figures on the occupation of people by professional, managerial, technical, skilled, unskilled and other grades, though no attempt has been made to aggregate these ward figures to TTWA level. Instead, the focus of the following section is at district level, with Allerdale and Copeland having been used as a proxy for the study area.

Figure 2.5 Percentage of all Employment by Economic Activity



Source: National Statistics

The categorisation used is based on that employed by National Statistics, though some of the categories have been combined to allow easier presentation and comprehension. The categories used are:

- managers and administrators, including corporate managers, administrators, proprietors in agriculture and services and prison officers;
- professional occupations, like doctors, solicitors, chemists, pharmacists, university professors and clergymen;
- associate professionals, including computer programmers, nurses, actors underwriters, building inspectors and laboratory technicians;
- clerical and secretarial workers, including civil service administrators, accounts, records and wages clerks and computer operators;
- skilled occupations, including plasterers, bricklayers, carpenters, motor mechanics, knitters, weavers and dental technicians;
- protective service occupations, such as NCOs in the armed forces, security and police officers;
- personal service staff, including cooks, waiters, hairdressers, nursery nurses and undertakers;
- buyers and sales occupations, including sales representatives and assistants;
- plant and machine operators, among which are metal making, food, drink, tobacco and paper process operatives, assemblers and line workers; and
- elementary occupations, including labourers, mates to trades people, kitchen porters, couriers, refuse collectors and farm workers.

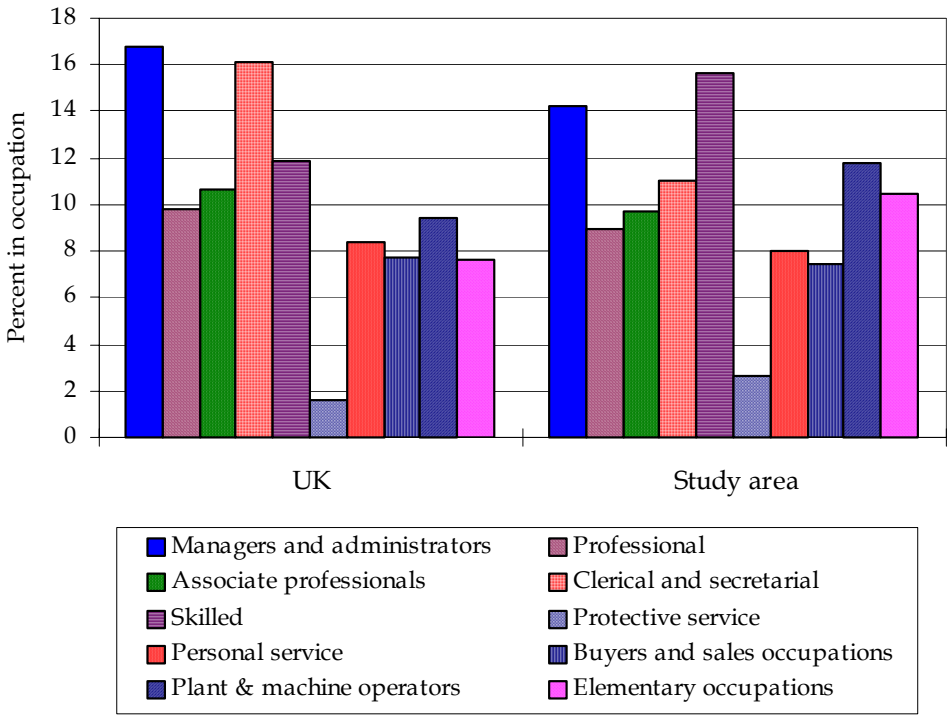
Using these categories to divide the labour force into "skill base categories" provides a skill base profile for the study area as shown in *Figure 2.6*.

The figure shows that the main occupational social class differences between the study area and the UK as a whole are in:

- clerical and secretarial, which is under represented in the study area by over five percentage points;
- skilled occupations, which are over represented by nearly four percentage points; and
- elementary occupations, which are over represented by nearly three percentage points.

Other lesser differences are the relatively low numbers of managers and administrators in the study area and the proportion of people employed as plant and machinery operators, which is slightly higher than the national average.

Figure 2.6 Employment by Occupational Social Class



Source: National Statistics
Note: Key reads left to right, and then down, ie "Managers" is the first bar and "Elementary" the last

The above average reliance of the area on manufacturing is reflected both in the high numbers of machine operators and skilled people and in the relatively low numbers of clerical workers.

Foot and Mouth Disease

The crisis in the tourism industry caused by the foot and mouth disease (FMD) in 2001 was far reaching, and affected many individual businesses. The effects of the crisis were compounded by the impact of the September 11 terrorism attacks. That said, the industry undertook unprecedented marketing activity, which resulted in a mitigation of the loss, most particularly in the final quarter of 2001 after the 'all clear' when there was a strong recovery particularly in Allerdale and South Lakeland (the two 'drivers' of tourism in Cumbria).

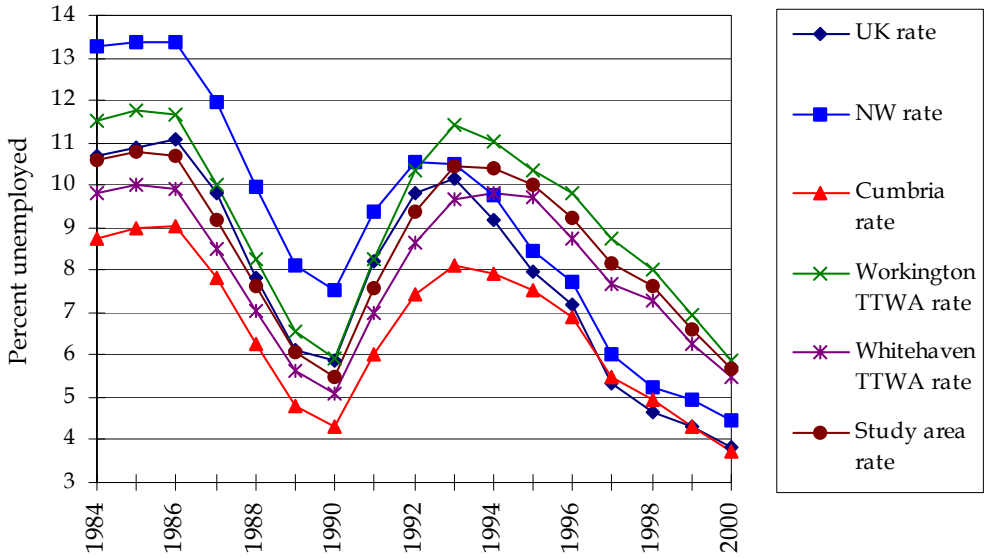
The tourism sector (which draws on several of the key sectors identified in *Table 2.1*) was estimated to employ some 13,688 people in 2001 (down three percent from the previous year), equivalent to some 30 percent of the county total (STEAM 2000, STEAM 2001). But because this is an estimate for Copeland and Allerdale, it is not directly comparable to the figures presented in *Table 2.1* which are employment estimates at the TTWA level.

Employment was down three percent on 2000, with expenditure at some £256 million for the two districts.

2.3.3 *Unemployment*

During the period of study for which data has been established (1982 – 2000), unemployment in the study area broadly reflected the inverse of changes in overall employment detailed above. From 1984 to 1986, claimant count unemployment rates in the overall study area were close to 10 percent(1). Disaggregation of the two TTWAs reveals that the Workington TTWA had a slightly higher rate than the neighbouring Whitehaven TTWA. Whilst high in today's terms, in the context of the then unemployment figures for the North West (13.3 percent) and the UK (10.7 percent), unemployment in the study area was not exceptional, and indeed was much better than the regional average (see *Figure 2.7*).

Figure 2.7 Comparative Unemployment Rates, 1984 - 2000



Source: National Statistics

The figure shows unemployment rates in the study area (as a whole and disaggregated by the two TTWAs) relative to those in Cumbria, the North West and the UK, between 1984 and 2000. It shows that in the latter half of the 1980s there was a sustained fall in unemployment rates across all the areas examined.

The beginning of the 1990s brought the start of a new recession which led to significant increases in unemployment at the national, regional and sub-regional levels. Despite impacts of the recession, unemployment rates did not reach the peaks experienced in 1984. Nonetheless, the Figure shows that unemployment in the study area did get worse relative to the UK and the North West. This was especially true for the Workington TTWA, which

(1) The claimant count unemployment rate is the number of unemployment claimants divided by the workforce, where the workforce is the number of employed plus the number of unemployment claimants.

unlike Whitehaven benefited less from the growth in fuel reprocessing activities.

By 1993 the rate of increase in unemployment in the UK and North West had begun to fall but this pattern was not reflected in the study area. By 1994 unemployment rates in the study area were higher than in the UK in general and in the North West. Though there has been increased convergence of unemployment rates in the two TTWAs of Workington and Whitehaven since then, unemployment rates in the study area remain in excess of those for the North West and UK as a whole. Consistent and current data showing unemployment rates at Travel To Work Area levels are not now available. However as an indicator, latest data suggests that workforce-based (rather than residency based) claimant counts in Whitehaven, Workington and Barrow TTWAs in January 2003 were the highest in Cumbria, at 4.4, 5.2 and 4.8 percent respectively. In terms of absolute numbers, the number of unemployed people in the Whitehaven and Workington TTWAs in July 2002 was 1,575 and 1,589 respectively. Though these figures were both down on the figure for the previous January (by 15 and 12 percent respectively), they were still sufficient to rank Workington sixth highest in the national ranking of TTWAs by unemployment rate in July 2002 (up from 11 in July 2001). Whitehaven, for its part, ranked 24 (down one spot from its position in July 2001).

Corporate change data, which is collected by CRED (Centre for Regional Economic Development) in partnership with the Cumbria Economic Intelligence Partnership, demonstrates that for the study area, job gains and losses over the past year (March 2002 – March 2003) have balanced each other out. Between March and August 2002 the area saw a net gain of some 129 jobs, including a gain of some 150 banking, finance and insurance type jobs, and 115 manufacturing jobs, countered by a loss of 47 construction jobs, 23 distribution, hotel and restaurant jobs and 10 public sector jobs. In the six months between August 2002 and March 2003, this gain was wiped out by a net loss of some 123 jobs, comprising 163 manufacturing jobs and 10 business support positions, which were offset only by a gain of 50 construction jobs.

Some recent job losses at key sites just outside the study area (including some 700 at BAe Systems in Barrow and 400 at GlaxoSmithKline in Ulverston) demonstrate the possible risks associated with an economy relatively highly dependent on a fairly small number of large employers. These risks are both in terms of the corporate strategy put into place and the industry involved.

2.3.4 Business

The Stock of Businesses

The number of businesses created in an area and the changes in the stock of businesses gives an indication of the nature and health of the local economy in that area. National Statistics collect annual data showing the number of businesses registered for VAT by sector and annual changes in these figures show whether the trend is rising or falling. This data is not available at TTWA

levels but it is published at district level. The figures for Allerdale and Copeland are used as a proxy for the combined Workington and Whitehaven TTWAs in *Table 2.2*.

Table 2.2 Businesses Registered in Copeland and Allerdale by Sector

VAT industry	Copeland		Allerdale		Total	
	2002 stock	**1994 stock**	**2002 stock**	**1994 stock**	**2002 business stock**	**Percent change since 1994**
Agriculture, fishing	405	430	985	1,005	1,390	-3.1
Mining, energy and water	5	0	5	5	10	+100
Manufacturing	75	85	175	175	250	-3.8
Construction	125	160	315	385	440	-19.3
Wholesale & retail	305	415	575	750	880	-24.5
Hotels & restaurants	200	210	370	405	570	-7.3
Transport & communications	55	55	150	155	205	-2.4
Finance	5	5	5	5	10	0
Real estate	215	110	275	225	490	+46.3
Public admin, other	110	90	160	160	270	+8.0
Education, health	20	25	35	35	55	-8.3
All industries and services	1,520	1,585	3,050	3,305	4,570	-6.5

Source: NOMIS, 2003, VAT registrations/deregistrations by industry
Note: NOMIS figures are rounded to the nearest five businesses. Stocks are as at the beginning of each year

The table shows that over the nine years 1994 – 2002 inclusive the two districts between them lost some 6.5 percent of total businesses, with the number of businesses in the two districts at the end of the period being some 4,570. The sectors that lost the largest absolute number of businesses were wholesale and retail, hotels and restaurants and construction. Analysis of employment data up to 2000 indicates that the number of construction jobs fell, reflecting the reduction in construction businesses. Conversely, the number of wholesale and hotel and catering jobs remained constant, and the number of retail jobs rose, suggesting that in these sectors there is a trend away from smaller firms and towards larger enterprises.

The number of companies registered as operating within the mining, energy and water sector grew from five to ten. Other than this, there were only two sectors which experienced a growth in the number of businesses across Allerdale and Copeland, and these were real estate and public administration, the latter including social security, charities, libraries and cultural activities. The trends in West Cumbria are at odds with the North West and the UK, where the period 1994 – 2002 saw moderate net increases in business registrations.

Investment

A study of capital expenditure in manufacturing between 1998 and 2000 in Cumbria indicates which sectors invest the most in their asset base. The data are presented in *Table 2.3*.

Table 2.3 Capital Expenditure by Manufacturing Sector (£m) 1998 - 2000

Description	SIC code	1998	1999	2000
Food products, beverages and tobacco	15	25.9	20.7	23.7
Textiles and textile products	17	3.2	2.8	5.6
Manufacturing apparel; dressing and dyeing of fur	18	1.3	0.9	0.5
Leather and leather products	19	1.8	1.1	n/a
Wood and wood products	20	2.4	2.5	2.1
Pulp, paper and paper products, print etc.	21, 22	22.6	n/a	38.8
Chemicals and chemical products	24	38.4	44.9	30.1
Rubber and plastic products	25	27.0	n/a	24.8
Other non-metallic products	26	5.1	4.6	6.2
Manufacture of basic metals	27	7.3	n/a	3.0
Fabricated metal products, etc	28	15.3	7.6	13.1
Machinery and equipment not classified elsewhere	29	1.2	n/a	1.2
Electrical and optical equipment	30, 31, 33	3.5	n/a	1.6
Radio, tv and telecommunications equipment	32	0.5	n/a	0.3
Furniture and manufacturing not classified elsewhere	36	5.2	4.8	3.0
Recycling	37	0.08	0.08	0.3
Column totals		**160.8**	**90.0**	**154.3**

Source: National Statistics Annual Business Inquiry, commissioned by Centre for Regional Economic Development, Northumbria University.

There are two significant sectors excluded from the above table: coke, refined petroleum and nuclear fuel, which largely comprises BNFL's activities, and transport equipment, largely accounted for by British Aerospace. At the time of publication investment data were not available for these two sectors as publishing the data might reveal commercially confidential information.

Data provided to the consultants by BNFL for the three financial years 1998/99 to 2000/01, though in financial years rather than calendar years, are broadly consistent with the data above and make for an interesting comparison. These figures are shown in *Table 2.4* and also include the data for 2001/02 – though this figure is not available at the wider Cumbrian manufacturing level.

Table 2.4 BNFL Capital Expenditure (£m), 1998/99 – 2001/2002

	1998/99	1999/2000	2000/01	2001/02
BNFL capital investment	391.7	380.3	298.8	213.1
Ratio of BNFL investment to non-BNFL Cumbrian manufacturing investment	2.43 : 1	4.22 : 1	1.94 : 1	n/a

Source: BNFL and Centre for Regional Economic Development, personal communication, May 2003

Comparing the figures in *Table 2.3* which show manufacturing investment in Cumbria with investment at BNFL reveals that the company dominates manufacturing investment in Cumbria to an enormous extent. During 1998 – 2000, the years for which comparable data are available, BNFL's expenditure on capital items was in the region of twice to four times the level of investment for the rest of Cumbrian manufacturing.

2.4 SOCIAL ISSUES

2.4.1 Health

The study area falls under the Department of Health's recently restructured North Cumbria District. The North Cumbria District has its headquarters in Carlisle and covers a wider region than the study area. As well as Copeland and Allerdale District Councils it also includes those of Carlisle and Eden. Whilst some health data are available by ward, the majority are provided at overall health authority level, with some figures also provided at district level.

Mortality

Health statistics show a marked variation from region to region for a variety of factors - including diet, age structure, occupational status, smoking, drinking and nature of residence. In particular, there is a well-recognised link between prosperity and health (see *Annex A* for a review of past studies on the link between unemployment and health).

Looking at mortality at district level for the two districts which most closely fit the study area, mortality rates for Copeland are some three percent higher than average levels for England and Wales, an excess mortality rate which represents some 21 additional deaths per annum (Department of Health, 2002). Mortality indicators for Allerdale are worse: here mortality rates are some 18 percent higher than the England and Wales figure, representing around 168 additional deaths per annum.

More than half of this excess mortality is due to ischaemic heart disease. Cancer is also a major cause of ill health in North Cumbria as it is elsewhere in the UK, being responsible for around 900 deaths per annum(1).

Within North Cumbria as a whole, the death rate varies across the district council areas, with the highest rates in Allerdale and Carlisle. *Table 2.5* illustrates some average annual age-specific death rates (per 100,000) for selected causes. Data relate to 1998 - 2000, the latest period for which figures are available.

Table 2.5 Average Annual Death Rates per 100,000 by Selected Cause

Cause	Sex	Allerdale	Copeland	NCHA	Carlisle	Eden	England and Wales
All causes	Male	1,187	1,038	1,143	1,191	1,113	1,007
	Female	1,265	1,143	1,219	1,283	1,102	1,079
All cancer	Male	309	277	302	321	286	271
	Female	277	259	278	309	245	244
Cancer of lung, trachea and bronchus	Male	84	70	83	94	80	72
	Female	51	39	51	64	45	42
Breast cancer	Female	58	43	50	45	54	44
Ischaemic[1] heart disease	Male	320	292	304	305	291	244
	Female	260	250	263	284	240	195
Stroke	Male	110	89	97	93	92	80
	Female	193	145	158	140	146	131
All accidents	Male	38	28	34	36	34	24
	Female	22	26	20	17	17	24
Motor vehicle accidents	Male	16	16	15	14	16	9
	Female	6	4	6	6	9	3
Suicide, self inflicted injury & injury undetermined	Male	24	20	24	24	24	15
	Female	6	5	5	7	0	5

Note: Caused by an inadequate supply of blood to the heart
Source: Department of Health (2002).

Particular insights can be gained by comparing the health data for Allerdale and Copeland with the England and Wales averages, although differences in age structure and demographics need to be taken into account. In the cause of death groups appearing in the table, we have seen that Allerdale's "all causes" average annual death rate does not compare favourably with the England and Wales average. Three of the key reasons for this are the categories of "all cancers", "stroke" and "ischaemic heart disease", for which Allerdale has a higher than average death rate. Copeland's death rate for heart disease is also higher than the England and Wales average. This finding is consistent with overall ward data, which reveal that mortality ratios tend to be worse in the coastal and western areas of Cumbria.

(1) Cancer is major cause of death across the UK. This report neither studies nor implies any link between radioactive discharges and cancer.

Mental Health

Suicide rates are a poor indicator of mental health, but they are employed for target setting on mental health issues because "there is simply nothing else suitable" (NCHA, 1999). Suicide in Allerdale and Copeland remains the second highest cause of death in young men aged 15-34, exceeded only by deaths in motor vehicle accidents. Indeed, suicide rates in Allerdale and Copeland are 42 and 61 percent higher respectively than the England and Wales average for this group. This group, young men, frequently experience social isolation and exposure to drugs, alcohol and poverty (see *Annex A*).

Overall male suicide rates (for all age groups) in Allerdale and Copeland are also high, at 50 percent more than the England and Wales average. Female suicides in Copeland reflect the England and Wales average, while in Allerdale they are some 28 percent higher.

2.4.2 Housing

Housing data is available at both ward and district level, though not at the level of the TTWA.

In 2001, there were a total of 74,216 households in Allerdale and Copeland, of which 58 percent were in Allerdale and 42 percent in Copeland (Cumbria County Council District Profiles, 2003, using National Statistics census data). *Table 2.6* shows dwellings in the two districts by type.

Table 2.6 Dwellings in Allerdale and Copeland by Type (2001)

Type of Dwelling	Number in Copeland	%	Number in Allerdale	%	Total number	%	England and Wales figures %
Detached	6,766	21.5	11,155	26.0	17,921	24.1	23
Semi-detached	11,785	37.5	13,734	32.1	25,519	34.4	32
Terraced	10,072	32.1	13,770	32.2	23,842	32.1	26
Purpose built flat	1,757	5.6	2,636	6.2	4,393	5.9	14
Other household space	821	2.6	1,342	3.1	2,163	2.9	5
Caravans, or other temporary/mobile structures	197	0.6	181	0.4	378	0.5	-
Total	31,398	100	42,818	100	74,216	100	100

Source: Cumbria County Council, District Profiles (2003), derived from National Statistics (2001)
Note: "Other household space" comprises converted flats, rooms in shared houses and flats located in commercial buildings. Figures may not add exactly due to rounding.

Across Allerdale and Copeland, the most common type of housing is semi-detached, comprising some 34 percent of all dwellings in the two districts combined. This compares to 37 percent in the North West (*ibid*) and 32 percent in England and Wales. The next largest dwelling type in Allerdale and Copeland is terraced housing, making up 32 percent of the total. This is the same as the figure for the North West and higher than the England and Wales figure of 26 percent. Some 24 percent of dwellings are detached, one

percent higher than the England and Wales average, though as expected for a predominantly non-urban area, there are fewer flats in the study area than in the rest of the country. All data are sourced from National Statistics, 2001 census.

In line with the situation across the North West and in England, most people living in Allerdale and Copeland are either buying their own houses or have finished buying them. Nearly two-thirds of houses (64 percent) are owner occupied, close to the England and North West figure of 68 percent. *Table 2.7* shows dwellings by tenure.

Table 2.7 Tenure of Dwellings

Household Tenure	Number in Copeland	Percent	Number in Allerdale	Percent	Total	Percent
Owned outright	8,822	29.9	13,481	33.9	22,303	32.2
Buying	11,072	37.5	13,999	35.2	25,071	36.2
Local Authority rental	4,122	14.0	1,298	3.3	5,420	7.8
Housing Authority rental	2,674	9.1	6,913	17.4	9,587	13.8
Private rental	1,650	5.6	2,508	6.3	4,158	6.0
Other	1,146	3.9	1,582	4.0	2,728	3.9
Total	29,486	100	39,781	100	69,267	100

Note: Figures may not add precisely due to rounding
Source: Cumbria County Council, District Profiles, 2003, figures based on 2001 census

The proportion of people in Allerdale and Copeland renting their houses from Housing Authorities is around twice the average for England & Wales and the North West (which are 6 and 6.5 percent respectively) while the proportion of dwellings rented from Local Authorities, at 7.8, is significantly less than comparable figures for England and Wales (13.2 percent) and the North West (13.6 percent). Aggregate figures for the two districts are however affected by a switch away from council housing towards Housing Authorities that has happened in Allerdale. Since the 2001 census, recent discussions with Allerdale confirm that the borough has now disposed of all of its council housing.

The proportion of people renting their homes privately is one to two percentage points lower than the England and Wales and regional average.

House Prices

House prices in the North West have been rising consistently since 1995 and strong growth is especially evident in the case of higher quality housing. *Table 2.8* gives an indication of the degree to which house prices have changed at the regional and sub-regional level. Allerdale and Copeland are used as a proxy for price changes in the study area.

Table 2.8 ***Percentage Change in House Prices by Location and Type, 1998 - 2003***

Dwelling Location/Type	Detached	Semi-detached	Terraced	Flat/ Maisonette	Average
North West	72	61	43	84	48
Cumbria	57	58	43	46	48
Allerdale	47	66	38	101	41
Copeland	44	46	26	5	22

Note: 1998 based on Q4 data, 2003 based on Q1 data
Source: Land Registry (2003)

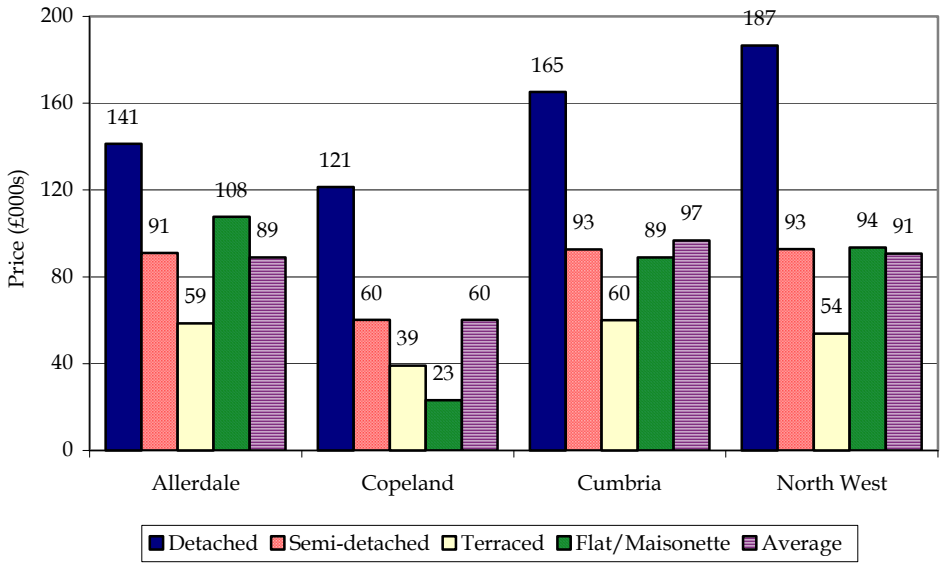
The strongest house price rises are in the North West and Cumbria, followed by Allerdale, and then Copeland.

Perhaps the most striking evidence shown in the table are the relatively low rates of price rise experienced in the Copeland property market since 1998. Copeland is more representative of the study area than Allerdale, because average prices of houses in Allerdale are pulled up by more expensive properties outside the study area (eg Keswick and the Lake District National Park).

The differential between house prices in East and West Cumbria is a clear indication of the general dislocation between the East and West Cumbrian economies, with labour shortages and relative affluence prevalent in East Cumbria, whilst the West Cumbrian economy is characterised by high levels of unemployment and deprivation.

Figure 2.8 shows absolute average house prices, which are based on data for the first quarter of 2003.

Figure 2.8 ***Average House Prices by Area, First Quarter, 2003***



Source: Land Registry

The figure illustrates that on average, detached properties in the North West are more expensive than those in Cumbria, while in turn, properties in Cumbria cost more than equivalent housing in Copeland and (with the exception of flats) Allerdale. Flats in Allerdale and terraced housing in Cumbria and Allerdale are more expensive than the average price for this kind of property elsewhere in the North West. This is probably due to the premium commanded for this type of housing in the Lake District National Park, which is a popular place amongst people who wish to buy second homes or retire there. Of the four areas shown, Copeland has the lowest residential property prices.

2.4.3 Crime

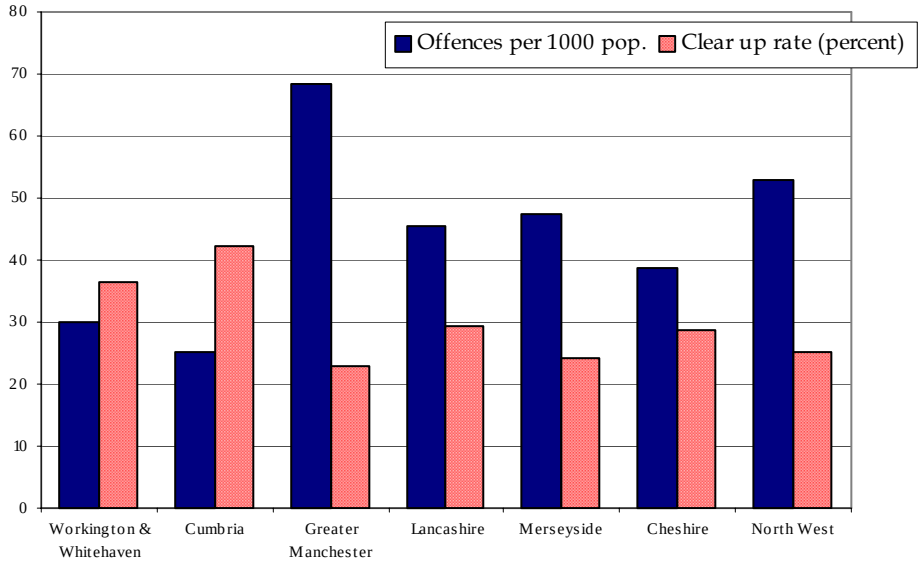
To understand the impact of crime on the study area, statistics were obtained from the Home Office showing notifiable offences recorded by the police between April 2001 and March 2002. To avoid inappropriate comparisons of absolute numbers of crimes for areas of different populations, all comparisons were made on a "crimes per *x* thousand people" basis, while clear up rates are expressed as a percentage of all notified crimes solved.

The closest proxy to the study area for which crime figures are collected is Basic Command Unit level, which in this case is the Workington and Whitehaven police force area. *Total* crime figures are not collected at the Basic Command Unit level but only at the wider sub-regional level. Work is underway to address this, but in the mean time, data are available for the Workington and Whitehaven police force area showing crimes and clear-up rates by selected type of crime. The crimes for which data are collected at this level are:

- violence against the person;
- sexual offences;
- robbery;
- burglary;
- motor vehicle theft; and
- theft from motor vehicles.

Figure 2.9 shows data related to all of these selected crimes together, and compares Workington and Whitehaven with the rest of the North West.

Figure 2.9 Selected Notifiable Offences by Area, 2001 - 2002



Source: Home Office (2002)

In 2001 - 2002 there were 30 notified offences of this type for every 1000 people living in the study area. This compares very well with the North West average of 53 offences of this type, though from examination of the figure it can be seen that the North West average is skewed by high figures especially in Greater Manchester and to a lesser extent Merseyside. The figure is higher than the Cumbrian average (25) but lower than that of the other counties, Cheshire (38) and Lancashire (45). The clear up rate for the selected offences in Workington and Whitehaven stands at 36 percent, which is lower than the Cumbrian average of 42 percent but higher than the averages for each of the other sub-regions: Cheshire, Lancashire, Merseyside and Greater Manchester.

For the selected crimes shown, the figure above demonstrates that Cumbria has lower crime levels and higher clear-up rates than the other North West sub-regions and this is most likely due to its more rural setting. This is also true when data showing all notifiable offences (which is available at sub-regional level) are compared. Part of the explanation for the relatively good performance of the Workington and Whitehaven areas is that having smaller towns, urban crime is reduced (and in particular vehicle theft and theft from vehicles), leading to an overall lower average.

Looking at the specific type of crime, Cumbria has the lowest incidence, and Workington and Whitehaven the second lowest incidence, of sexual offences, burglaries, vehicle thefts and thefts from vehicles, compared to all the remaining sub-regions. Workington and Whitehaven have the lowest robbery rates per 1000 population, with Cumbria second lowest, while for violence against the person offences, Cheshire has the fewest reported offences per capita, followed by Cumbria and then Workington and Whitehaven.

These ratings do not reveal much of the differences between crime rates in the study area and those of major urban centres. A comparison of rates, rather than rankings, shows some stark differences: Merseyside has nearly ten times as many robberies per capita compared with Workington and Whitehaven, and Greater Manchester more than 16 times as many. Vehicle theft is nearly six times as likely in Greater Manchester compared with Workington and Whitehaven, and sexual offences are over twice as likely. The most evenly distributed crimes throughout the North West are violence against the person and theft from a vehicle, which are between two and two and a half times as likely to happen in the sub-region with the lowest incidence as they are in the highest.

2.4.4 Education

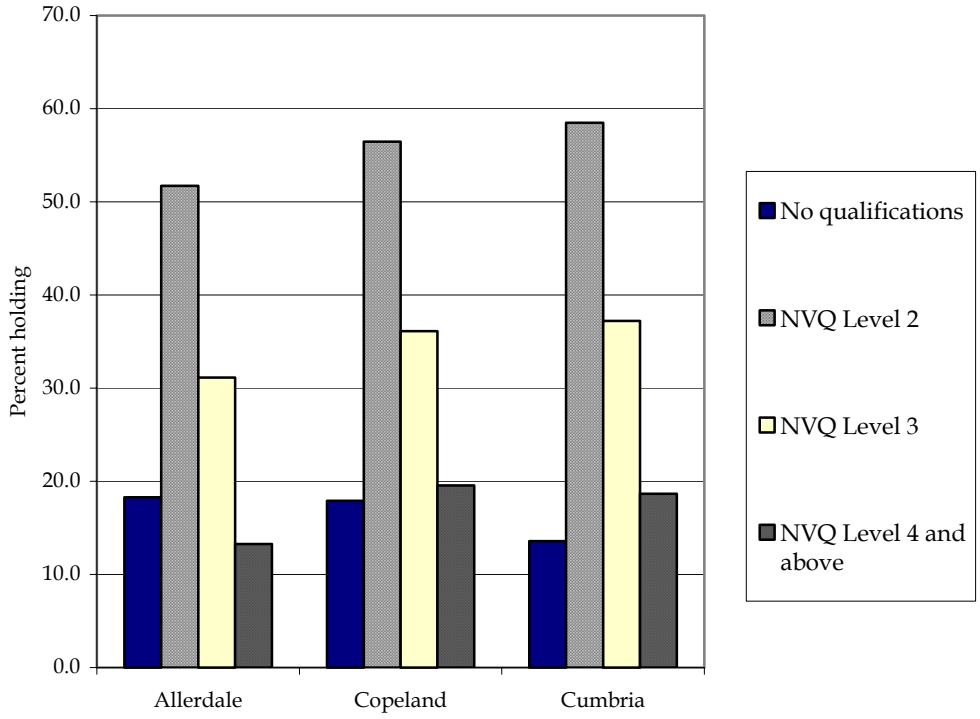
Education and training qualifications are collected as part of the Labour Force Survey, administered by National Statistics. The data are not available at ward or TTWA level: but the Local Labour Force Survey, which is carried out annually, provides district and county level data.

As part of the survey, respondents aged over 16 are asked what is the highest level qualification they have. *Figure 2.10* presents the findings from the 2001 – 2002 survey, and shows the proportion of people for whom each National Vocational Qualification (NVQ) level is the highest qualification held. Because of the number of different types of qualifications commonly held by survey respondents (around 40) each one is converted into an equivalent NVQ. NVQ level 1 is the lowest qualification, its equivalent being fewer than five GCSEs at grades A-C. NVQ Level 2 comes next, approximately equivalent to five or more GCSEs at grades A-C; NVQ Level 3, the next highest level, is equivalent to two or more A levels, while NVQ Level 4 approximates to HNDs and undergraduate degrees. NVQ Level 5 is the highest qualification, and includes higher degrees.

An analysis of the average level of qualifications held by people of working age at the national, regional and district level shows that the study area workforce (using Copeland and Allerdale as a proxy) is comparatively badly qualified at all levels of vocational and educational achievement.

According to DFES estimates from the Labour Force Survey, some 25 percent of working age people in England and 22 percent in the North West are qualified to NVQ Level 4 or above. In Cumbria this drops to 19 percent. While Copeland averages 20 percent (and this average is probably increased by the district's concentration of BNFL technical and management staff), the figure for Allerdale is 13 percent - only half the national average.

Figure 2.10 Highest Qualifications Held by Working Age & Economically Active People



Source: Local Labour Force Survey, National Statistics, 2001 - 2002

A similar pattern emerges lower down the education and training spectrum, where according to DFES estimates, at the England and North West level around two thirds of people are qualified to NVQ Level 2 or above. This compares with some 60 percent in Cumbria and only 56 and 52 percent for Copeland and Allerdale respectively.

Findings at the lowest level of attainment – the proportion of working age people having no qualifications at all - reflect this negative picture. While the average in England is 14 percent, in Copeland and Allerdale an average of 18 percent of people of working age hold no qualifications.

All of this demonstrates that at the top, middle and bottom of the scale of education and training, the study area lags significantly behind regional and national averages.

2.4.5 Social Exclusion

There are many parts of both rural and smaller urban areas in West Cumbria where poverty and deprivation exist. The incidence of disadvantage is an important factor in determining the demand for local services, particularly for health, as the causes of ill health include poverty, socio-economic disadvantage, stress, unemployment, unhealthy diets and addiction to alcohol, tobacco and drugs. Indeed, there is "a simple and obvious link

between being poor and having poor health" (North Cumbria Health Authority, 1999).

Cumbria County Council's Information and Intelligence team employs what is known as a "geo-demographic classification" to categorise people into one of six groups, to help assess social disadvantage. The technique used is the "ACORN" method developed by CACI Information Services, which is used widely by local government and also in marketing. ACORN is an acronym for "a classification of residential neighbourhoods" and is a postcode-based system based on 1991 census data that assesses the socio-economic group of people likely to be living in certain types of accommodation. Activity is underway to revise the classification according to 2001 census data but in the mean time regular amendments (including a major overhaul of the figures in 2000) have been made based on primary research and lifestyle data, as well as income statistics at local levels.

Six broad categories are defined which are then sub-divided further as required. The six categories are:

- "thriving" - the people established at the top of the social ladder, who are healthy, wealthy and confident consumers;
- "expanding" - business people in better off families, paying off mortgages and bringing up children in affluent, family areas;
- "rising" - young, affluent urban people or young professionals in towns and cities, working and studying their way up the career ladder;
- "settling" - skilled workers and "comfortable middle agers" in the middle of the social spectrum, living in home owning areas and leading steady lifestyles;
- "aspiring" - those trying hard to increase their quality of living, often new home owners or white collar workers living in better off multi-ethnic areas;
- "striving" - the people who find life most demanding; the definition includes council estate residents, older people living in less prosperous areas or people in multi-ethnic, low income areas.

CACI's assessments of the social disadvantage (and advantage) of residents in Cumbria (and elsewhere) are carried out for each ward and also at district level. The findings for Copeland, Allerdale and Cumbria are presented in *Table 2.9* below.

Table 2.9 Social Disadvantage: Estimated Percentage of Households Matching Each Categorisation

Household Group	Allerdale	Copeland	Cumbria
Thriving	20	11	23
Expanding	8	13	7
Rising	0	1	2
Settling	38	31	36
Aspiring	13	19	14
Striving	20	27	17

Source: Cumbria County Council, District Profiles, 2003, commissioned from CACI, 2002

Perhaps the most striking characteristic presented in the table is how poorly the top "thriving" group is represented in Copeland, relative to the average for the county. Towards the more disadvantaged end of the scale too, the relatively poor performance of Allerdale and in particular of Copeland is also apparent, with both districts performing worse than Cumbria as a whole in the bottom ("striving") and second from bottom ("aspiring") groups.

Only in the expanding category do both Allerdale and Copeland exceed the Cumbrian average. Copeland's relatively good performance here (six percentage points above the county average – a gap which has increased by a half since the last time this research was carried out in 1999) may well be based on significant numbers of BNFL staff living in affluent/executive type family areas within the borough.

Comparing the 2002 findings with those of 1999 shows that in all of the areas considered, the proportion of households fitting into the top social group has fallen, though it has grown for the second top social group ("expanding"). In Cumbria, the proportion in the rising group has grown, whilst staying the same in Copeland and Allerdale. Improvements have been made across each geographical area in the settling category (now a larger proportion of people in each case), and aspiring category (now a lower proportion). Of concern to policy makers will be that in the most deprived social group ("striving") the proportion of households has grown – by only 0.5 percentage points in Allerdale, but by one percentage point in Cumbria and by over four percentage points in Copeland – the biggest change in any group.

The implications of these findings are that in Allerdale, and particularly in Copeland, there are likely to be higher levels of deprivation compared to the rest of Cumbria, leading to greater demand for welfare and public services. Moreover, for Allerdale (and again, in particular for Copeland) these data indicate that the proportion of people fitting into the top social group is falling, while the number of people at the very bottom of the social strata is rising.

Income Levels

A complete data set showing income levels for the TTWAs that comprise the study area is not available. However, data from the New Earnings Survey (2002) suggests that insofar as gross weekly earnings in the study area reflect the Cumbria average, they are likely to be lower than the averages for the North West and for Great Britain as a whole. *Table 2.10* presents this data.

Table 2.10 Average Gross Weekly Earnings, 2002 (£'s, Adult Rates)

Type of Employment	Great Britain	North West	Cumbria	Percent change, in relative position since 1999
Full-time employees	464	427	396	-5
Full-time males	514	471	442	-6
Full-time females	383	354	308	-5
Full-time manual males	371	358	380	-1
Full-time manual females	252	241	228	-9
Full-time non manual males	610	555	508	-8
Full-time non manual females	405	373	332	-3

Notes: The percent change column shows change (in percentage points) of wages in Cumbria relative to those in Great Britain as a whole. As an example, –5 indicates that wages in Cumbria dropped by five percentage points between 1999 – 2002 compared to the national average (eg in 1999 they may have been 90 percent of the GB average compared to 85 percent in 2002). All figures relate only to employee incomes (not self-employment incomes). Also excludes social benefit incomes, incomes from stocks and shares, employers social contributions etc

Source: New Earnings Survey, 1999 and New Earnings Survey 2002

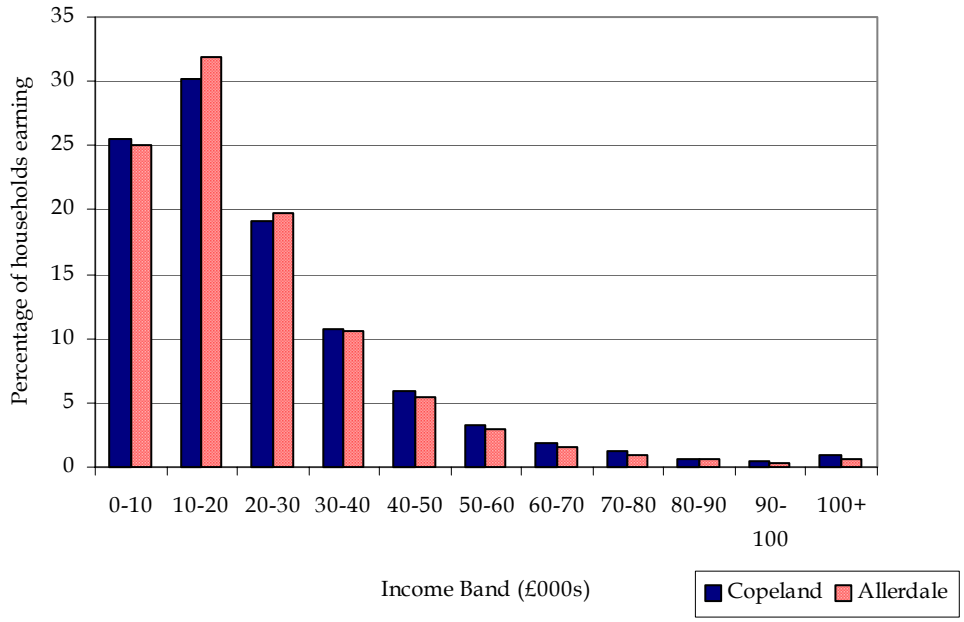
The table shows that in all of the seven categories presented, the Great Britain average figure is higher than the North West figure, which in turn is higher than the Cumbria figure - with one exception. The exception is the case of full-time manual males. In this category, the pattern of the GB average being higher than the North West average is maintained, but the Cumbrian average was not only higher than the North West average (by £22 per week) but is also higher than the average for Great Britain as a whole (by £9 per week). The explanation for this is almost certainly the relatively high wages paid by BNFL to manual staff at its plants in West Cumbria.

The Cumbrian group earning the least relative to the Great Britain average are full-time female workers, whose average gross income is only 80 percent of the GB average. This position has worsened since 1999, when the New Earnings Survey showed that full-time female workers in Cumbria earned 85 percent of the national average. In fact, a cursory look at the data shows that average Cumbrian wages relative to those in Great Britain as a whole fell for every group between 1999 – 2002 (see *Table 2.10*).

Income distribution by TTWA is not available, but district income figures are prepared. Copeland and Allerdale can therefore be used again as approximates for the study area. A graphic illustrating income distribution in these two districts is presented in *Figure 2.11*.

The Figure shows a skewed pattern of income distribution in which a higher proportion of households have a low income. For example, approximately 25 percent of the population of both districts have an income of between zero and £10,000. The majority of households (57 percent in Allerdale and 56 percent in Copeland) have an income between zero and £20,000. *Figure 2.11* also tells us that higher proportions of Copeland residents are in receipt of incomes in excess of £30,000 than Allerdale residents.

Figure 2.11 Gross Annual Family Income 2002: Copeland and Allerdale



Source: Cumbria County Council, District Profiles (2003)

In August 2002, 4.5 percent of households in Copeland were claiming Working Families Tax Credit. In August 2000, 4,410 local residents were claiming income support – approximately six percent of the total. For Allerdale, some 4.7 percent of households were claiming Working Families Tax Credit in August 2002. In August 2000, the number of local residents claiming income support was 5,725 – in percentage terms, this was the same as Copeland at around six percent (Cumbria County Council, 2003).

Car Ownership

Areas of high car ownership are often seen as affluent (and those with low car ownership seen as poor) and the rates of car ownership in an area can be used by central government to aid in the allocation of resources to local authorities for certain services. However in parts of Cumbria and in other places where there is a high rural population and low levels of public transport, this relationship becomes weaker, as owning a car becomes a necessity for those who wish to work, and/or have access to local services. Car ownership is higher in rural areas and lower in large urban areas, reflecting a greater reliance on the car outside urban areas.

In Copeland, the number of households without access to a vehicle in 2001 (27.9 percent) is slightly higher than the England and Wales average of 26.8 percent. Lack of access to a vehicle has implications for a household's accessibility and social exclusion, particularly where households without cars are located in predominantly rural areas of the borough.

In the district of Allerdale, overall car ownership is higher, most likely reflecting the lifestyles and behaviour of those consumers who live in the

wealthier parts of the area. Yet with 24.1 percent of all households in the district still lacking access to a private car, the figure remains above the rural average of 15 percent (National Travel Survey, Department of Transport), notwithstanding the relatively remote nature of the area (all figures from National Statistics, 2001 Census, except where otherwise stated).

2.5 THE ENVIRONMENT IN WEST CUMBRIA

2.5.1 Perception of Area

West Cumbria suffers from the legacy of industrial decline. Yet some of those industries which remain, for example chemicals, electronics and nuclear reprocessing, have been able to develop strongly, which has had a counterbalancing impact on the image of the region.

Away from industry the external image of West Cumbria benefits greatly from the area's location immediately next to the Lake District. Tourism used to be concentrated in the south and central Lake District and, up until ten years ago, few visitors ventured west to the Cumbria coast to places such as Maryport, Whitehaven or Workington or to the Furness peninsula. However more tourist activity is now taking place in the study area with, for example, Whitehaven's marina now completed and full, the Maritime festival is now well established and the town's image strengthened through the hosting of the Tall Ships visit in June 2002. The intention is that the improved marina will provide a new focus to the town and continue to act as a catalyst in its regeneration. Recent research into tourist perceptions of West Cumbria has indicated that Sellafield plays no significant role in deterring visitors, with 84 percent of visitors surveyed in Kendal saying that the plant has no influence on their selection of destinations for visits(1). Of the remaining 16 percent it is unclear whether Sellafield is an attractor or a deterrent – the impact of public fears about nuclear installations has to be balanced against the impact of the Sellafield Visitor Centre, which is one of the major attractions (in terms of visitor numbers) in the county, and one which is all-weather and all-year (important in an area where the main attractions are outdoors).

2.5.2 Infrastructure

The nature of the area, bounded as it is by the sea to the North, South and West, and having the Lake District on its east side, has meant that transport links are generally poor. Key infrastructure links are largely on a north-south axis rather than an east-west one. The principal main road link is the A66, providing access to the M6, to the east of the study area and linking Cumbria southwards with England and Wales and northwards with Scotland. Following the same corridor as the M6 is the West Coast Main Line offering direct services to Glasgow, (with connecting services to and from West Cumbria).

(1) Perception of West Cumbria, a report by the Bowles Green Partnership for the West Cumbria Tourism Initiative, 2000

Within West Cumbria local communication has been improved by reconstruction of the A66 to Workington via Cockermouth. The A595 provides the main link between Millom (and points South and East, including Barrow-in-Furness) in the South of the study area, and Workington. However, this road is of very poor quality, being narrow and windy for most of its length and with few overtaking opportunities, meaning that access from the South of is slow and unreliable. Further North the A596 continues to Maryport and then leaves the study area on its way to Carlisle.

The Port of Workington is West Cumbria's main general cargo port, with key traffic being bulk cargoes such as coal, chemicals, steel, scrap and timber. Further down the coast, and just beyond the study area there is a port at Barrow as well as a small airport.

Although there are airports at both Carlisle and Barrow, the area suffers from a lack of scheduled air services. The nearest airports with London or European links are Manchester, Newcastle and Glasgow, each of which is between two and three hours from the West Cumbrian coastal towns. The practical implication of this is that day visits from, for example, London, are only possible by taking the first and last flights or trains, hiring a car and restricting meetings in West Cumbria to a maximum of two hours. This compares unfavourably with other peripheral locations within the UK, such as Inverness or Plymouth, where scheduled air services permit reasonably full business days.

2.6 CONCLUDING REMARKS

As with the UK, West Cumbria has an ageing but stable population. However, this stability masks a decline in the number of young workers relative to the UK, suggesting that young people leave Cumbria, possibly for higher education, but do not return.

Employment in the study area declined steadily between 1982 -2000, except for the peak caused by the construction of THORP in the late 1980s and early 1990s. This decline is partly associated with a long-term decline in industrial employment, and has affected males more than female employment, which has actually grown. Past experience has shown employment tends to be heavily influenced by BNFL Sellafield site activity, with construction employment being particularly sensitive to BNFL investments. The decline in employment continues to result in the area having unemployment levels that are above levels for the North West and the UK. While the nature of the local economy (in terms of its split between industrial sectors) generally reflects the national picture (with the key exception of energy), the occupational status of employees and average gross weekly earnings are lower when compared with the UK average. West Cumbria also has a lower rate of new business formation than the UK.

The social characteristics of the area reflect the relative decline of the local economy. Analysis by Cumbria County Council has demonstrated that the

West of the county, and Copeland in particular, suffer from high levels of deprivation. The health of the West Cumbria population is also poor compared with England as a whole, with the area performing worse on a range of indicators including heart disease, strokes, cancer and suicides. With regard to housing, the stock in West Cumbria is more likely to be terraced and semi-detached, with fewer detached houses and purpose built flats. Housing tenure in the study area is generally comparable with England, but house prices have not risen as fast as in the rest of the North West or England. Finally, educational attainment in Cumbria is poor by national standards, with less than two thirds as many employees with a degree level qualification (or higher) as the national average. Performance is also poor at lower levels of educational attainment.

The perception of the area reflects both the history of industrial decline and the high quality of the landscape. It is also relatively inaccessible, with only one good quality external road link and limited rail services.

West Cumbria therefore suffers from a number of economic and social problems, which provide the context for assessing the impacts of future scenarios for the Sellafield Plant.

3 RESEARCH EVIDENCE ON THE IMPACT OF EMPLOYMENT EVENTS ON LOCAL COMMUNITIES

3.1 INTRODUCTION

The volume and nature of employment at BNFL's Sellafield complex together with the isolation of West Cumbria mean that the site's interactions with the local economy are unique. However, insights into the impact of changes in employment on site can be gained from examining the effects of major changes in employment elsewhere.

An international literature review of the impacts of major employment changes has therefore been undertaken focusing on:

- the nuclear industry, both in the United Kingdom and abroad; and
- on other industries in economically depressed or peripheral regions of the United Kingdom.

The cases identified are described briefly in *Table 3.1*.

Table 3.1 Case Studies of Major Employment Changes

Company	Location	Brief Description
Nuclear Industry Case Studies		
Dounreay	Caithness, Scotland	Major nuclear installation in very remote location whose employment has fluctuated over time
Savannah River Site	South Carolina and Georgia, United States	Major nuclear site whose mission of manufacturing materials for nuclear weapons has terminated, and which is now in the decommissioning and waste management phase
KSO	Oskarshamn, Southern Sweden	Nuclear power plant scheduled for closure
Case Studies from Other Industries		
Pfizer Pharmaceuticals	East Kent, England	Major science led manufacturer in remote and economically depressed area of Kent
VSEL/ BAe Systems Shipyard	Barrow-in-Furness, England	Major employer in Cumbria which has experienced large run down in employment
UK Coalfields	South Wales, County Durham and Nottinghamshire	Large employers of well paid manual workers in predominantly rural areas
Swan Hunter Shipyard	Tyne and Wear, England	Major shipyard which closed in an economically depressed area of North East England

This section sets out a summary of available knowledge on each of these cases.

3.2 THE IMPACT OF MAJOR EMPLOYMENT CHANGES IN THE NUCLEAR INDUSTRY

3.2.1 Dounreay[1]

Background

In 1988 it was decided that expenditures on the UK fast breeder nuclear reactor programme would be heavily reduced. A reduction in research and development (R&D) expenditure from more than £50 million to £10 million per annum was projected, implying a substantial and sharp reduction in R&D related employment (some 1,500 jobs) at the Atomic Energy Authority (AEA) establishments at Harwell, Risley and Sellafield over the period to 1991 (Pieda plc, 1996). A cut in employment, albeit smaller than at the other sites, was announced also for Dounreay over the same period. The shut-down of the prototype fast reactor was, however, not planned to occur until 1994, and of its associated fuel reprocessing plant until 1997. Despite an initially and comparatively small job loss (some 300), a more substantial reduction had occurred by 1997.

Employment in other sectors, except energy and water, also fell slightly (from 1981 levels). The primary sector had been showing a long term decline since the 1960s, whilst manufacturing employment, which had rapidly increased between 1966-81 fell between 1981 and 1991. However, between these years there was no significant change in the employment structure in Caithness, suggesting that until 1991 the run down had not had any major impact on the region. The data indicate, however, that a substantial loss in employment has taken place since 1991 (Pieda, 1998). Dounreay accounted for as much as one fifth of the total labour force in Caithness in 1988 and is, despite subsequent redundancies, still the largest employer in the local area.

Economic and Social Impacts

- *Employment Effects*. The downsizing of Dounreay has been gradual, and it is therefore difficult to identify indirect impacts on employment. However, the direct number of employees was over 2,100 in 1988 and has decreased to a current number of around 1,200 (UKAEA website, 2000), meaning that more than 900 jobs have been lost. The Pieda report (1996) found that around 1,000 jobs had been lost in the service industry, which is dominated by the run down at Dounreay, and accompanied by a fall of around 400 jobs in manufacturing in the area (indirect effects). The net disposable income[2] on site amounted to £19.9 million in 1988 and £16.9 million in 1996 (in each year's prices). However, expressed in constant 1988 prices the disposable income fell to £12.4 million in 1996, a drop of £7.5 million in real terms.

(1) Caithness and Sutherland Enterprise, Highlands and Islands Enterprise and Future Skills Scotland are currently preparing a report to identify the staff and skills requirements of decommissioning activity at Dounreay. However, at the time of writing results are not available.
(2) Expressed net of income taxes and insurance contributions.

- *Expenditure Effects*. In 1996 the value of local inputs purchased by Dounreay had fallen by some £1.8 million per annum (in 1988 prices). This is contributed to a loss of local incomes and employment in the local economy.

- *Regional Change in Unemployment Levels.* The vast majority of employees at the Dounreay Plant are male. Prior to 1988 this ensured that male unemployment in Thurso was much lower than for the Highlands and Islands area as a whole. However, male unemployment increased between 1988 and 1994 in Wick as well as Thurso from 16.8 percent to 19 percent and 8.6 percent to 15.9 percent respectively. Female unemployment rates have traditionally been lower than male in the Highlands and Islands area, and fell between 1988-95. In total, unemployment increased from 8.8 to 10.8 percent in Thurso, but decreased from 12.8 to 10.8 percent in Wick over the 1988 to 1994 period. Although Dounreay employed labour from a wide range of locations, the greatest impact was on the local Thurso travel-to-work area.

- Over the period 1988 to 1995, the percentage employment reduction in related manufacturing and service sectors was 29.6 percent, much higher than the corresponding reductions for the Highlands and Islands (5.8 percent) and Scotland (1.5 percent). Total employment in Caithness fell by 13 percent between 1991-93. It is, however, important to note that employment in the whole of the UK also declined over this three year period from 21.117 million to 26.060 million, a fall of 3.9 percent.

- *Migration*. From a population of just under 3,300 in 1951, Dounreay experienced an increase in population to over 8,000 in 1961 and 9,000 in 1971. However, as early as 1971, ie before the downsizing of Dounreay, there was a trend of a slow but steady decline (3.8 percent by 1991). By 1994 the population had fallen by a further 2.4 percent, which indicates a more rapid decrease in the level and an increase in out-migration. This is contrary to the regional increase in population of 16 percent that the Highlands and Islands experienced over the years to 1991.

- *Housing*. The housing stock was stable between 1981 and 1988. Between 1988-91, however, a drop in the housing stock of nearly 100 from 3,636 to 3,561 occurred, probably related to out-migration.

- *Skill Levels.* There were some 350 employees with degrees at Dounreay in 1988 but this number has dropped along with the decline in the research and development activity. Nevertheless, as decommissioning work has substituted for other activities, there has been an increased need for project management and economic and safety assessment skills, which also require highly trained staff.

3.2.2 *The Savannah River Site, USA*

Background

In the 1980s and 1990s the Savannah River Site (SRS), on the border of South Carolina and Georgia, spent between $1.3 and $2 billion per annum in terms of purchases of goods and services. More than 60 percent of these expenditures had a direct impact on the two state economies, thus also creating significant indirect effects. In terms of total income, SRS's contribution to the two states amounted to somewhere between $1.6 billion and $2.7 billion annually between 1987-97, although most of the impact was concentrated in the Central Savannah River area.

Prompted by a change in defence policy in 1991, however, the total expenditure has decreased continuously since 1992 with subsequent effects on regional employment and income. These effects are examined below.

Economic and Social Impacts

- *Employment.* The facility as a whole cut the number of employees by 40 percent (from 25,180 to 15,032) between 1991 and 1997 (direct effect). Contractors were forced to undertake reductions in their staff, leading to a loss of 845 jobs, and indirect job losses amounted to 16,642. Thus, in total 26,068 jobs, or 36 percent of those dependent on SRS, were lost over the period. However, the impact of SRS layoffs during 1991-97 was not as severe as might be expected from the heavy dependence of these counties on SRS. This could be attributed to several reasons: migration and retirement, and a generally strong regional and national economic performance over these five years.

Table 3.2 Savannah River Site Employment Impacts - Total for Region

Effect	Fiscal Year 1990-91	Fiscal Year 1996-97
Savannah River Site Jobs	23,056	14,475
Jobs created through procurement	3,351	2,506
Indirect jobs	46,035	29,393
Total	**72,442**	**46,374**
Change between 90/91 - 96/97:		
- absolute numbers	**-26,068**	
- percentage change	**-36 percent**	

Source: Grewal (1997)

- *Expenditure Effects.* Site expenditures were decreased by 30 percent in real terms between 1991 and 1997. The impact of budget cuts was more severe on the payroll (33 percent of total dollar expenditures) as compared to procurement (9.5 percent).

- *Income Effects.* As a result of the decreased expenditures, the states of South Carolina and Georgia experienced a total drop in direct and indirect

income from $2.8 to $1.9 billion between 1992-97. The downsizing at SRS had most significant implications for the income in the immediate vicinity of the site and the decrease in total income between the fiscal years of 1990/91 and 1994/95 was $181 million (see *Table 3.3*). It is, however, thought to have decreased significantly more after 1994/95, but data for this period are unavailable.

Table 3.3 Income Impact of SRS on the Region ($ Millions)

Effect	Fiscal Year 1990-91	Fiscal Year 1994-95*
Total direct impact	1,129	1,042
Indirect impact	1,242	1,147
Total Income impact	2,370	2,189
Change between 90/91 - 94/95		
- absolute numbers ($ Millions)	**-181**	
- percentage	**-8 percent**	

Source: Grewal (1997)
*Data for 1996-97 are not available, but the decrease is undoubtedly larger than demonstrated by the table

3.2.3 KSO, Sweden

Background

In anticipation of the restructuring of Swedish energy provision, the Swedish association of municipalities with nuclear reactors, KSO, carried out a study to forecast the socio-economic consequences. The resulting report (KSO, 1999) describes the projected effects in the five different municipalities. The projections provided by the report are based upon a total closure of the nuclear industry in 2005, and the analysis stretches as far as 2017. The report covers all the reactors scheduled for closure in Sweden. However, in terms of relevance to Sellafield, Oskarshamn is of most interest. The Oskarshamn plant is poorly situated in terms of infrastructure and, albeit located in the more populous south of Sweden, communications are poor and the surrounding area somewhat less economically prosperous than the national average.

Social and Economic Impacts

- *Employment*. Of the 13,900 jobs in the municipal labour market, 1,072 are employed by the nuclear plant. Industry is the single largest sector of employment (4,000), followed by health care (3,000), commerce (2,000) and energy production (1,100). Of the 1072 employed in the nuclear plant, 85 percent live in the municipality and 15 percent in the region or a nearby town. A total closure would consequently cause a direct job loss of 1072, corresponding to 8 percent of the regional labour market.

- *Expenditure Effects.* Closure of the Oskarshamn reactor will affect 220 suppliers who generate around 600 full-time jobs per annum (indirect effects). Estimates regarding induced effects show that an additional 50 percent of the directly employed, ie 535 jobs, would be lost. These

estimates are based on a decline in other sectors, eg manufacturing, business and schooling. In total, the projected job loss amounts to over 2,200, or 16 percent of the current labour market.

- *Migration*. Three different scenarios were estimated. Firstly, a projection of population change was prepared. Secondly and thirdly, to this baseline was added the effects of a total closure, resulting in migration of either 50 percent or 75 percent of redundant workers below 55 years of age and their families. Hence, it was assumed that those over 55 would follow the migration pattern of previous years. By year 2017, this would mean that an additional 1,255 to 1,876 residents would have migrated away from Oskarshamn due to the closure of the power station.

- *Housing*. Oskarshamn is presently experiencing an excess supply in the housing market, and house prices are consequently low. Assuming the above migration scenarios, this problem will worsen unless the lost jobs at the nuclear plant are substituted by other opportunities. If migration turns out to be in line with the 50 percent migration scenario, the demand for housing is estimated to drop by 955 units and, if in line with the higher scenario, by 1250. Given that the total *population* is 27,000, these numbers are likely to have a significant impact on the local housing market.

- *Skill levels*. As compared with the local economy, employees at the nuclear plant have a fairly high level of education, 36 percent having completed at least a one-year course at university (compare with 20 percent locally). Plant closure would therefore bring down the skill levels in the local economy.

3.3 THE ECONOMIC IMPACTS OF EMPLOYMENT CHANGES OUTSIDE THE NUCLEAR INDUSTRY

3.3.1 VSEL Shipyard, Barrow-in-Furness

Background

The VSEL (now BAe Systems) shipyard in Barrow-in-Furness was at its peak of activity during the Trident nuclear programme in the late 1980s and early 1990s. Since then, the economic activity has decreased dramatically but Barrow, a borough of 70,000 people, is still partially dependent upon the company.

The area is of interest for three reasons. Firstly, VSEL like BNFL is by far the largest employer in the local economy. Barrow is perhaps dominated to a higher degree by a single employer than any other borough of similar size in Britain (Beatty and Fothergill, 2000). Secondly, infrastructure and characteristics in the local economy resemble those of the Whitehaven TTWA (where BNFL is situated). Thirdly, some of skills required are somewhat similar in the two industries, and cuts in the labour force could potentially render workers of similar skills redundant.

Economic and Social Impacts

In 1999, a survey was carried out (Beatty and Fothergill, 2000) to assess how employment and benefit claimants have been affected by the changes in the VSEL labour force. It involved interviews with 329 men aged 25-64 who were either long-term unemployed or "economically inactive". The following summarises key findings.

- *Employment - claimant count effects*. In 1990, Barrow's shipyard employed 14,400 people and the redundancy programme was originally intended to take this number down to between 7,000 and 9,000. However, a decision was taken in 1992 to further reduce the level to 5,000 by 1995. As a consequence, the Barrow TTWA lost one third of its 1989 workforce due to shipyard redundancies (Klosinski, 2000). Currently, with some short-term contractors the total labour force is 5,400, thus rendering the direct job losses 9,000. Some services such as security (Reliance Security Services), finishing (Denholm) and computer services (Computer Science Corporation) have been out-sourced, making the numbers directly dependent on the shipyard a little higher. Despite the reduction in the workforce, Barrow had an unemployment rate above 6 percent (early 2000), a high figure relative the UK average (4 percent) but low considering the scale of employment loss.

- *Hidden Unemployment.* One reason for these seemingly paradoxical data is hidden unemployment. The term is defined as unemployed non-claimants, participants on government schemes, excess early retired, and excess long-term sick. By adding these groups to benefits claimants, a measure of real unemployment is derived. It counts "all those who might reasonably be expected to have been in work in a fully-employed economy" (Beatty and Fothergill (2000). The claimant count is heavily dependent on Department of Social Security rules. Thus, as rules governing eligibility for unemployment benefit have tightened, the numbers recorded as unemployed have fallen. The real unemployment figures may be nearly treble the official data (see *Table 3.4*).

Table 3.4 Alternative Measures of Unemployment in Barrow-in-Furness

Gender	Claimant Count (percent)	Real Unemployment (percent)
Men	11.9	25.6
Women	3.7	20.4
Total	8.6	23.5

Source: Beatty and Fothergill (2000)

In terms of incapacity benefit claimants, Barrow ranks as fourteenth out of 353 English districts - at 15 percent of all 16-64 year old men. This represents 3,500 men out of a total male working age population in the town of just 23,500. Clearly, very many of these individuals would be unable to work due to illness or incapacity regardless of employment

opportunities. However, Beatty and Fothergill assume a range of hidden unemployment of between 2,100 and 2,700. Not all of these workers are fully able bodied and capable of manual work.

- *Migration*. Given that the majority of the incapacity benefit recipients are older, one would expect unemployment (hidden or otherwise) figures to rise rather than out-migration, as older workers have less incentive to move to gain new work and are often less able to re-skill. In addition, population levels normally only change gradually, so a rise in unemployment should be expected in any case (Beatty and Fothergill, 2000). This presumption is reinforced by the fact that the number of men of working age in Barrow claiming sickness-related benefits actually fell from 4,100 to 3,500 between 1996 and 1999. Over the same period, claimant unemployment among men in Barrow has fallen by less than the national average - by about a third in Barrow compared to nearly half across Britain as a whole. However, young people are more mobile. Indeed, the current pattern in West Cumbria is that this group leaves the area to access higher education and employment, and often does not return (SQW, 2000).

The experience of Barrow confirms the capacity of a local economy to adjust to losses of employment in a major employer. However, the social costs of this adjustment may be hidden.

3.3.2 Pfizer

Background

Pfizer is situated at Sandwich in East Kent. The area has suffered from a number of economic shocks in recent years, including a decline in employment at the Channel ports, the closure of the East Kent coalfield and the rapid reduction in employment at military installations in the area. Despite being in the South East of England and close to connections to continental Europe, the area is poorly served by highway and public transport links. For example, rail journeys from London to Sandwich take well over two hours, despite the distance being only 75 miles.

As a result, the East Kent economy displays many of the problems prevalent in remote rural parts of the UK in that its level of economic activity is low. The service sector accounts for as much as 75 percent employment in the area, with health, education and other public administration the largest component. The second largest category of employment is distribution and hotels, followed by transport and communications.

Economic and Social Impacts

The study identified the following economic impacts:

- *Employment.* Direct employment supported by the company supported 3,400 jobs in East Kent with an additional 250 spread around the UK. Indirectly, Pfizer supported another 1,250 and 625 opportunities in Kent

and East Kent respectively. Induced employment was estimated to amount to 285 and 325 in the respective economies and, expressed in jobs supported per Pfizer job, the figures were 0.7 in Kent and 0.5 in East Kent.

- *Expenditure Effects*. Pfizer's accounts indicated an expenditure of £534 million in 1997, of which £438 million was operational (ie flowed into the economy). Kent accounted for 18 percent (12 percent in East Kent) of all goods and services purchased by Pfizer and nearly a quarter of goods purchased in the UK. Capital expenditure amounted to £96 million, of which the majority was sourced in the UK.

- *Income Effects*. The total amount of economic activity created by Pfizer was estimated at £964 million in expenditure with a value added component of around £827 million. The contribution to the UK economy was a value added of £358 million. For every pound spent by the company, a total of £1.80 flowed into the economy through indirect and induced expenditure effects.

- *Wages.* Employees were well paid, receiving 70 percent higher wages than the average of the rest of Kent, although this partly reflects the highly qualified nature of the workforce.

- *Migration*. In the four-year period preceding 1998, 300-600 employees per year were recruited to the company, mainly from outside Kent. 40 percent of the employees at Pfizer had a degree or a higher degree. In effect the company draws skilled labour to the area as well as creating employment opportunities locally.

3.3.3 The Swan Hunter Shipyards

Background

Following the bankruptcy of the Swan Hunter shipyard in 1993 a gradual closure followed only to result in a re-opening in 1995. Tomaney et al (1995) carried out a study to assess the experiences of the nearly 3,000 workers made redundant or otherwise leaving the company in the two-year period. A questionnaire was sent out to 2,200 former employees, of which 1,645 replied.

Economic and Social Impacts

- *Migration*. Of those active in the labour market, one fifth had found employment outside the North East of England, thus implying that a sizeable proportion migrated as a result of the redundancy.

- *Duration of Unemployment.* Of the 1,645 respondents, 38.5 percent remained unemployed two years after the closure. Importantly, those made redundant at an earlier stage were slightly more likely to have found employment (33 percent versus 45 percent, see *Table 3.5*).

- *Education*. Of the skilled manual workers, 42 percent were unemployed at the time of the survey, nearly on par with the unskilled (45 percent). Managers and design/technical workers, and clerical workers were all experiencing significantly lower unemployment rates, 18 percent for the former two categories and 29 percent for the latter category.

- *Age structure*. Age proved the most crucial factor for re-employment, with 50 percent of those aged 50-54 still out of work in 1995. Interviews revealed that these workers had experienced discriminatory attitudes from employers. Although employment rates increased with the amount of time from the incident, the rate of unemployed workers over 50 years of age was much higher than that of younger workers.

- *Health.* Only a very small fraction had left the labour market through retirement. However, as many as 12 percent of the respondents reported being sick, two years after redundancy, with a strong bias towards workers between 60-64.

- *Skill transfer*. 60 percent of those employed at the time of the survey were using the skills acquired whilst in the shipyard. Many of those who were not felt bitter about the fact that their skills were not appreciated elsewhere.

Table 3.5 Employment Status by Date of Leaving Swan Hunter (Percent)

Year of leaving	Occupational Status					
	Not Stated	Unemployed	Retired	Sick	Education and Training	Employed or Self-employed
1994 or later	1.8	44.8	0.3	7.6	2.0	43.5
1993 or earlier	2.1	32.7	1.5	16.0	3.6	44.1

Source: Tomaney et al (1995)

3.3.4 The South Wales, Durham and Nottingham Coalfields

Background

The coalfield areas of South Wales, Nottinghamshire and Durham provide a diverse cross section of experiences in the coalfields. The examples from Wales and, in particular, County Durham are particularly given the more peripheral nature of these regional economies.

Economic and Social Impacts

- *Employment*. In Nottinghamshire, as many as 26,900 jobs (or 18.9 percent of total jobs in the coalfield area) were lost in direct employment (see *Table 3.6*). The region also experienced a natural increase in the workforce of 6.3 percent. South Wales and Durham also saw large slumps in the coal industry employment and job reductions were in the order of 23,800 (12.2 percent) and 15,700 (10.6 percent). Although there were natural increases

in the work forces in both regions, they were more moderate than that of Nottinghamshire.

Table 3.6 Labour Market Impacts - Changes 1981-1991

Effect	Coalfields		
	South Wales	Nottinghamshire	Durham
Employment in coal in 1981	27,800	41,900	22,900
Job *loss* in coal 1981 to 1991 (number)	23,800	26,900	15,700
Job loss in coal (percent) (1)	12.2	18.9	10.6
Natural increase in workforce (percent)	3.0	6.3	3.9
Net out-migration (percent)	5.9	5.3	4.3
Increase in net out-commuting (percent)	-3.4	3.4	-4.0
Reduction in economically active (percent)	8.6	6.2	8.3
Increase in non-coal jobs	4.2	6.5	4.9
People on government schemes (percent)	2.2	1.7	3.2
Increase in unemployment (2)	-2.2	2.3	-2.3

Source: CRESR (1996)
(1) As a percentage of economically active (ages 16-64) males in the coalfield area in 1981
(2) The authors note that the inclusion of hidden unemployment (or "discouraged workers") would virtually double the number of unemployed given by the claimant figures

- *Migration.* Migration flows showed great diversity between areas but all the large coalfields lost significant numbers of male workers through net out-migration. Durham experienced a loss of just over four percent through such labour flows whilst Nottinghamshire and South Wales experienced net reductions of between five and six percent.

- *Out-commuting*. Contrary to expectations, net out-commuting decreased in South Wales and Durham by between 3-4 percent, whereas Nottinghamshire saw an increase by over three percent.

- *Economic activity rates*. A reduction in economic activity amongst men of working age (18-64 years) strongly affected coalfield areas. South Wales experienced the greatest drop (8.6 percent), followed by Durham (8.3 percent) and Nottinghamshire (6.2 percent).

- *Post-closure job creation*. Most coalfields saw an increase in non-coal jobs, although to varying degrees. In Durham and South Wales, employment in sectors outside the coal industry increased by 4.9 percent and 4.2 percent respectively, both superseded by Nottinghamshire where as many as 6.5 percent new jobs were created outside the coal industry as compared with 1981.

- *Regional Change in Unemployment*. The Nottinghamshire coalfield experienced an increase in unemployment of 2.3 percent. The increase might have been reinforced by a lower net out-migration and reduction in economically active as compared with South Wales and Durham where the unemployment figures actually decreased by just over two percent (due to general improvements in the national unemployment figures).

The coalfield case studies show that male employment was unambiguously and negatively affected by the closures, with tens of thousands job losses in each coalfield area and significant slumps in economic activity rates. To a large extent, however, this was offset by alternative job creation and to some degree by out-migration and commuting, thus insulating unemployment from dramatic increases. It is important to note that the decrease in economic activity disguises some of the real unemployment increase which might be as much as double the size of the given numbers (CRESR, 1996). The loss of male jobs in pit villages was proportionally much higher than in coalfields in general (see *Table 3.7*).

Table 3.7 UK Labour Market Accounts - A Comparison between Coalfields and Pit Villages (1981-91)

Parameters	Coalfields (percent change)	Pit Villages (percent change)
Job loss in coal	12.8	25.0
+ Natural increase in workforce	5.0	4.6
- Net out-migration	4.8	8.3
- Increase in net out-commuting	0.4	4.8
- Reduction in economically active	6.8	7.3
- Increase in non-coal jobs	3.6	2.5
-Number on government schemes	2.2	2.5
= Increase in unemployment	0.04	1.7

Source: Beatty & Fothergill (1996)

3.3.5 Taff Merthyr Colliery - Worker Experiences Two Years After Closure

In 1994, two years after closure of the Taff Merthyr Colliery in South Wales, a survey of a hundred former employees was undertaken (Guy, 1994). The survey found:

- *Wages*. Whilst employed at Taff Merthyr, the workers had an average salary of £270 per week. Over four fifths of those now in paid employment have had to adjust to a lower wage, the new average for outside the coal industry being £153. Only two percent earned more at the time of the survey. However, 47.9 percent were actually in employment(1) two years after the closure whilst 44.9 percent were unemployed and 7.1 percent in training.

- *Employment*. The great majority of those men currently unemployed (70 percent) had been out of work continuously after leaving the pit, despite most workers looking for a wide variety of employment outside the coal industry.

(1) Including self-employment (2 percent).

- *Health*. As many as 55 percent of those respondents who were not working were claiming sickness benefit rather than unemployment benefit, indicating significant health problems and hidden unemployment (claimants of incapacity benefit are not counted as unemployed).

- *Skill match*. Only a hand-full of workers was working in the mining industry at the time of the survey. The vast majority of redundant workers in employment had found jobs in factories, which covers a wide range of differing employment, from temporary and unskilled to well paid and highly skilled. Others found employment in the service sector.

3.4 DISCUSSION

Introduction

Throughout *Section 3.3* the impact of sudden employment shocks on a range of economic and social indicators has been assessed. This section provides a summary of the more important effects(1).

The economic factors have been analysed over a ten year time span, with the employment loss being the central year in each case (ie data are presented for the five years preceding the incident and the five years following it. Given that the downsizing in Dounreay was spread out over several years and that most of the pit closures took place over an extended period, it proved difficult to isolate a particular incident. The Durham coalfields, where the relevant closures occurred over a number of years, illustrate this problem(2). Given that the relevant time spans cover different periods of time, any simultaneous national downward employment bias is automatically less important in the analysis. This point is further strengthened by the fact that the coalfields experienced an economic trend that was distinctly different from the national economic performance(3).

Employment

The employment figures varied greatly between the different areas over the ten-year period. Counties such as Nottinghamshire and the Highlands and Islands occasionally reached employment rates(4) of nearly 60 percent whereas Tyne and Wear, and Mid-Glamorgan experienced levels around 50 percent. Also the *changes* in employment were markedly different in the years preceding as well as following the incident. The coalfield areas of Mid-Glamorgan and Durham both saw increases in employment of between 1-3

(1) It should be noted that this final analysis has been confined to the UK cases as it has proved difficult to find comprehensive regional data for the US nuclear plant closure, and because the Swedish nuclear plant closure was pre-closure.
(2) In order to account for the sequence of closures and thus isolate the different shocks, macro indicators were measured in two periods: the first starting in 1986 and the second lagged by two years starting in 1988.
(3) ''Overall, male employment in the non-coal component of coalfield economies in England and Wales fared some 10 percentage points better than in the economy as a whole. In effect, this meant that by 1991 there were 65,000-70,000 more male jobs in the coalfields outside coal than if national trends had prevailed" (Beatty and Fothergill, 1996).
(4) As measured of the economically active population.

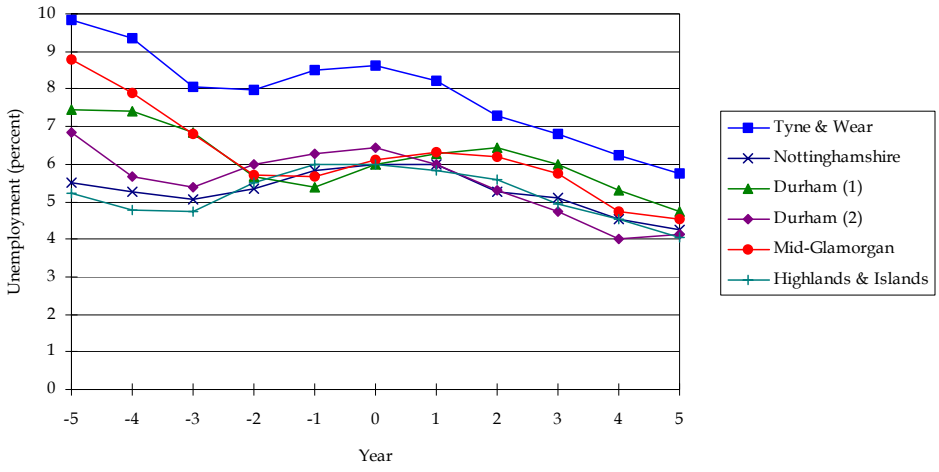
percent, whilst Tyne and Wear and Nottinghamshire experienced a decrease in employment even before the main closures. To some degree this can be explained by the fact that Nottinghamshire experienced a sequence of mine closures earlier, which put downward pressure on employment in the area.

There is an interesting pattern to be found across the case studies in that a significant drop occurred in employment in the year of employment loss. Notably, Durham and Mid-Glamorgan experienced decreases of as much as 5 percent in year zero as compared with the previous year, and Nottinghamshire and Tyne and Wear saw a decrease of 1 percent. Highlands and Islands experienced increasing employment, but this can more credibly be ascribed to the sequential nature of the Dounreay downsizing and to other factors in the region(1). Interestingly, there appears to be a trend of recovery in employment only two to three years after the closure or rundown.

There was a return to similar or higher employment rates in nearly all cases after only 2-3 years, as shown in *Figure 3.1*. This indicates that the different regional economies have a large capacity to accommodate structural changes within only a few years.

This view is further confirmed by the unemployment rate in which a downward trend can be seen in all regions over the period. There is, however, a clear-cut upward turn in unemployment around year zero which returns to the long-term trend about two years after the employment loss.

Figure 3.1 Unemployment Rate



Source: ERM analysis

Economic Activity

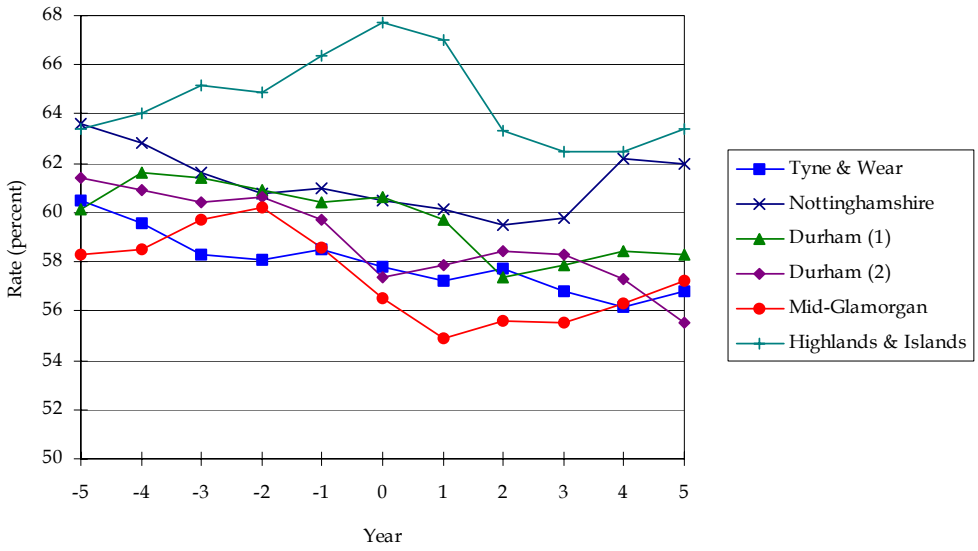
Concern regarding a reduction in the rate of economically active was raised in the earlier case studies. In particular, it was argued that the high level of

(1) eg there was a trend of out-migration from Thurso to other parts of Highlands and Islands (1998).

economic inactivity disguises unemployment. The rationale behind this argument is that workers become discouraged in areas where there is a great shortage of employment opportunities, thus transferring from the unemployment-related benefit system to that of sickness-related benefits. This phenomenon was demonstrated in particular by the closures in the coalfields and that of VSEL in Barrow (CRESR, 1996, and Beatty and Fothergill, 2000). The net effect is to transfer people out of the official unemployment count and thus generate hidden unemployment.

To account for this, the rate of economically inactive was considered. The results show that the derived unemployment trend is indeed somewhat misleading: it overstates the employment trend and points in a different direction to that of the economic activity rate for certain years, thus confirming the concern. Nevertheless, the economic activity rates mirror the trend established by the employment rate, namely that activity rates declined in the years immediately after the employment losses but typically started to recover later.

Figure 3.2 ***Economic Activity Rates***



Source: ERM analysis

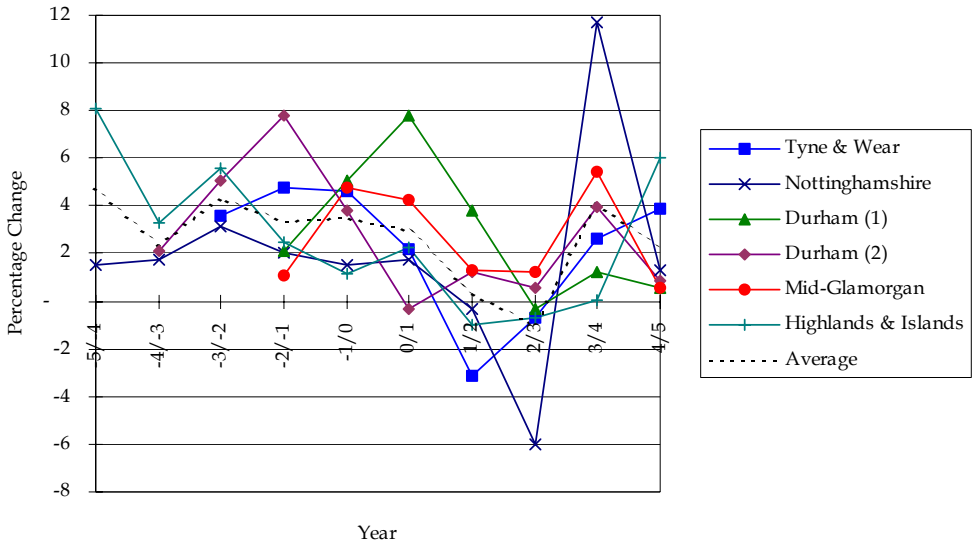
Notably, the unemployment and economic activity rates both tend towards a conversion with the employment rate a couple of years after the year of incidence, again indicating the an area's capacity to accommodate economic shocks.

Real Household Income

Taken as an average of all regions' real household income, the annual growth rate fluctuated between 2-5 percent over the period preceding the critical year (see *Figure 3.3*). Durham in particular experienced a sharp increase in the annual growth rate of real household income but similar to all other counties

there was a significant slump between the year before and the actual year of the incident, lasting until around two years after. Tyne and Wear, Nottinghamshire, and Highlands and Islands all had a period of between 2-3 years of negative growth rates but, along with all other counties, experienced an upswing thereafter.

Figure 3.3 ***Real Household Income Growth***



Source: ERM analysis

Multiplier Effects

Although larger firms (with 100 or more employees) are less common in rural than in urban areas (1.4 percent of firms vs. the national level of 2.2 percent), they account for a considerably larger share of rural employment (RDC, 1998). As shown in the case studies, larger rural firms are a very diverse group. For the most part larger rural firms are not highly dependent upon their local area for suppliers or customers (RDC, 1998), with the exception of those who have nurtured a local supplier or customer base. They do, however, have a significant, positive impact on the local employment base and typically employ their workforce from the adjacent communities.

3.5 CONCLUDING REMARKS

The linkages between firms and the local economy are influenced by a variety of economic and social factors. For example, plant closures are likely to coincide with a national economic recession. It has even been shown that linkages vary between foreign owned and indigenous firms (Turok (1993b) in Barrow and Hall, 1995) and it is therefore difficult to draw any definite conclusions. By examining recent UK evidence on the impact of large employment losses a number of observations can be made.

Case studies such as Pfizer, Savannah River and Dounreay make clear that large firms contribute greatly to the local economy in terms of expenditure and income as well as employment. Although they are not dependent on local suppliers, the latter are much affected by actions of the former (RDC, 1998). Investment and employment decisions by large companies have regional impacts on employment and income and indirectly affect population and migration, which, in turn, affect factors such as house prices and skill levels.

This view is further confirmed by the effects that changes within these organisations have had at county level. The coalfield examples showed that the impact of pit closures on the local male labour force was strongly negative (Beatty and Fothergill, 1996 and CRESR, 1996), with employment and economic activity decreasing significantly at a local and county level. At the county level, employment and economic activity as well as real household income dropped at the time of the incident, but increased or returned to previous levels only a couple of years after. However, evidence suggests that the actual sites where jobs have been lost have not experienced the same rate of regeneration as the region as a whole. For example, both Ollerton (the Guardian, 2000) and Taff Merthyr (Guy, 1994) have continued high levels of unemployment and lower activity rates.

Although it is intuitively obvious that large firms do have a great impact on their immediate surroundings, the case studies have shown that out-migration and commuting help local economies to adjust to employment shocks. In addition, the county level data have shown that, if defined more widely, local economies do indeed have the capacity to adjust in employment terms within only a few years. However the process of adjustment can be painful and incomplete, with large social costs, such higher unemployment and crime and poorer health, being typical.

4 THE NUCLEAR INDUSTRY, BLOCKS AND SCENARIOS

4.1 INTRODUCTION

This section describes the activities at Sellafield (and associated West Cumbrian sites such as Drigg), for both BNFL and other operators. Some of these activities are essential, but many are optional, either in terms of whether they should occur at all or at what level of activity they can be carried out. Within this framework, the Business Futures Working Group has developed *scenarios* for future operation of the Sellafield site operations.

The activities at Sellafield cannot be viewed in isolation. Sellafield is an integral part of the UK nuclear fuel cycle; additionally, there are interactions with the worldwide nuclear fuel cycle. *Section 4.2* gives a brief description of the nuclear fuel cycle. *Section 4.3* presents a summary of the UK Nuclear Industry and the Sellafield site's role within it, plus the interactions of the Sellafield Site with the worldwide Nuclear Industry.

In order to assess potential levels of activities on the Sellafield site, the activities of the site have been split into *blocks*. These *blocks* include both the nature of the activities on site and also the potential future scale of these activities. The blocks and their derivation are described in *Sections 4.4* and *4.5*. By combining a set of blocks that covers all the activities of the site, "walls" can be built representing complete Sellafield scenarios. Scenarios are described in *Section 4.5*. The scenarios developed have been designed to cover the full range of potential scale of activities of the Sellafield site. Finally, concluding remarks are made in *Section 4.7*.

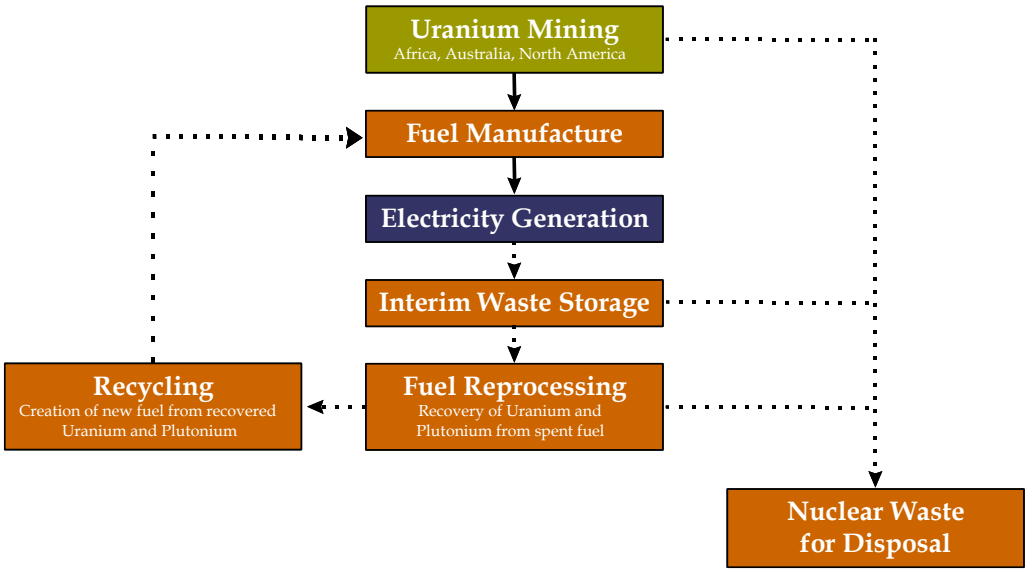
4.2 THE NUCLEAR FUEL CYCLE

Figure 4.1 gives a summary overview of the UK Nuclear Fuel Cycle and a brief description is provided below:

- Uranium ore is imported from Africa, Australia or North America to the UK.

- Fuels are then produced from this ore at the BNFL Springfields site, near Preston. Magnox reactors use natural uranium metal fuel. Other plant types (AGR and PWR) use enriched uranium in the form of ceramic uranium oxide. In the UK, UNRECO enriches uranium at its Capenhurst plant in Cheshire.

Figure 4.1 The Nuclear Fuel Cycle: A Summary



- The fuels produced are burnt in Nuclear Reactors, with the heat from nuclear fission being used to form steam, which then drives steam turbines to produce electricity. Over time, the build up of the fission products formed from the uranium reduces the efficiency of power production to the extent that new fuel must be used. The fuel removed from the reactor is termed "spent fuel". The spent fuel contains uranium, plutonium and waste products.

- Following generation, spent fuel can either be treated as a High Level Waste and stored, awaiting final disposal, or reprocessed. Reprocessing, which, in the UK, only takes place at the Sellafield site, involves the recovery of uranium and plutonium from spent fuel. Spent fuel is received at Sellafield from both the UK and overseas customers, of which Japan, Germany and Switzerland are the most important.

- The uranium and plutonium recovered during reprocessing can be used to form new fuels. In the UK, uranium oxide can either be returned to the BNFL Springfields site near Preston to form new AGR fuels or can be combined with plutonium oxide to form MOX (Mixed Oxide Fuel) on the Sellafield site.

- Nuclear waste is produced at all stages in the Nuclear Fuel Cycle. It is categorised according to its level of radioactivity: High (HLW), Intermediate (ILW) or Low (LLW). The management and disposal of nuclear waste depends predominantly on its radioactivity level but also on the chemical (eg acidic) and physical properties (eg liquid) of the waste stream.

In between each of these processes nuclear material may need to be transported. For example, uranium mining and enrichment and fuel assembly is typically undertaken at more than one location. Similarly, power stations and waste reprocessing typically take place on separate sites.

4.3 THE UK NUCLEAR INDUSTRY

4.3.1 Fuel Manufacture

As noted above, there is no mining of uranium ore in the UK. However, fuel manufacture in the UK is undertaken by BNFL, a company wholly owned by Government. All UK fuels for the Magnox and AGR reactors are produced at BNFL's Springfields site near Preston, which also produced the first loadings of fuel for the UK's only PWR, Sizewell B. In addition, at Sellafield the Sellafield MOX Plant (SMP) produce MOX (Mixed Oxide Fuel) with the pilot plant, the MOX Demonstration Facility MDF, providing technical support.

4.3.2 Electricity Generation

History and Types of Reactor

The UK has been generating electricity commercially using nuclear power since 1956. The UK's first nuclear reactors are based on Magnox technology. These use non-enriched natural uranium metal fuel elements within a Magnox (magnesium alloy) cladding. Magnox reactors have relatively low thermal efficiencies due to the limited temperatures at which this fuel can operate. Apart from the UK, only France, Japan and Italy built a very limited number of Magnox reactors.

The second generation of UK reactors are based on AGR (Advanced Gas Reactor) technology, using enriched uranium dioxide fuel pellets within stainless steel cladding. These reactors are thermally more efficient than the Magnox reactors, but were not adopted anywhere else in the world.

Rather than using gas for cooling the reactor core, LWRs (Light Water Reactors) use ordinary or "light" water as a coolant. Two variants of the water-cooling system were built across the world: Pressurised Water Reactors (PWR) and Boiling Water Reactors (BWR). In the UK, only Sizewell B (PWR) uses this technology, but they are the most common reactor type worldwide.

The Ownership of UK Nuclear Power Plants

The UK electricity supply industry was privatised in the 1980s. The original intention was that all nuclear plant operated by the State-owned CEGB and SSEB would also be privatised, but in the event only the AGR and PWR reactors were privatised, and the industry now consists of these reactors owned by British Energy in the private sector, with the Magnox stations transferred to BNFL. Liability for experimental reactors previously operated by the UKAEA at Dounreay and elsewhere remains with them.

*Table 4.1*to *Table 4.3* show the remaining operational nuclear plants. The combined capacity of 13 GWe represented 17.5 percent of the UK electricity supply industry's capacity in 2000. BNFL's Magnox plant represent 4.5 percent of the UK's capacity and British Energy's AGR and PWR plant 13 percent. Nuclear plant tends to run as base load plant and although it constitutes only 17.5 percent of capacity, it generates 29 percent of the UK's electricity.

BNFL's Magnox Plants

Closure dates for BNFL's Magnox fleets have been revised in recent years, and current ones are shown below.

Table 4.1 UK Magnox Plants (Owned by BNFL)

Name	Date of First Grid Connection	Closing Date(1)	Age at Cessation of Generation	Net Capacity (MWe)
Reactors Undergoing Decommissioning				
Berkeley	1962	1989	27	2 x 138 = 276
Transfynydd	1965	1993	28	2 x 195 = 390
Hunterston A	1964	1990	26	2 x 150 = 300
Reactors to be Decommissioned				
Calder Hall (Sellafield)	1956	2003	47	4 x 50 = 200
Bradwell	1962	2002	40	2 x 123 = 246
Chapelcross	1959	2005	46	4 x 50 = 200
Dungeness A	1965	2006	40	2 x 220 = 440
Hinkley Point A(2)	1965	2000	35	2 x 235 = 470
Oldbury A	1967	2008	41	2 x 217 = 434
Sizewell A	1966	2006	40	2 x 210 = 420
Wylfa	1971	2010	39	2 x 495 = 990
Summary	**1956-77**	**2002-21***	**35-50**	**3,400**

Source: BNFL Press Release, 23 May 2000 (see www.bnfl.com) and report of Co-ordination Group to the BNFL National Stakeholder Dialogue Main Group, November 2002

Notes: (1) Wylfa needs to undergo a periodic safety review in order to secure operation to these dates.

(2) Hinkley Point A will not be bought back into operation from its current shutdown for business reasons.

Table 4.2 UK AGR Plants (Owned by British Energy)

Name	Date of First Grid Connection	Net Capacity (MWe)
Dungeness B	1983	2 x 555 = 1,110
Hartlepool A	1983	2 x 605 = 1,210
Heysham 1	1983	2 x 575 = 1,150
Heysham 2	1988	2 x 625 = 1,250
Hinkley Point B	1976	2 x 610 = 1,220
Hunterston B	1976	2 x 595 = 1,190
Torness	1988	2 x 625 = 1,250
Summary	**1976-88**	**8,380**

Table 4.3 UK LWR Plants (Owned by British Energy)

Name	Grid Connection	Net Capacity (MWe)
Sizewell B PWR	1995	1,188
Summary	**1995**	**1,188**

4.3.3 Reprocessing

Two major choices arise from what to do with spent fuel:

- treat it as a High Level Waste and store the whole fuel assembly until the heat emissions have declined to levels where the waste can be packaged for final disposal; or

- reprocess the spent fuel, recovering uranium and plutonium and generating other wastes requiring storage and eventual disposal.

The UK has traditionally chosen the reprocessing route, whereas other countries (notably the US) favour treating spent fuel as a waste.

There are only three major reprocessing facilities in Western Europe as shown in *Table 4.4*.

Table 4.4 Western European Reprocessing Plants

Name	Country	Opened	Capacity (tonnes/year)
BNFL, Magnox, B205 (Sellafield)	UK	1964	1,200
BNFL, THORP (Sellafield)	UK	1994	1,200
Cogema, Cap la Hague	France	1990-1994	1,650
Sources: BNFL, Institute for Energy and Environmental Research, www.ieer.org			

The Sellafield plant reprocesses all of the UK's Magnox fuel. The THORP plant reprocesses fuel from the UK AGR plants and from customers overseas.

4.3.4 Recycling

Uranium

Uranium oxide from reprocessing can be used to make new fuel elements for AGR or LWR plants. In the UK, recovered uranium has been used only for AGR fuel at BNFL's Springfields plant near Preston.

MOX (Mixed Oxide Fuel)

MOX is formed from a mixture of uranium oxide and plutonium oxide (typically with plutonium at around five to seven percent). MOX can be used in any LWR, typically up to about 30 percent of the fuel loading. *Table 4.5* shows the Western European MOX plants – the commissioning of the Sellafield MOX Plant (SMP) increased the current Western European capacity

by some 75 percent. The UK government announced on 3 October 2001 its acceptance of plutonium commissioning and subsequent operation of the Sellafield MOX Plant. Current MOX production is dominated by French and Belgian plants. Until licensing of the SMP, UK capacity was limited to the MOX Demonstration Facility (MDF) at Sellafield. BNFL has announced that MDF will now operate as a support facility for SMP.

Some commentators contend that the future MOX market is highly uncertain. It depends to some extent on whether MOX is seen as a method for disposing of 'free' plutonium. MOX is unable to compete on cost with newly mined uranium at currently low uranium prices, but for some utilities the choice is a strategic one. The potential future for the current UK stock of plutonium has been examined within the BNFL National Stakeholder Dialogue, which published its report in 2003.

Table 4.5 Western European MOX Plants

Name	Country	Opened	Capacity (tonnes/year)
BNFL, MOX Demonstration Facility (MDF), Sellafield(1)	UK	1993	8
BNFL, Sellafield MOX Plant (SMP)(2)	UK	*	120
Belgonucleaire (Dessel)	Belgium	1973	35
CEA (Caderache)	France	1963	115
Total (including SMP)			**278**

Source: Institute for Energy and Environmental Research, www.ieer.org
Notes: (1) BNFL plans to run MDF as a support facility for SMP
(2) Not yet commissioned

4.3.5 Nuclear Waste

As noted above, nuclear waste is categorised into three types depending on its activity: High, Intermediate and Low. The following briefly describes each type and where it arises on the Sellafield site:

- High Level Waste (HLW) has the greatest concentration of radioactive materials and produces substantial quantities of heat. The vast majority of the UK's liquid HLW is stored on the Sellafield Site. This liquid HLW is vitrified (solidification in borosilicate glass) and is then encased in stainless steel. If un-reprocessed spent fuel and plutonium were declared to be waste, they would also be HLW. Long-term policy for the management of HLW is in the process of being determined following the 'Managing Radioactive Waste Safely' consultation in 2001, and the announcement of a new Committee on Radioactive Waste Management, scheduled to start work in 2003.

- ILW is less radioactive. It consists primarily of metals from the cladding of fuel rods, with smaller quantities of cement, graphite, organic materials and inorganic sludges. On the Sellafield site, ILW results from the removal of cladding materials during reprocessing, decommissioning work and from the treatments of effluents prior to discharge to the environment. ILW is typically encapsulated in stainless steel drums.

Long-term policy for the management of these wastes is in the process of being determined.

- LLW (Low Level Waste) is the least radioactive. Most of the LLW produced by the nuclear industry at present is metals and organic materials, which arise largely as lightly contaminated miscellaneous scrap. The metals are mostly in the form of redundant equipment; the organic materials are mostly discarded protective clothing, paper towels and plastic wrappings. When nuclear plants are decommissioned, there will be large quantities of LLW consisting of building materials and big items of plant and equipment. Most of the nuclear waste produced outside the nuclear industry is LLW. In the UK, LLW is disposed of at the national depository at Drigg (4.5 miles south of the Sellafield site). LLW is compacted and containerised prior to landfill. Currently, 50 percent of LLW disposed of to Drigg arises from the Sellafield site.

These wastes are currently managed by BNFL. However, the Government has announced plans to establish a Nuclear Decommissioning Agency (the NDA). The NDA will be charged with managing the historic liabilities associated with the UK's nuclear programme. The NDA will manage BNFL and other liabilities, and the intention is that BNFL will then focus on other (revenue generating) aspects of its current business, principally fuel production and reprocessing. It should be noted that the assumptions set out below in *Section 4* will be sensitive to the NDA's strategy, and the results of this socio-economic study should therefore be reviewed in the light of future changes.

4.4 BLOCKS OF ACTIVITY AT SELLAFIELD

4.4.1 Introduction

In order to facilitate a detailed economic analysis of the implications of business scenarios at Sellafield, activities at the site have been broken down into a number of blocks that can be modelled, either individually or collectively as parts of one of the five scenarios described below. This section therefore describes the blocks. First, however, we present a brief history of the Sellafield site.

4.4.2 Sellafield Site Operations

Overview

The Sellafield site is one of the most important and complex nuclear sites in the UK. It houses all the UK's reprocessing and MOX production facilities and also contained the UK's smallest operational commercial reactor plant (the Calder Hall Magnox plant), although this closed in spring 2003. It is difficult to understand the operations of the site without understanding its history.

Plutonium Production for Weapons Production

The current Sellafield site occupies an area 1½ miles by 1 mile (750 acres). Prior to 1946, Windscale was already acting as a Defence site. Nuclear operations began at Sellafield (then named Windscale) in 1946. Two atomic piles were built with the purpose of producing plutonium for nuclear weapons for the UK and its allies (principally the US). During nuclear fission of uranium in the piles, plutonium was produced which was recovered using chemical separation and sent to the Aldermaston weapons production site in Berkshire. The heat from the piles was not recovered and no power was generated. The piles were closed down in 1957 following a fire and they are now being decommissioned by a consortium that includes BNFL, Rolls Royce and Nukem, on behalf of the owner, the UKAEA.

Commercial Nuclear Development

Sellafield also became a key site in commercial nuclear development in the UK. The world's first commercial nuclear power station, Calder Hall (a Magnox plant), was connected to the electricity grid in 1956 and is still operational. Magnox plants were not highly efficient and a prototype of the next generation of UK nuclear plant (AGR – Advanced Gas Reactor) was built on the Sellafield site and operated between 1963 and 1981.

Reprocessing of Spent Nuclear Fuel

UK policy has favoured reprocessing spent nuclear fuel rather than storing it as a high level waste. Reprocessing involves chemical separation of spent nuclear fuel, whereby the spent fuel is dissolved in nitric acid and the uranium and plutonium are then separated from this solution.

The Sellafield site had built up experience of chemical separation when producing plutonium from the Windscale atomic piles. Reprocessing of spent fuels from the UK's Magnox reactors began in 1964.

The UK also wished to reprocess fuel from its subsequent generations of reactors. Foreign nuclear generating companies also expressed considerable interest in this route. Thus, in the early 1970's, when it was expected that prices for newly mined uranium would continue to increase, the THORP (Thermal Oxide Reprocessing Plant) was proposed and designed. The building of THORP was controversial, but after a public inquiry construction began in 1980. The project was a major engineering exercise, taking over 10 years and costing £2.8 billion.

After a further public consultation before THORP was commissioned, reprocessing began on spent fuel in March 1994. Contracts with UK and overseas generators had been signed to cover reprocessing of 7,000 tonnes of spent fuel over the 10 year period to 2004 and 60 percent of the required volume for the second decade of operation.

MOX (Mixed Oxide Fuel) Production

The decision not to develop fast breeder reactors in the UK in the foreseeable future has meant that a new use, storage or disposal options have to be found for the plutonium freed from spent fuel by reprocessing. LWRs were becoming the standard across the world in the 1980's and 1990's. Rather than using uranium fuel only, it is possible to operate LWRs using a combination of uranium fuel and MOX as discussed in *Section 4.3.4*. The share of MOX that can be used in the fuel and its percentage of plutonium vary by reactor type.

In response to this market opportunity, a MOX Demonstration Facility (MDF) was built at Sellafield and has been operational since 1993. The MDF has a capacity of only 8 tonnes of fuel per year, and its successful operation encouraged the construction of the much larger Sellafield MOX Plant (SMP) at a cost of £300 million, which has a capacity of 120 tonnes of fuel per year. The SMP was completed in 1998 and has been commissioned sing uranium only. It will not be fully operational until commissioning is completed with both uranium and plutonium and is currently dependent on a UK Government decision regarding the authorisation of the plant.

4.5 DERIVATION OF BLOCKS

4.5.1 Background

To enable modelling of the socio-economic impacts of different operating scenarios, Sellafield has been broken down into a number of logical blocks such a Magnox, THORP, etc. Projected workforce numbers (BNFL and Agency) for the 25 year period of the study have been produced for each block, together with contractor numbers based on capital spend associated with the block. The process of defining blocks has been led by BNFL, but with peer review from the socio-economic steering group and from "green experts" – representatives of environmental NGOs.

Further blocks reflecting alternative scenarios to the reference blocks have also been produced, for example Block T2 - THORP to Current Plan and T1 – THORP Stop Now. All blocks associated with the scenario being modelled are added together to produce the overall picture for that scenario.

Five scenarios are being modelled for this update of the 2001 study:

- SF1a MIN - Early end to Reprocessing.
- SF1a MAX - Early end to Reprocessing.
- SF2 - Current Reference Case
- SF2a MIN - Current Reference but with accelerated Retrievals and Decommissioning.
- SF2a MAX - Current Reference but with accelerated Retrievals and Decommissioning.

4.6 SCENARIOS FOR FUTURE ACTIVITIES AT SELLAFIELD

4.6.1 Introduction

Blocks cover both an activity and the potential level of this activity in the future. As stated earlier, combinations of blocks are put together to form scenarios. Such scenarios can be used either to bound the range of future potential site activities or to show sensitivities of scenarios to changes in one or a small number of blocks.

4.6.2 Timing of Blocks

Several of the blocks require new plant or processes to be built and commissioned. Such new build requires time. When a scenario includes such a block, it must be noted that the block cannot be implemented immediately.

4.6.3 Description of Blocks

The following blocks have been modelled in this 200£ report:

- ***M1 Magnox Stop Now.*** Under reprocessing scenario SF1a, B205 operates until 2005/06 to reprocess wet stored fuel currently in system. Pace of reprocessing dictated by the rate at which historic fuel can be retrieved within the Fuel Handling Plant. Current Plans are base on retrieving the historic fuel over five years. Following discussions with George Daly this scenario assumes it can be retrieved over three years, which could be challenging, but achievable.

- ***M2 Magnox to Plan.*** Magnox reprocessing reference case taking into account station current lifetimes (see *Table 4.1*).

- ***C2 Calder to Plan.*** Calder reference case. Closure end of March 2003 followed by reduction in numbers as announced by the company.

- ***T1 THORP Stop Now.*** Reprocessing schedule from JJF scenario SF1a, THORP ceases operations at end March 2003. Capital-spend retained to support maintenance of infrastructure.

- ***T2 THORP Current Business Plan.*** THORP reprocessing reference case from 2003 Business Plan.

- ***SN2 AGR Dry Storage at Sellafield.*** Construction of an AGR Dry Store at Sellafield with AGR fuel transferred from wet storage following commissioning. Timescale assumptions – construction period of four years with operations starting in 2010/11.

- ***SN4 Cask Storage of Low Spec MOX.*** Construction of a cask storage facility at Sellafield with any low specification MOX fuel from blocks SMP2 & Pu8transferred to casks for storage. Timescale assumptions – one year to build cask storage area with casks purchased as required.

Operational for receipt of casks from 2005/06. Costs based on British Energy Collaboration project for Westinghouse AP1000 Reactor. It has also been assumed this could be utilised to store the output from any new Ceramic Plant – Pu3.

- ***SN5 Magnox Dry Store.*** Construction of a Magnox Drying Facility & Dry Store at Sellafield for all Magnox fuel not reprocessed through B205. Timescale assumptions – five years construction with operations commencing in 2010/11, followed by progressive ramp up to full operations in 2017/18. Costs based on previous study.

- ***SMP1 Reference Case SMP.*** SMP operates until 2013 in line with current Business Plans.

- ***SMP2 SMP Early Closure.*** SMP operates until 2007/08 to work off the arisings of plutonium (Pu) from THORP Reprocessing up to its assumed early closure date of end March 2003. Magnox Pu arising assumed to be left in storage or treated/utilised in plant(s) other than SMP.

- ***Pu3 New Build Plant – Inert Matrix Fuel or Ceramic.*** Construction of a new plant to immobilise Pu in an Inert Matrix Fuel or Ceramic. Timescale assumption – five-year construction period with operations commencing in 2012/13. Costs based on previous study.

- ***Pu6 Interim Storage as PuO2 (Modified SMP). N***ot modelled as a) socio-economic impact is negligible and b) Pu storage requirements are already included in other blocks – M1 and M2.

- ***Pu8 MDF.*** Reference case MDF. Assumes that MDF operates as a development facility only to support SMP. Negligible socio-economic impact as workforce numbers are small. MDF manpower numbers included within other blocks for study update.

- ***CU1 Current Clean-up Plan.*** The information is based on Decommissioning Policy Review (DPR) 8 estimates with the cost translated into number of workers using a relationship derived from the Decommissioning Liabilities Models. Whist these models only apply to a few plants, albeit the more expensive, the same cost/manpower ratio has been assumed to apply to all plants. Development of the overall DPR programme has focussed on a number of key plants with the modelling extrapolated across similar plants. Notional estimates have been used for some minor plants. The total DPR programme extends beyond 100 years and this study only utilises information that falls within the 25-year study period. These numbers do not include site overheads. Project Management and Safety Case costs are not included explicitly in DPR. It is assumed as per DPR that BNFL workforce is 90 percent during initial decommissioning, 50 percent during dismantling, 10 percent during demolition and 100 percent during care and maintenance, and surveillance and maintenance.

- ***CU2 Accelerated Decommissioning.*** To facilitate accelerated decommissioning it has been assumed minimal decontamination will be undertaken and plants will be dismantled using remote technology where feasible. The approach also avoids hold points within the programme by removing the Surveillance and Maintenance, and Care and Maintenance periods where remote technology is utilised. Studies into this approach are currently ongoing and underpinning information for this block is not at a highly developed stage. Timing of decommissioning linked to early end of reprocessing.

- ***SP1 Current BNFL Magnox and THORP Plans.*** Support plants based on reference case for 2003 Business Plan.

- ***SP2 After end of Reprocessing – Early Closure.*** Waste plant operational end dates adjusted to reflect reduced waste volumes resulting from early end to Magnox and THORP reprocessing.

- ***Inf1 Current BNFL Magnox and THORP Plans.*** Support Services and R&T based on current business plans.

- ***Inf2 After End Reprocessing – Early Closure.*** Support Services and R&T have been adjusted pro-rata to the sum of the other blocks to reflect a reduced/increased requirement in line with the operational/decommissioning activities on the site associated with an early end to reprocessing.

- ***Contract & Support (Pro-rata).*** This block covering BNFL Instruments, Environmental Services, DRS and other contractors (excluding Capital /Support included in other blocks) is in line with current plans. A pro-rata adjustment is made to reflect the non-reference scenario.

- ***SP4 Accelerated Retrievals.*** Waste plant operational end dates adjusted to reflect timescales associated with accelerated retrievals and decommissioning.

- ***CU3 Accelerated Decommissioning.*** Similar to CU2 other than timing of decommissioning is linked to current business plans for reprocessing, etc.

- ***Inf4 Infrastructure (when accelerating Decommissioning).*** Support Services and R&T have been adjusted pro-rata to the sum of the other blocks to reflect a reduced/increased requirement in line with the operational/decommissioning activities on the site associated with accelerated retrievals and decommissioning.

4.6.4 Study Scenarios

The study scenarios are summarised in the following tables.

Table 4.6 Scenario SF1 - Stop Now and Prepare for Closure

SF1 Max – Minimum Immobilisation	
M1	Magnox early closure – 1.4.03 – reprocessing stops in 2005/6
SN5	Magnox drying and dry storage – construction begins 2007/8, operational 2012/13
C2	Calder shut
T1	Thorp early shutdown – 1.4.03
Pu6	Interim storage of Pu02 (not separately modelled)
SMP2	SMP operates to clear foreign Pu – closes 2007/8
Pu8	MDF – support facility only - included in other blocks
SN4	Interim cask storage – only for pre-delivery foreign MOX
CU2	Maximum cleanup – cost no object
SP2	Support plants after reprocessing shutdown
Inf2	Infrastructure activities – after reprocessing shutdown
SF1 Min – Maximum Immobilisation	
M1	Magnox early closure – 1.4.03 – reprocessing stops in 2005/6
SN5	Magnox drying and dry storage – construction begins 2007/8, operational 2012/13
C2	Calder shut
T1	Thorp early shutdown – 1.4.03
Pu6	Interim storage of Pu02 (not separately modelled)
SMP2	SMP operates to clear foreign Pu – closes 2007/8
Pu8	MDF – support facility only - included in other blocks
SN4	Interim cask storage – only for pre-delivery foreign MOX
CU2	Maximum cleanup – cost no object
SP2	Support plants after reprocessing shutdown
Inf2	Infrastructure activities – after reprocessing shutdown
Plus:	
SN2	Dry storage of AGR at Sellafield – construction begins 2008/9, operational 2012/13
SN3	Conditioning AGR – outside time horizon
Pu3	New build inert matrix fuel or ceramic for Pu treatment for Magnox Pu – construction begins 2009/10, operational 2014/15
SN4	Cask storage for product of Pu3

Table 4.7 SF2 – Current BNFL Business Plan

M2	Magnox reprocessing – closes 2012/13
C2	Calder shut
T2	Thorp reprocessing closes 2010/11
Pu6	Interim storage of Pu02 (not separately modelled)
SMP1	SMP operates to clear foreign Pu – complete 2012/13
Pu8	MDF – support facility only - included in other blocks
SN4	interim cask storage – only for pre-delivery foreign MOX
CU1	Cleanup to current BNFL programme
SP1	Support plants for current BNFL programme
Inf1	Infrastructure activities for current BNFL programme

Table 4.8 Scenario SF2a - Current BNFL Business Plan with Accelerated Retrievals and Decommissioning

SF2 Min – No Pu Immobilisation

SF2 Min – No Pu Immobilisation	
M2	Magnox reprocessing – closes 2012/13
C2	Calder shut
T2	Thorp reprocessing closes 2010/11
Pu6	Interim storage of Pu02 (not separately modelled)
SMP1	SMP operates to clear foreign Pu – complete 2012/13
Pu8	MDF – support facility only - included in other blocks
SN4	interim cask storage – only for pre-delivery foreign MOX
CU1	Cleanup to current BNFL programme
SP1	Support plants for current BNFL programme
Inf1	Infrastructure activities for current BNFL programme
SF2 Max – Maximum Pu Immobilisation	
M2	Magnox reprocessing – closes 2012/13
C2	Calder shut
T2	Thorp reprocessing closes 2010/11
Pu6	Interim storage of Pu02 (not separately modelled)
SMP1	SMP operates to clear foreign Pu – complete 2012/13
Pu8	MDF – support facility only - included in other blocks
SN4	interim cask storage – only for pre-delivery foreign MOX
CU1	Cleanup to current BNFL programme
SP1	Support plants for current BNFL programme
Inf1	Infrastructure activities for current BNFL programme
Plus:	
SN2	Dry storage of AGR at Sellafield – construction from 2008/9, available 2012/13
SN3	Conditioning AGR – outside time horizon
Pu3	New build inert matrix fuel or ceramic for Pu treatment for Magnox Pu – construction 2009/10, operational 2014/15
SN4	Cask storage for product of Pu3

Table 4.9 Sellafield Site Scenarios for Study Update

Scenario	Magnox Reprocessing / Fuel Mgt	Calder Hall	THORP Reprocessing / AGR Fuel Mgt	Plutonium Management	MOX Production	Clean Up Decommissioning	Support Plants	Infrastructure	Contract and Support
SF1 MIN - Stop Now and prepare for closure	M1 SN5	C2	T1	Pu6*	SMP2, Pu8** & SN4***	CU2	SP2	Inf2	YES (Pro-rata)
SF1 MAX - Stop Now and prepare for closure	M1 SN5	C2	T1 SN2, SN3 long term	Pu6* Pu3**** (utilising SN4)***	SMP2, Pu8** & SN4***	CU2	SP2	Inf2	YES (Pro-rata)
SF2 - BNFL Current Business Plan	M2	C2	T2	Pu6*	SMP1 & Pu8**	CU1	SP1	Inf1	YES
SF2a MIN - Current Plan with accelerated Retrievals and Decommissioning	M2	C2	T2	Pu6*	SMP1 & Pu8**	CU3 (New block)	SP4 (New block)	Inf4 (New block)	YES (Pro-rata)
SF2a MAX – Current Plan with accelerated Retrievals and Decommissioning	M2	C2	T2 SN2 SN3 long term	Pu6* Pu3**** & SN4***	SMP1 & Pu8**	CU3 (New block)	SP4 (New block)	Inf4 (New block)	YES (Pro-rata)
Notes:	Pu6*	- Workforce / Costs included within M1 or M2							
	Pu8**	- Workforce / Costs included within SMP1 or SMP2							
	SN4***	- Relates to SMP2 & Pu8 *(in lieu of Pu1 & Pu8 in original study)*. Also utilised for Pu							
	Pu3****	- Applicable to Pu generated from Magnox Reprocessing							

4.7 CONCLUDING REMARKS

A brief overview of the history and configuration of Sellafield provides the context for the blocks and scenarios for future Sellafield site operations developed by the Socio-economic Study Group. The main points are that:

- The nuclear industry is characterised by the wide range of choices that can be made in its design and operation. These include whether to generate electricity using nuclear power, what type of plant is used, whether to reprocess or store spent fuel from reactors, what to do with separated plutonium, and how to manage and dispose of nuclear waste.

- The nuclear industry is extremely complex and the Sellafield site is no exception. Feedback and constraints between the various plants and processes mean that detailed scenarios of future operations can only be produced by experts with an in-depth knowledge of the Sellafield site. Clearly this knowledge is most prevalent within BNFL and, to a lesser extent, organisations (including NGOs) that have had a professional interest in the development and operation of the site. BNFL and other members of the steering group could therefore seek to influence the design of the scenarios to meet their own needs. ERM has seen no evidence of such bias and would like to commend and thank BNFL and other members of the socio-economic study sub-group for their attitude and assistance throughout the process.

- The scenarios developed for this study should be interpreted as "bounding scenarios" for the likely range of BNFL activities in West Cumbria. They can be summarised as:

    - SF1 (Minimum and Maximum) – "Stop Now and Prepare for Closure." This scenario represents an early end to reprocessing, with variants relating to the level of Pu immobilisation.
    - SF2 – "Current Business Plan." This scenario represents Sellafield operations as currently planned for in the currently approved business plan.
    - SF2a (Minimum and Maximum) – "Current Plan with Accelerated Retrievals and Decommissioning." This scenario represents the Current Business Plan but with waste retrieval and decommissioning activity brought forward as much as is possible, regardless of cost.

- Many other scenarios could be developed either additionally or as alternatives to the two mentioned above. The actual future of Sellafield site activity is extremely uncertain, and could be altered by political, commercial, regulatory, environmental and technical policies and pressures, both from within the UK and overseas. The policies adopted by the proposed NDA are particularly relevant in this regard.

5 SURVEY RESULTS

5.1 INTRODUCTION

This section of the report presents the results of surveys targeted at three main groups namely: employees; suppliers to BNFL; and local firms, with the aim of identifying the current level of dependence on BNFL in the local economy. These surveys were undertaking during 2000 and 2001 as a part of research undertaken for the original study. They have not been repeated for this update report because it is not considered that results would change in a material way (ie would not ultimately effect the multiplier estimates produced through the econometric modelling reported in *Section 6*).

5.2 EMPLOYEE SURVEY

5.2.1 Introduction

The aim of the employee survey was to provide information in order to assess the impact of each of the scenarios on direct employment at BNFL and, consequently, expenditure in West Cumbria.

The questionnaire was designed to:

- identify the socio-economic characteristics and skills of the workforce;
- assess the dependency of local employment on BNFL; and
- identify the level and type of expenditure (by BNFL employees) in West Cumbria.

5.2.2 Sample Size

There are approximately 9,300 direct employees and agency staff at BNFL. In addition, there are approximately 2,800 contractors, the majority of whom are construction contractors and the balance work for companies providing site services such as cleaning and catering.

In 2000 a list of all BNFL employees was used to select a representative sample of 1,000 BNFL employees including a proportion of agency (50) and contractor staff (150). The sample was structured between operations according to the relative magnitude of change within each operation under the scenarios. The sample sizes were therefore: support services (150); THORP (200); MOX (80); Calder Hall (80); reactors (80); waste retrieval and decommissioning (50); waste management services (80); and Magnox reprocessing (80). The sample was also stratified by qualification and occupation (Band 2 - 5) to allow analysis of the impact of each of the scenarios on the skills and employment profile at the plant. A high response rate of 65 percent meant that a total of 650 questionnaires were returned.

5.2.3 Approach to Surveys

A pilot survey of between 5-10 questionnaires was completed by randomly chosen employees at BNFL, to ensure that questions were clear to participants and meaningful in terms of the information required.

The distribution of the employee questionnaires was undertaken by BNFL with returns being sent to Trade Union officials. The covering letter emphasised the independence and confidential status of the survey. Surveys were posted to employees' home addresses and hence completed without the aid of an interviewer. In the analysis, the responses of employees have been weighted by grade to ensure that surveys are representative.

5.2.4 Survey Findings

Socio-characteristics and Skills of the Workforce

The first section of the employee questionnaire aimed to find out the basic socio-economic characteristics of the workforce. Based on the (weighted) average employee, the results suggest that the workforce at BNFL is relatively long-serving:

- the mean average age of employees at BNFL Sellafield is 42 years old; and
- the mean length of service with BNFL Sellafield is 14 years.

Dependency of Local Employment on BNFL

The employee questionnaire was designed to reveal how dependent West Cumbria is on BNFL. A series of questions were put to employees regarding motivation to move to, and stay resident in West Cumbria. The survey results show:

- nearly half of all respondents (45 percent), stated the main reason for choosing to live in West Cumbria was to work for BNFL Sellafield; and

- nearly a fifth of all respondents (19 percent), stated that BNFL was the reason for choosing to move to the area.

The survey also found that:

- 19 percent of BNFL employees have spouses/partners who also work at BNFL Sellafield;

- 10 percent lived in a household where more than one member was employed at the site; and

- just over a quarter (26 percent) stated that they had other relatives (outside their own household and not already accounted for) working at BNFL Sellafield.

Level and Type of Expenditure of by BNFL Employees in West Cumbria

The final section of the questionnaire asked employees what proportion of their annual disposable income they spent on various goods and services as given in *Table 5.1*. The results show that the highest proportion of annual disposable income in terms of the categories given, is "housing", followed by "other" and "groceries".

Table 5.1 Spend on Goods and Services

Goods and Services	All Respondents
Housing	24
Groceries	17
Cigarettes	1
Restaurants, pubs and clubs	9
Vehicle running costs	13
Travel	2
Holidays in Cumbria	2
Holidays outside Cumbria	10
Other	22
Total	**100**

Source: ERM survey

These results are similar to results obtained nationally under the household expenditure survey, except for more being spent on holidays, restaurants, pubs and clubs and other leisure pursuits.

5.3 SUPPLIER SURVEY

5.3.1 Introduction

The Supplier Survey was sent to a sample of businesses that supply BNFL with capital equipment and on-going supplies. The same form was sent to both capital and recurrent expenditure suppliers. This is because the ways in which the local economy is impacted are essentially the same, although the breakdown between employment costs and costs of capital items will differ. The aim of the survey was to identify the degree to which local suppliers are dependent on the continued activity of BNFL for their business. The results of the survey were used to estimate the likely impact on BNFL's suppliers of the implementation of any of the scenarios (and their component blocks). Such impacts could lead to the expansion or contraction of suppliers' businesses with subsequent knock-on effects on the local economy, especially where jobs are created or no longer required.

5.3.2 Population and Sample Size

The total population of suppliers to BNFL is around 16,000. This includes one-off suppliers of capital equipment as well as those on which BNFL relies for the continuing operation of its business. In the latter case these suppliers include the providers of services as well as goods.

A sample of 88 questionnaires was sent to individual suppliers of BNFL. The list was provided direct from BNFL and included all the largest suppliers to BNFL as well as a sample of smaller suppliers, with some 80 percent of questionnaires being directed at large suppliers and 20 percent being directed at smaller companies. The businesses targeted were representative of the Standard Industrial Classifications of relevance to the study including, for example, machinery and equipment, engineering, construction, chemicals, transport services etc.

To ensure that the emphasis is placed on the impact on the local economy of BNFL's operations, all of the suppliers targeted were based in West Cumbria, although some questionnaires were sent to firms that had a head office outside of the study area. In these cases respondents were invited to answer with respect only to their operations in the study area.

5.3.3 Approach

The survey forms were sent out in the middle of November and follow-up telephone calls were made to all of those who had not replied by the middle of December 2000. BNFL staff made subsequent follow-up telephone calls directly to suppliers to encourage them to complete the questionnaires. By the end of January 2001, 37 usable, completed questionnaires had been received and the responses from these were reviewed, coded and input into a spreadsheet for subsequent modelling. All respondents who sent back a completed questionnaire were contacted in order to acknowledge receipt of the competed survey form and to thank the supplier for their participation.

5.3.4 Survey Findings

About the Business

The first section of the questionnaire was used to confirm basic information about the suppliers to BNFL and gain a clearer picture of business operations.

Site Location

- 15 suppliers (40 percent) have just one other site within the UK, 11 (30 percent) have between 2 and 5 other sites and the remaining 11 (30 percent) have between 6 and 13,000; and

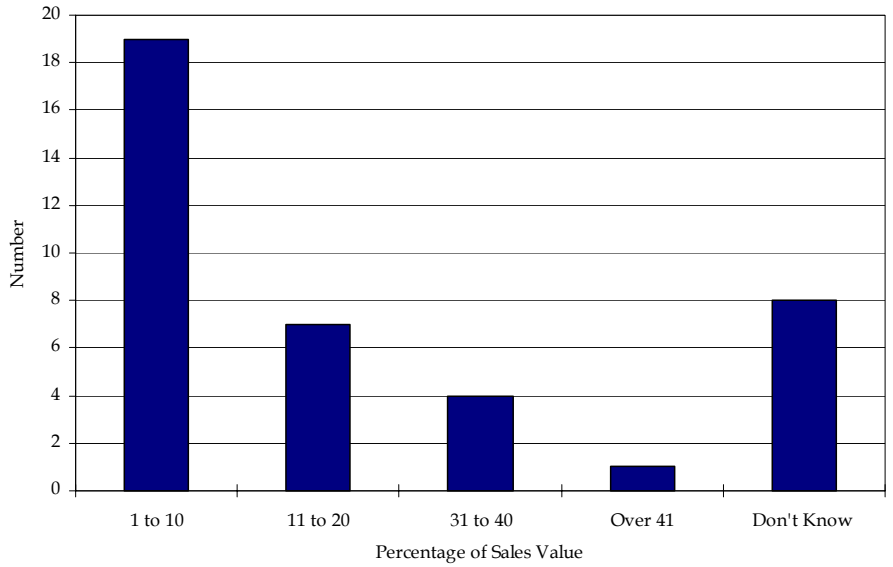
- 32 out of 37 suppliers used a site that is within the West Cumbria travel to work area (TTWA) to supply BNFL.

Main Customers

The 37 suppliers were asked to identify their 5 main customers. Out of 185 customers given, 39 are based within the study area (21 percent). The significance of these 39 customers to the supplier was measured in terms of

their contribution to the suppliers own sales value. This was given in percentage terms and is illustrated in *Figure 5.1*.

Figure 5.1 Customers Located Within West Cumbria as a Percentage of Sales



Source: ERM survey

Number of Employees

The number of people employed by the supplier at the sites within question totalled 10,620, with the majority of suppliers (62 percent) employing between 1 and 50 full-time equivalent employees (*Table 5.2*).

Table 5.2 Number of People Employed by the Company at that Site

Full-time Equivalents	Number of Respondents	Percent %
1 to 50	**23**	**62**
51 to 100	8	22
101 to 150	2	5
351 to 400	3	8
401+	1	3
Total	**37**	**100**

Source: ERM survey
Note: the one company employing more than 400 employed 8,420

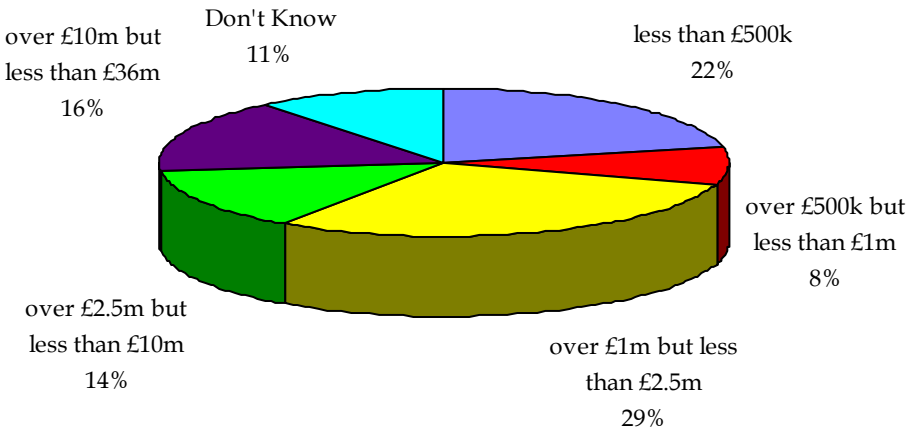
Annual Turnover

The respondents were asked to estimate their annual turnover.

- The sum of all answers is £181.6m, equalling an average of £5.5m annual turnover per supplier (based on 33 respondents, 4 did not answer).

- 29 percent of suppliers have an annual turnover of between £1m and £2.5m, followed by 22 percent with an annual turnover of less than £500k. A significant proportion (16 percent) also have an annual turnover of over £10m *(see Figure 5.2)*.

Figure 5.2 Annual Turnover of Company in West Cumbria



About the Services Provided to BNFL Sellafield

Suppliers tended to supply goods to more than one BNFL site with the highest number supplying SCS (*Table 5.3*). The type of goods supplied is given according to Standard Industrial Classification (SIC).

Reliance on BNFL

The questionnaire aimed to indicate how reliant companies are on BNFL through a series of questions relating to the size and value of business with the company:

- 59 percent of businesses stated that under 50 percent of their business was with BNFL of which 10 (27 percent of the total) stated under 10 percent.

- 41 percent stated that over 50 percent of their business was with BNFL, of which 5 (14 percent of the total) stated between 91 percent and 100 percent.

Table 5.3 BNFL Site Supplied

Site	Number of Respondents	Goods Supplied
All	13	Machinery and equipment not classified elsewhere Fabricated metal products, except machinery Supporting and auxiliary transport activities Other business activities Wholesale trade except motor vehicles Construction
Calder	4	Fabricated metal products, except machinery
Drigg	2	not stated
Magnox	3	Construction
SCS	15	Sewage and refuse disposal, sanitation Machinery and equipment not classified elsewhere Wholesale trade except motor vehicles Construction Other business activities Computer and related activities
T &O	2	not stated
THORP	3	Other business activities Machinery and equipment not classified elsewhere
WMS	5	Other non-metallic mineral products
WR&D	4	Machinery and equipment not classified elsewhere Other business activities
All except SCS	1	Medical, precision and optical instruments, clocks

Source: ERM survey

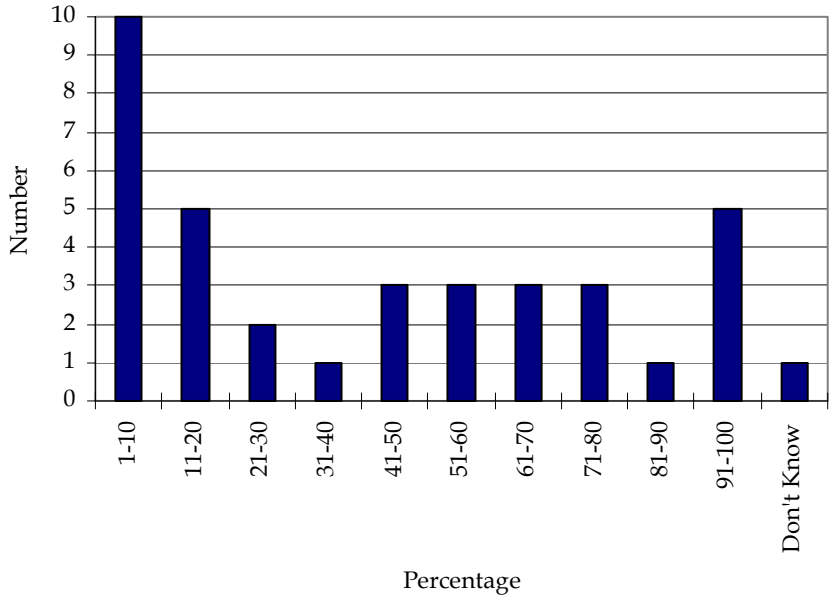
A further breakdown is given in *Figure 5.3*. An issue raised by respondents was partnership arrangements, (mentioned by four respondents), all of who were in agreement that partnership with local businesses offered advantages to both parties.

"We are about to sign a partnership agreement with BNFL, through which we hope to be able to provide better resource management and workload forecasting, leading to a better service"

Most respondents welcomed the opportunity to ensure local labour is used as much as possible and two respondents were critical of BNFL's perceived low use of local firms and labour.

"*BNFL's main contractors do not make sufficient use of local labour and sub-contractors. It is common for them to establish small local offices in Sellafield and bring their work force from elsewhere"*

Figure 5.3 Percentage of Business with BNFL



Source: ERM survey

Expenditure on Wages

The number of staff directly involved in the provision of services to BNFL for all companies is 844. Not all firms provided information regarding their expenditure on wages, but of those that did (employing 743 staff) company expenditure totalled £13.14m, giving an average wage of £17,690. More than one supplier mentioned the upward pressure BNFL exerts on local wages.

"BNFL has a significant upward impact on local wage rates, and because of the large number of staff they employ, its difficult for us to hire skilled labour and good quality school leavers as modern apprentices"

Suppliers to BNFL

Respondents were also asked which of their main customers also supply BNFL:

- 14 respondents out of 37 (38 percent) identified 15 customers who work directly for BNFL; and
- this constitutes 8 percent of the 185 main customers identified.

The types of goods supplied by the main suppliers to BNFL, and the types of goods supplied to the main customer by the respondent are given in *Table 5.4*.

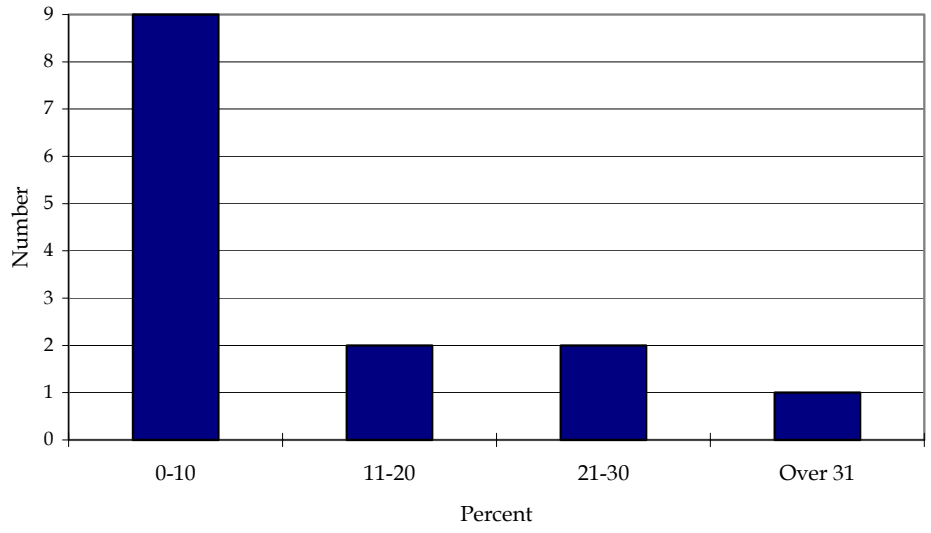
Table 5.4 ***Which of Your Customers Also Work Directly for BNFL Sellafield?***

Company	What do they supply ?	What do you supply them ?
1	Real estate activities	Wholesale trade except motor vehicles
2	Construction	Construction
3	Hotels and restaurants	Other business activities
4	Chemicals and chemical products	Land transport; transport via pipelines
5	Machinery and equipment not classified elsewhere	Fabricated metal products, except machinery
6	Machinery and equipment not classified elsewhere	Other business activities
7	Machinery and equipment not classified elsewhere	Fabricated metal products, except machinery
8	Construction	Construction
9	Other business activities	Wholesale trade except motor vehicles
10	Fabricated metal products, except machinery	Machinery and equipment not classified elsewhere
11	Construction	Construction
12	Hotels and restaurants	Wholesale trade except motor vehicles
13	no answer	Other business activities
14	no answer	Wholesale trade except motor vehicles
15	no answer	Wholesale trade except motor vehicles

Source: ERM survey

The proportion of turnover dependent on supplying these customers who themselves work for BNFL is given in *Figure 5.4.* Most respondents stated a fairly low figure, with 60 percent stating 10 percent and under.

Figure 5.4 ***Proportion of Turnover Dependent on Supplying Businesses who Themselves Work for BNFL (of the 15 of 37 Businesses that are Dependent)***



Source: ERM survey

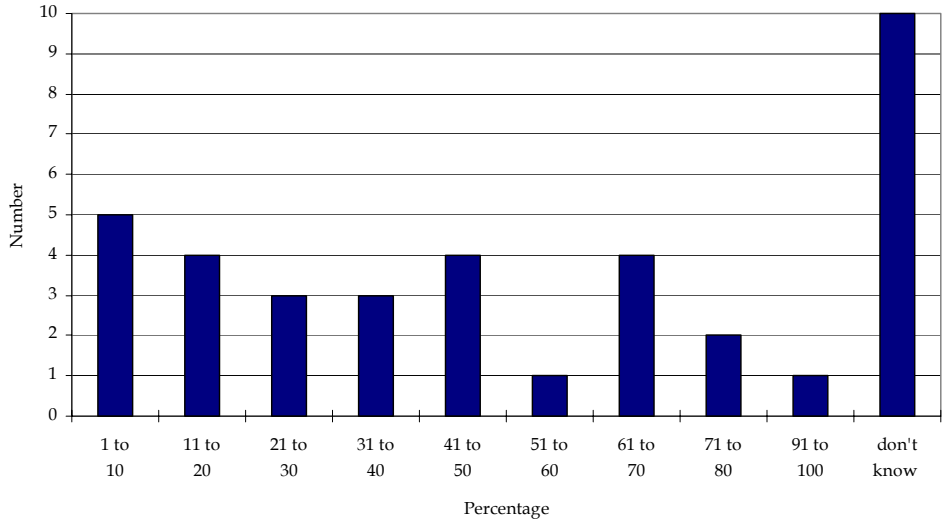
Suppliers to BNFL Suppliers

The final part of the questionnaire aimed to identify the types of characteristics and locations of the suppliers used by the respondents in order to fulfil their contracts with BNFL.

Each company was asked to give their 3 main suppliers and most did, a total of 74 names were given. Only 12 of these were thought to be located within the travel to work area (16 percent), although 41 addresses were missing (55 percent). The total expenditure with supplies for all respondents associated with fulfilling contracts with BNFL was £33.3 million.

In proportion to total expenditure on supplies (all contracts not just BNFL contracts), 51 percent of respondents (19) thought that this represented under 50 percent of their total expenditure on suppliers and 22 percent (8) respondents thought that this represented over 50 percent of their total expenditure on suppliers. The remaining 10 respondents did not know.

Figure 5.5 Cost of Fulfilling BNFL Contracts as a Proportion of Total Expenditure on Suppliers



Source: ERM survey

Effects of Changes in Future BNFL Activity

As one would expect, there is a direct correlation between BNFL operations and the operations of companies who supply BNFL. The results are summarised in *Table 5.5* and described in more detail below.

Table 5.5 Summary of Impacts of Changing Levels of Business with BNFL

Level of Change in Business with BNFL	Percentage of Companies Reporting Corresponding Change in Business
Increase in business with BNFL by:	
• 20 percent	65 percent
• 40 percent	86 percent
• 60 percent	92 percent
• 80 percent	97 percent
• 100 percent	97 percent
Decrease in business with BNFL by:	
• 20 percent	62 percent
• 40 percent	84 percent
• 60 percent	92 percent
• 80 percent	95 percent
• 100 percent	95 percent

Source: ERM survey

(a) Increase in BNFL operations

- 24 companies (65 percent) stated that an increase in business with BNFL by only 20 percent would have a positive impact on jobs of which 63 percent (15) stated that the impact would be between 1 and 10 FTEs. 21 percent (5) did not know and the remaining 16 percent(4) were split amongst higher categories.

- 32 firms (86 percent) stated that an increase in business with BNFL by 40 percent would have a positive impact on jobs of which 59 percent (19) stated that the impact would be between 1 and 10 FTEs, 25 percent (8) stated higher categories and 16 percent (5) did not know.

- 34 firms (92 percent) stated that an increase in business with BNFL by 60 percent would have a positive impact on jobs of which 59 percent (20) stated that the impact would be between 1 and 10 FTEs, 29 percent (10) stated higher categories (including 2 suppliers who stated the two highest numbers 69 and 300) and 12 percent (4) who did not know.

- 36 firms (97 percent) stated that an increase in business with BNFL by 80 percent would have a positive impact on jobs of which 33 percent (12) stated that the impact would be between 1 and 10 FTEs, 25 percent(9) stated high categories (of between 21 and 400), 22 percent(8) stated that the impact would be between 11 and 20 FTEs, and 19 percent (7) did not know.

- 36 firms (97 percent) stated that an increase in business with BNFL by 100 percent would have a positive impact on jobs of which 56 percent (20) stated high categories (with 500 at the top end of the range), 22 percent (8) stated between 1 and 10 FTEs, 14 percent(5) stated between 11 and 20 FTEs and 8 percent (3) did not know.

(b) Decrease in BNFL operations

- 23 firms stated that a decrease in business with BNFL by 20 percent would have a negative impact on jobs of which 65 percent (15) stated that the impact would lead to a decrease of between 1 and 10 FTEs, 19 percent (5) did no know and three suppliers stated higher losses (18, 23 and 100).

- 31 firms stated that a decrease in business with BNFL by 40 percent would have a negative impact on jobs of which 55 percent (17) stated that the impact would lead to a decrease of between 1 and 10 FTEs, 23 percent (6) stated between 11 and 20 job losses, 19 percent (5) did not know and three suppliers stated higher losses (36,46 and 200).

- 34 firms stated that a decrease in business with BNFL by 60 percent would have a negative impact on jobs of which 59 percent (20) stated that the impact would lead to a decrease of between 1 and 10 FTEs, 21 percent (7) stated high categories, 12 percent(4) stated between 11 and 20 and 12 percent (4) did not know.

- 35 firms stated that a decrease in business with BNFL by 80 percent would have a negative impact on jobs of which 43 percent (15) stated that the impact would lead to a decrease of between 1 and 10 FTEs, 40 percent stated higher categories and 17 percent (6) did not know.

- 35 firms stated that a decrease in business with BNFL by 100 percent would have a negative impact on jobs of which 49 percent (17) stated that the impact would lead to a decrease of between 1 and 10 FTEs, 40 percent stated high categories (the highest being 103,116 and 500) and 12 percent (4) did not know.

5.4 LOCAL FIRMS SURVEY

5.4.1 Introduction

This survey was intended to provide verification of the linkages in the economy, for example, the level of spending from employees of BNFL Sellafield and its suppliers, and other indirectly dependent companies.

The survey population is defined by the total number of businesses in the study area (Workington and Whitehaven Travel to Work Areas). In identifying the type of local firms which should be included, the consultants identified three main separate categories of business. These were businesses which operate as "third tier suppliers" (ie they supply goods or services to firms which supply BNFL directly), businesses which operate within the tourism sector, and businesses thought to be relatively independent of both tourism and BNFL related activities.

They final selection of businesses included:

- local hotels, restaurants and pubs;
- local shops and petrol stations;
- transport companies (eg taxis, mini bus hire);
- other retail outlets which rely upon spending induced by BNFL; and
- businesses providing products and services to companies known to directly supply BNFL.

A number of firms in the latter group (which may be classed as "suppliers of suppliers") were identified directly as a result of the local suppliers' survey, the questionnaire for which included a question asking respondents to state the names and addresses of two or three of their own largest suppliers.

In a small number of cases (five) it became apparent that BNFL was a minor customer of the respondent. Where this was the case the interview was continued and results were recorded in a separate category of firms, BNFL direct suppliers.

5.4.2 Approach to Surveys

In order to achieve a good response rate the survey was undertaken by means of face to face interviews. The interviews were undertaken in business premises in each of the study area's largest towns, namely Millom, Cleator Moor, Egremont, Whitehaven, Workington and Maryport, as well as in smaller settlements. The number of interviews undertaken in each town was weighted according to the towns' size, with most being undertaken in the larger towns of Workington, Whitehaven and Egremont. In order to get a representative selection of fifty firms, the following sample was developed:

- 30 percent of completed questionnaires from third tier suppliers;
- 30 percent of completed questionnaires from firms in the retail and tourism sector (this included supermarkets, bars and restaurants as well as more traditional guest houses, museums and tourist attractions);
- 40 percent of completed questionnaires from firms not in either of these categories.

The interviews were carried out over three days in December 2000. A total of 175 businesses were visited for the survey and 55 completed questionnaires were obtained, plus an additional five who turned out to be from direct suppliers to BNFL. After all of the interviews had been finished, the responses to the completed questionnaires were reviewed, coded and input into a spreadsheet for subsequent modelling. A quantitative study was made of all 55 completed questionnaires for the three main groups of businesses.

5.4.3 Business Responses

The main business activity of respondents is given according to the standard industrial classification (*Table 5.6).*

Table 5.6 Main Business Activity and Number of Employees

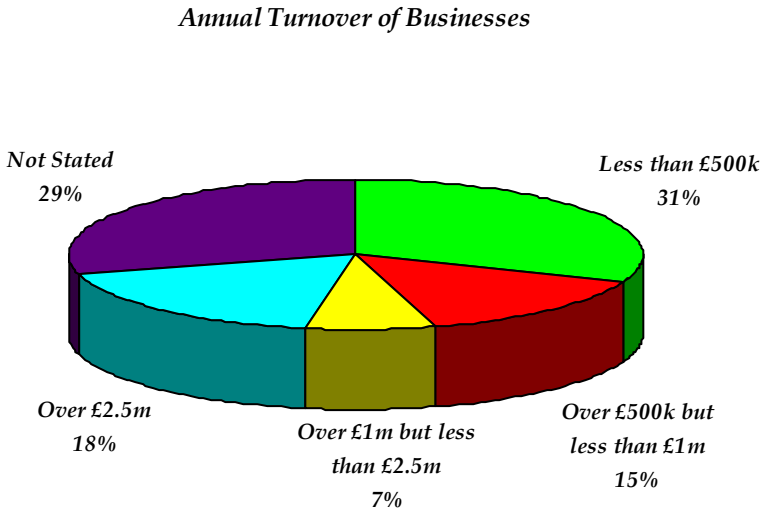
SIC	Activity	Number of Businesses	Number of FTE employees *(13 business did not know)*
18	Wearing apparel; dressing and dyeing of fur	1	180
20	Wood and wood based products, articles of straw	1	don't know
21	Pulp, paper and paper products, articles of straw	1	don't know
26	Other non-metallic mineral products	1	45
27	Basic Metals	1	57
28	Fabricated metal products except machinery	1	6
30	Machinery and equipment not classified elsewhere	1	7
31	Office Machinery and computers	1	7
36	Furniture, Manufacturing not classified elsewhere	1	45
40	Electricity, gas, steam and hot water supply	1	3
45	Construction	1	6
50	Sale, maintenance and repair of motor vehicles; sale of fuel	3	96
51	Wholesale trade except motor vehicles	6	7
52	**Retail trade, except of motor vehicles, repair**	**14**	**125**
55	Hotels and restaurants	7	58
63	Supporting and auxiliary transport activities	1	9
64	Post and telecommunications	1	don't know
65	Financial intermediation, except insurance and pension	2	101
71	Renting of machinery and equipment without operator	3	3
74	Other business activities	6	135.5
92	Recreational, cultural and sporting activities	1	1.5
	Total	55	892

The highest number of respondents within one sector was (14) in the "retail (except motor vehicles)" sector, whilst the highest number of jobs within one sector are generated by "wearing apparel; dressing and dying of fur", followed by "other businesses", "retail (except motor vehicles)" and "financial intermediation (except insurance and pension)". The number of full-time equivalent (FTE) employees per business is between 1 and 10 for just under half of all firms (25), with the remaining 30 dispersed amongst higher categories.

Annual Turnover

The sum of all respondents' annual turnover totalled £81m, equalling an average annual turnover of £2m (based on 39 respondents). In terms of the four categories shown in *Figure 5.6*, the category in which the highest number of businesses fall is less than £500k.

Figure 5.6 Annual Turnover of Businesses in the Local Business Survey



Source: ERM survey

Type of Customer

Key findings were as follows:

- for 37 businesses, their main customers were residents;
- for 17 businesses, their main customers were from outside Cumbria;
- for 14 businesses, their main customers were visitors and tourists;
- for 13 businesses, their main customers were other West Cumbria Businesses; and
- 39 knew where their customers are based, although not all could apportion turnover to customer type as shown in *Table 5.7*.

Impact of scenarios upon local firms

47 businesses were asked if they thought any customer spending in their business depended on BNFL's operations. An overwhelming majority of 72 percent (34) gave an affirmative answer yes. Only 2 businesses (4 percent) did not know and 11 (25 percent) thought customer spending was not dependent on BNFL's operations.

Table 5.7 Percentage of Turnover by Customer Type

Type of Customer	Percentage of Turnover	Number of Businesses
West Cumbria Residents	not stated	9
	1-10%	1
	11-50%	12
	51-70%	3
	71-80%	6
	81-90%	2
	91-100%	6
Visitors and Tourists to the area	not stated	22
	1-10%	7
	11-50%	7
	51-100%	3
West Cumbrian Businesses	not stated	23
	1-10%	7
	11-50%	1
	51-100%	8
Businesses from outside West Cumbria	not stated	23
	1-10%	4
	11-50%	7
	51-100%	5
Other	0%	36
	1-10%	1
	11-50%	2
	51-100%	0

Impact on Local Firms of Changes in Employment at BNFL

In order to gauge impacts, companies were asked about the effects of a hypothetical 20 percent increase and decrease in employment at BNFL. Responses are discussed below.

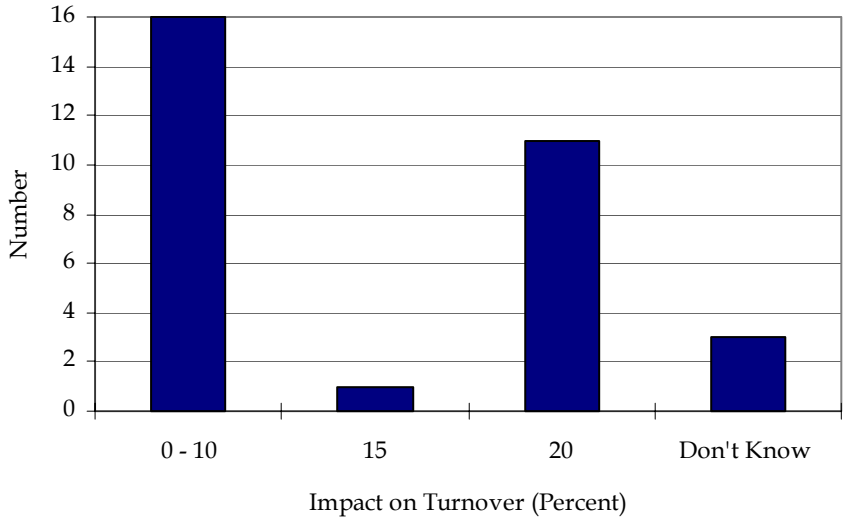
(a) 20 Percent Increase in Employment at BNFL

31 business (91 percent) out of the 34 respondents who thought that customer spending was in some way related to BNFL operations stated that an increase in employment at BNFL would have a positive impact on their own business turnover.

Impact on turnover was given in percentage terms and is illustrated in *Figure 5.7*. The first column includes all those who stated between 1 percent and 10 percent increase, whilst the remaining columns 15 percent and 20 percent were given as exact figures.

As illustrated in the figure, half of all businesses thought that their turnover would be increased by up to ten percent if employment at Sellafield increased. In terms of employment, 12 out of 34 businesses (35 percent) stated that increasing employment at BNFL would have a positive impact on their own capacity to generate new jobs.

Figure 5.7 Positive Impact on Local Firms of an Increase in Employment at BNFL



Source: ERM survey

Therefore, most respondents envisaged expansion in their business should employment increase at Sellafield. Respondents at the fringe of the study area (eg Millom or Maryport) were less likely to report this though. For those respondents who anticipated little change in their own circumstances, this was more likely to be where the respondents came from the fringe of the study area such as Millom or Maryport. Two respondents remarked that BNFL's expansion would cause them recruitment difficulties, due to BNFL's perceived dominance of the engineering industry in the area. This is a theme that also arose in the supplier survey. Sample responses given by local firms for this question included:

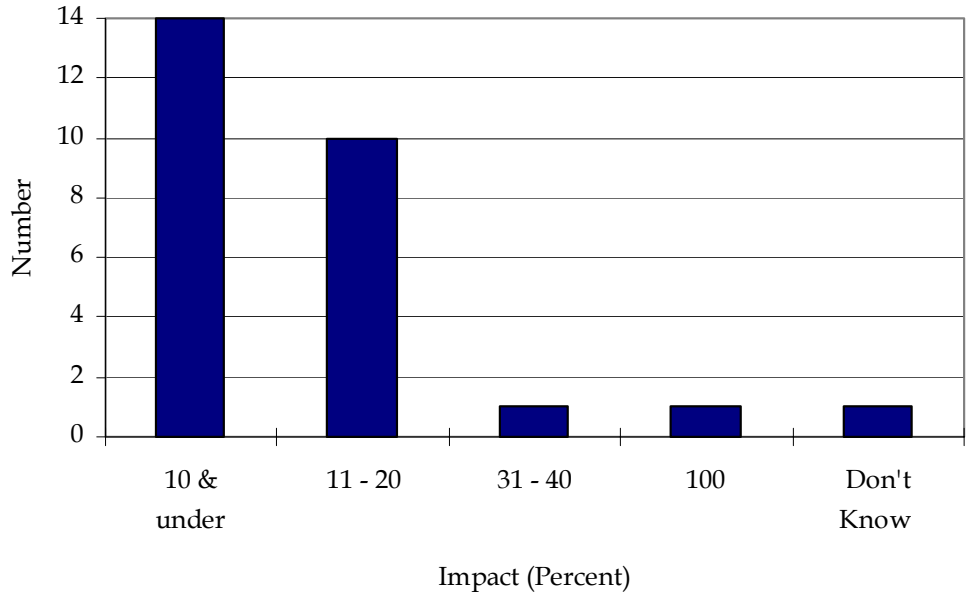
- *Buy more stock, leading to a higher turnover (vehicle sales and repair).*
- *Home deliveries would increase, people would feel more secure and incur larger shopping bills as a result (retail foods).*
- *We would expand through serving meals (pub).*
- *We would need to relocate to a bigger factory and office (computer engineering).*
- *More vehicles and staff would be needed (engineering supplier).*
- *Would not make any difference (materials handling equipment).*
- *No effect (retail foods, Millom).*
- *Wouldn't change greatly, as a competitor would probably move in (name withheld).*
- *No need to change, impact would be insignificant (tourist attraction, Maryport).*
- *Buy more vehicles, rent more space (industrial cleaner).*
- *Increase staffing (DIY supplier, Workington).*
- *Won't need to do much, in longer term may employ an extra person (carpet retailer, Millom).*
- *Wouldn't need to change much (travel agent).*
- *We may lose employees to BNFL and thus have problems recruiting high skilled labour (engineering firm, Cleator Moor).*

- *It would be harder to keep employees, both skilled and unskilled (plastics company, Whitehaven).*

(b) 20 Percent Decrease in Employment at BNFL

27 businesses (79 percent) out of the 34 respondents who thought that customer spending was in some way related to BNFL operations stated that a decrease in employment at BNFL would have a negative impact on their own business turnover.

Figure 5.8 Negative Impact on Local Firms of a Decrease in Employment at BNFL



Source: ERM Survey

If employment declined, 12 out of 34 businesses (35 percent) stated that it would have a negative impact on their own capacity to generate additional jobs.

Most respondents who had thought that an expansion would help their business thought that contraction would have a negative effect. Only one respondent, a bed and breakfast owner, expected a higher turnover due to increased income from benefit claimants.

Two engineering firms (both with turnovers in excess of £3m) thought there might be labour market *benefits* for them in the event of a decline in employment at BNFL. Sample responses from local firms in answer to this question are presented below:

- *We would have to diversify in some way - after looking extremely carefully at how to change (manufacturing and installation of double glazing).*
- *We would need to have a big restructure of staff - part-timers' hours would be cut and full-timers would need to work longer for no extra pay (retail foods).*

- *We would not be able to expand (pub).*
- *There would be less employment in the area, and knock-on effects on local businesses (and therefore our business) (name withheld).*
- *No effect (retail foods, Millom).*
- *Reduce costs, cut vehicles and staff (industrial cleaner).*
- *Decrease staffing (DIY supplier, Workington).*
- *Scare stories about BNFL in March, April and May 2000, plus the floods, led to us being down by £0.5 million (travel agent).*
- *Local engineering contractors would become less expensive, this would be good for us (engineering firm, Cleator Moor).*
- *We would need to condense deliveries, so instead of 3-4 deliveries a week there would be one or two larger ones. This saves on fuel and time costs (wholesale food supplier to fast food outlets).*
- *When Kangol laid off 100 staff, there was an initial drop in one of our customer's turnover [a take away food shop in Cleator Moor], though there was a recovery when people began to feel more secure again. This kind of thing would happen all over West Cumbria (wholesale supplier to fast food outlets).*
- *Given the degree of reliance on coach parties, the impact of changes in BNFL activity is unlikely to be enormous (hotel, Workington).*

Impact of BNFL (Including the Visitor Centre) on Tourism

The widely held view of respondents was that BNFL has a neutral or positive impact on local tourism. Only one respondent thought West Cumbrian tourism would be healthier without the plant, with many acknowledging the contribution from the visitors centre. Whilst acknowledging the perceived contribution that BNFL makes to tourism, two respondents from Maryport noted that they thought Maryport was too far away to benefit.

Sample responses included:

- *I do not think there would be a difference either way (retailer).*
- *Without BNFL, there would be a decline in tourism, everything else being equal (vehicle sales and repair).*
- *Tourism would decrease as the visitor centre is well advertised (pub).*
- *The visitor centre raises the profile of the coastal strip in general. What they are doing with advertising is good as it makes people more aware that there is more to Cumbria than the central lakes. But I doubt that people are attracted this far (this view was expressed by two separate tourist attractions in Maryport).*
- *It would be better without the plant. But the plant is necessary for the local economy (newsagent).*
- *BNFL has a positive impact. The visitor centre is an interesting day out, especially for people from North Cumbria (travel agent).*
- *Bad news about BNFL leads to a sustained reduction in tourism which takes about 2 years to recover from. Otherwise the effect is neutral (art gallery).*
- *Tourism would decrease slightly without BNFL (supermarket, Millom).*
- *It does not make any difference, at least to our clientele. In the nine years we've been running this hotel only one person has made a strong objection to the plant. Others are flexible and are willing to listen to arguments (hotel, Workington).*

Other Comments

These comments can be broadly grouped into three categories: comments about the impact of the plant in the local economy, comments about the environmental issues arising from the plant, and comments about BNFL's interaction with other local firms.

The impact of the plant on the local economy is shown by some of the anecdotal evidence which was given to the interviewers, including the following:

- *In my tiny village south of Carlisle there are three people who work for BNFL. In my family my father used to work for BNFL and my husband works for them. My cousin and her husband both work for BNFL. One other cousin works for BNFL. And two of my cousins' husbands work for BNFL (tourism officer).*
- *There was a significant rise in business when the Sellafield plant went on to monthly pay. The day after pay day (the 15th of each month) we have a regular rise in business of 20 percent as people go on big shops and home deliveries increase. It works the other way, too. Previous rumours about job losses have led to significant reductions in shopping bills as people economise (supermarket, Whitehaven).*
- *When the fuss over the forged quality assurance on the Japanese fuel rods hit the local press we had over 100 cancellations. These people cancelled for fear of not being able to pay for their holiday. Many of them would have lost their £200 deposits (travel agent, Whitehaven).*
- *We are very busy immediately after BNFL pay their staff on the 15th. The clients don't change but the orders do - an extra £200 per customer is not unusual. Also, it is very common for employees of BNFL (especially those on shifts) to send out for takeaway food for 20-30 people (wholesaler to fast food outlets).*
- *When there are bad news stories there are quiet weeks, people stop asking for quotes (it usually recovers). This is because people don't want to buy on tick with job insecurity (heating and plumbing installations).*
- *Whenever there is a rumour about lay-offs at BNFL, consumption decreases. People cut down on spending immediately (car spares).*

Several respondents alluded to the environmental aspects arising from the operation of a nuclear waste reprocessing plant. The comments made in this regard included these:

- *Nobody wants it but where would we be without it? It is necessary to compromise between the needs of the local economy and the needs of the environment (manufacturer and installer of double glazing).*
- *It [the plant] needs to be safe, but I am happy with it. What alternative is there? It is a very big employer (travel agent).*
- *Sellafield is good from an economic point of view, but not from an environmental one (petrol station).*
- *They should invest money into alternative fuel on the same site so that nuclear power can eventually be substituted for another energy source.*

As in the Supplier Survey, there was a concern from a small number of respondents about the impact of BNFL on the local labour market and that BNFL are not doing enough to work with and support local industry. The comments came from five businesses (just under 10 percent of the total):

- *BNFL should do more to support local and small businesses (vehicle sales and repair).*
- *They don't use sufficient local resources. They say they do, but they don't. My clients are complaining they can't get access (recruitment and accountancy).*
- *They used to use local business but now they don't. They've gone to single partnership agreements. We used to work for them, but not any more (name withheld).*
- *We used to supply BNFL, but now they've gone to a single supplier. Many of these are big multinationals from outside the area (name withheld, separate business from above).*
- *It is harder to recruit professional business type people as BNFL have bid up the wages of professionals and even administrative staff (tourist attraction, Maryport).*

5.5 CONCLUDING REMARKS

Surveys of employees, suppliers and other local businesses have been undertaken for this study in order to develop an understanding of the role of the site in the local economy.

In 2000 Sellafield employed approximately 11,500 BNFL, agency and contractor staff. The average age of staff was 42 and the average length of service was 14 years. Almost half of respondents stated that they live in West Cumbria because of Sellafield, and almost a fifth moved to the area to work at the site. A number of families are highly dependent upon the site, with almost a fifth of respondents having a partner or spouse who work on site, and more than a quarter having relatives outside their household working at Sellafield.

The high wages offered by the company lead to unusually high expenditures on leisure pursuits, with workers spending almost twice the proportion of their incomes than the national average on going out (to pubs, restaurants and other entertainment) and holidays as the national average.

Surveys of suppliers found that over 40 percent depended upon BNFL for half or more of their turnover in West Cumbria. The surveys also found that suppliers also supply BNFL indirectly, with almost 40 percent identifying other customers who supply BNFL. Not surprisingly, BNFL's suppliers indicated that their turnover and employment would be sensitive to changes in the scale of activity on site.

A similar picture was found with other local businesses who do not supply BNFL directly. ERM interviewed a variety of leisure, retail, transport and other businesses. The great majority reported that the expenditure by BNFL workers and suppliers was an important factor in their turnover, and

impacted upon their ability to generate new employment. This was reflected by poor levels of business when uncertainty emerged about the future of the plant. However, a small number of businesses also mentioned that the benefits and conditions offered by BNFL made it difficult to recruit and retain skilled staff locally.

6 ECONOMIC IMPACT ASSESSMENT

6.1 INTRODUCTION

This section reports the results of the economic modelling undertaken for this study. The results are presented for the five scenarios that have been developed by the Socio-economic Sub-group. The scenarios are built up from combinations of blocks, which cover both an activity and the potential activity in the future, and have been developed to bound the range of future potential site activities or to show sensitivities of scenarios to changes in one or a small number of blocks.

The five scenarios reported in this chapter, which comprise three core scenarios two of which have minimum and maximum variants, are:

- SF1 (Minimum and Maximum) – "Stop Now and Prepare for Closure." This scenario represents an early end to reprocessing, with variants relating to the level of Pu immobilisation.
- SF2 – "Current Business Plan." This scenario represents Sellafield operations as planned for in the currently approved business plan.
- SF2a (Minimum and Maximum) – "Current Plan with Accelerated Retrievals and Decommissioning." This scenario represents Current Business Plan but with waste retrieval and decommissioning activity brought forward as much as is possible, regardless of cost.

The scenarios are described in more detail in *Section 4* of this report. The focus for the analysis of each scenario is on numbers employed over the scenario forecast horizon (2003/2004 through to 2026/2027), the corresponding knock-on impact on the rest of the local economy and residential location of the site employees.

The current business plan provides the baseline against which the other scenarios are compared. It is important to note that this is not because it is believed that this scenario is more likely to happen than the other scenarios put forward, it is simply that any scenario needs to be measured against a common baseline in order to calculate impacts.

The activities of BNFL clearly have a major impact on the rest of the West Cumbria economy. The employment consists of:

- *Direct employment*. BNFL employees, Agency staff and contractors, expressed as full-time equivalents;

- *Indirect employment* (industry effect). Employment in BNFL's suppliers; and

- *Induced employment* (spending effect). Employment generated by expenditure in the local economy by direct and indirect employment.

The employment impacts of the five scenarios are presented in *Sections 6.2* to *6.5*. *Section 6.6* provides a comparative evaluation of the scenarios by examining the knock-on effects on the local economy of each scenario on unemployment, migration flows and population.

6.2 SF2 – BNFL CURRENT BUSINESS PLAN SCENARIO

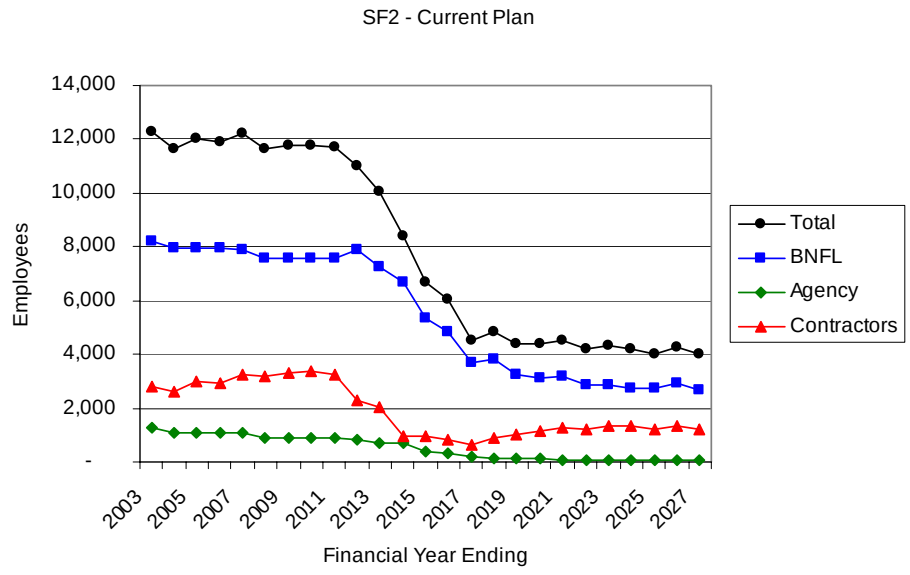
6.2.1 Site Employment

Measured in terms of full-time equivalent employees (FTEs), average site employment in the 2002/2003 financial year was around 12,100(1). This total is built up from three components: BNFL employees (52 per cent), Agency staff (10 per cent) and Contractors (38 per cent).

Males dominate the on-site workforce numbers. Of the total BNFL employees, 17 per cent are females, of who over forty per cent work in an operations support role (eg HR and facilities management). Results from the Contractors survey show that almost all capital related Contractors are male, while service oriented contractors (eg cleaners and caterers) are split 60 : 40 males : females.

Looking ahead using site employment projections supplied by BNFL, *Figure 6.1* shows projected site employment projections out to 2026/27, for Fuel BNFL, Agency staff and Contractors.

Figure 6.1 ***Projected Site Employment at BNFL Sellafield Under Current Business Plan Scenario (FTEs)***



The figure shows that site employment is expected to have peaked at a little over 12,000 and thereafter is expected to fall. The rate of decline is rapid in the

(1) Full-time equivalent employment counts a part-time worker as 0.4 of a full-time worker.

period to from 2011 to 2017 (primarily because THORP closes and major capital projects are completed).

6.2.2 *Indirect Employment*

In terms of on-site employment, BNFL is an important part of the local economy. Yet its influence does not stop there. If BNFL increases production it will need more employees (direct employment effect) and it will need to buy in more goods and services (some of which will be bought locally). The increases in employment will generate more income from employment some of which will be spent in the local economy. The increased purchases of goods and services from local industries will also generate extra income for local industries. Extra sales will generate additional employment and purchase effects so there will be second round then third round effects etc.

The sum of all these effects (including changes to levels of government spending) will give the total impact of site activity on the local economy. The total impact divided by the initial change is known as the *multiplier*.

The Office for National Statistics (ONS) provides UK-level information about the purchases patterns of industries and consumers, which are contained in Input-Output tables. Techniques are available for estimating what the input-output table should look like in West Cumbria. These techniques are supplemented using information supplied by BNFL on their purchasing patterns by block, and information from the employee survey which asked BNFL employees about the proportion of their incomes that are spent on various categories of goods and services.

For example, the employee survey showed that the proportion of income spent on discretionary spending in pubs, clubs and restaurants and on holidays was significantly higher than UK consumers as a whole.

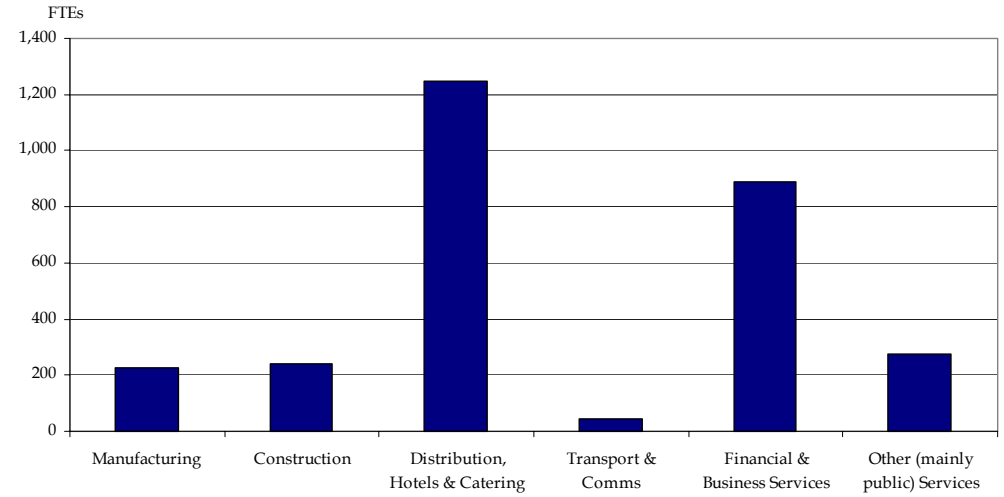
The mix of numbers of BNFL employees, Agency staff and Contractors has knock-on effects on the local economy in terms of their employment incomes and hence spending power, some of which may be spent locally.

It is not just the mix of BNFL employees, Agency staff and Contractors that is important. Earnings by block differ considerably, reflecting the skill levels required to carry out the tasks and duties associated with the job in a competent and efficient manner. Top of the earnings league are those employed in the Research and Technology, while average earnings for those employed in Support Services (eg human resources, safety) tend to be lower.

To forecast earnings by block, we have assumed that the grade profile within each block remains the same in the future and hence any changes in the level of employment by block are increased pro rata. The ratio of BNFL employees to Agency staff by block also remains fixed over the forecasts period. Overall site earnings are in excess of the average for the rest of the local economy, and we expect this to continue in the future.

Figure 6.2 shows the level of jobs in West Cumbria, by broad industry, that are wholly dependent on site activity. Based on the multiplier of 1.22 calculated by the 2001 Socio-economic Study, on-site employment of 12,100 supports around 2,630 local "indirect" jobs. This multiplier is high in the UK context. For example, HM Treasury Guidance suggests a typical multiplier of between 1.05 and 1.11 for local employment impacts. The high multiplier is less surprising once the high disposable income of workers and the isolated nature of West Cumbria are taken into account.

Figure 6.2 Jobs Dependent on Site Employment by Sector

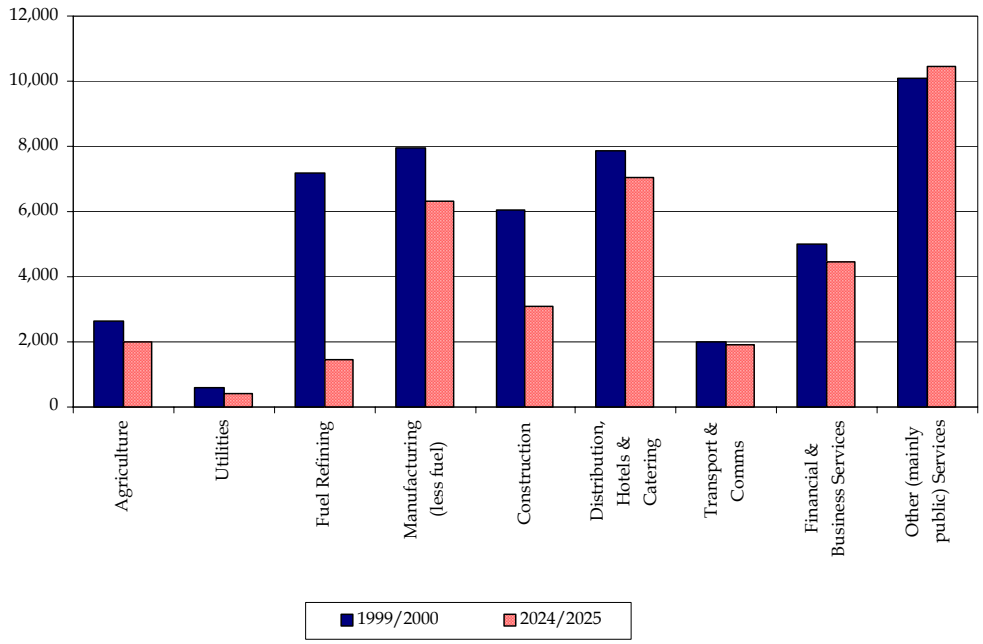


In terms of the types of job supported by site-activity, 1,200 jobs are in the Distribution, Hotels and Catering sector (14 per cent of total jobs in that sector). Around 900 jobs in the Financial and Business Service sector are wholly dependent on site activity. These include such jobs as car rental, accounting, and banking.

The forecasts produced for this study suggest that the changing orientation of the economy will continue over the foreseeable future, on the back of strong growth in private services such as hotels and catering and retailing, as well as in mainly public services such as health. For the former, this has much to do with changing patterns of income and spending as incomes rise and additional spending is more on leisure pursuits and other discretionary spending. For the latter, much of the growth is down to the general ageing of the population, and a corresponding response in increased government expenditure on hospitals and other support services for the elderly.

This point is reiterated in the *Figure 6.3* below, which shows changes to the sectoral composition of the West Cumbria economy over the next 25 years.

Figure 6.3 ***Changes in the Sectoral Composition of the West Cumbria Economy 1999 to 2025***



Despite the overall change being of manageable proportions, it must be recognised that the change will be rapid when it occurs and certain areas within West Cumbria will be hit disproportionately hard. It must also be recognised that some of the new employment growth will be in occupations that offer much lower salaries and less attractive conditions of employment than BNFL does at present (for example seasonal employment in the tourist industry). These issues are addressed below.

6.2.3 Location

The relative isolation of Sellafield within West Cumbria means that there is very little commuting to the site from outside Workington TTWA or Whitehaven TTWA. Ninety-six per cent of BNFL employees live in either of the two TTWAs, although the Whitehaven TTWA dominates, with over 70 per cent of BNFL employees living there.

For those working at Sellafield, the choice of where to live within West Cumbria is determined by the willingness and ability to pay for accommodation. BNFL employees on higher incomes (Grades 2, 3 and 4), have a higher propensity to live in highly desirable residential locations such as Cockermouth, while those towards the bottom end of the BNFL pay scale (Grade 5), have a higher tendency to live in more traditional industrial communities such as the towns of Whitehaven and Egremont. Residential locations of BNFL employees are illustrated below in *Table 6.1*.

Table 6.1 Residential Location of BNFL Employees by Grade

Location	Resident Employees	Percent of total	Grade 2/3	Grade 4	Grade 5
Whitehaven	2,484	27	9.7	29.0	61.3
Workington	1,257	14	7.4	29.3	63.3
Egremont	949	10	7.4	26.7	65.9
Cleator Moor	576	6	4.2	26.8	68.9
Cockermouth	495	5	34.5	35.8	29.7
Millom	484	5	8.0	26.7	65.3
Seascale	394	4	22.0	33.4	44.6
Frizington	313	3	34.5	35.8	29.7
Barrow-in-Furness	261	3	12.8	29.2	58.0
Maryport	229	2	5.2	22.2	72.5
St Bees	193	2	26.3	34.3	39.4
All Employees	9,272	100	11.9	29.5	58.6

Source: Analysis of BNFL payroll data, 2002-2003

Note: This table covers only directly employed BNFL staff, ie it excludes agency and contract staff. These workers are also overwhelmingly local, and hence residential location patterns will be very similar

The significance of all on-site employment (estimated using the percentage figures for BNFL employees) compared with total employment for the top five residential locations is presented in *Table 6.2*.

Table 6.2 Sellafield On-site Employment as a Percentage of Total for Selected Communities

Location	Resident Site Employees	Total Employment	BNFL Employment as a Percentage of Total Employment
Whitehaven	2,484	8,208	30
Workington	1,257	12,145	10
Egremont	949	2,087	45
Cleator Moor	576	1,140	51
Cockermouth	495	2,547	19

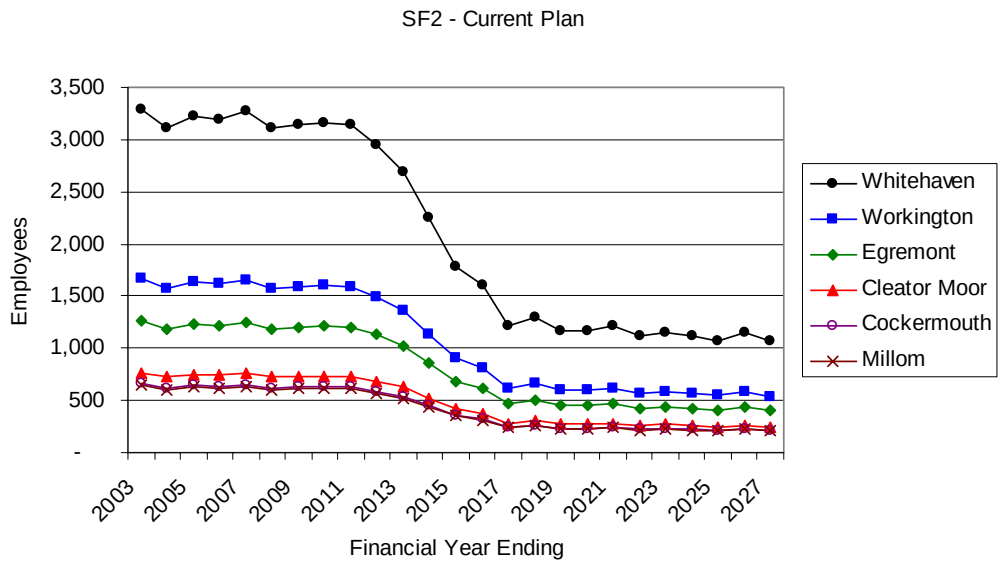
Source: Analysis of BNFL payroll data

Note: This table includes both BNFL staff as well as agency and contract workers, and hence employment figures are higher than given in *Table 6.1*.

As can be seen, the dependence on on-site employment is very high, particularly in the Copeland Borough communities (Whitehaven, Egremont and Cleator Moor). It should also be noted that this analysis excludes indirect employment (estimated at 22 percent of total on-site employment), so is actually an underestimate.

Over time, as *Figure 6.1* shows, these employment levels can be expected to fall to just a third of current levels (this finding is pretty similar under all five scenarios. *Figure 6.4* illustrates the residential location of employees over time for the most affected communities.

Figure 6.4 Selected Residential Locations of On-site Workers - Current Business Plan



6.3 SF1 – STOP NOW AND PREPARE FOR CLOSURE SCENARIO

6.3.1 Employment

As noted in *Section* 4, the key feature of this scenario is the earlier wind down in activity when compared against the "SF2 Current Business Plan" Scenario. The decline in activity in THORP and Magnox reprocessing accounts the bulk of employment loss against Current Plan. Reigning back site activity also brings about a decline in employment in support services such as HR and purchasing and stores. Employment of site contractors also falls back as capital spend declines, which reduces the numbers of capital related contractors, and site activity declines, thus reducing the need for service contractors such as cleaners and caterers.

On-site employment is forecast to diverge from the SF2 "Current Business Plan" scenario by almost 6,200 on-site under the minimum plutonium immobilisation scenario and about 4,500 under maximum immobilisation in 2010, although by the end of the study period the average is between 500 and 1,000 under both. The forecast employment levels are presented in *Figure 6.5*and *Figure 6.6*. As can be seen, the broad profile is similar in both scenarios.

Through industry and consumer spending effects, the decline in direct employment at Sellafield brings about an accompanying decline in local "indirect" jobs supported by site activity. This is equivalent to a further loss of 1,250 jobs under the maximum immobilisation scenario and 990 under minimum immobilisation compared with SF2 Current Plan.

Figure 6.5 Site Employment Under SF1 – Minimum Plutonium Immobilisation Scenario

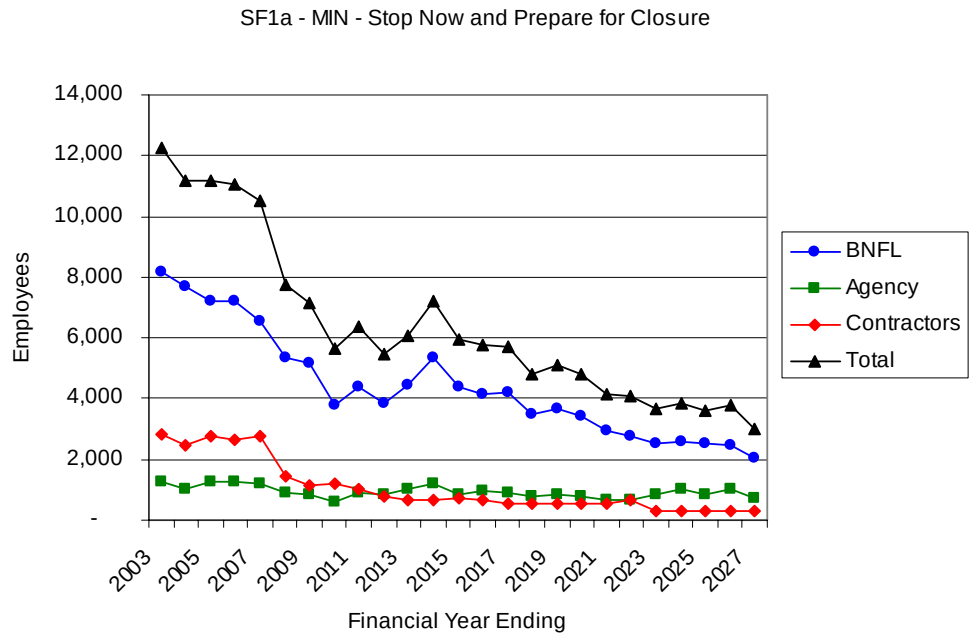
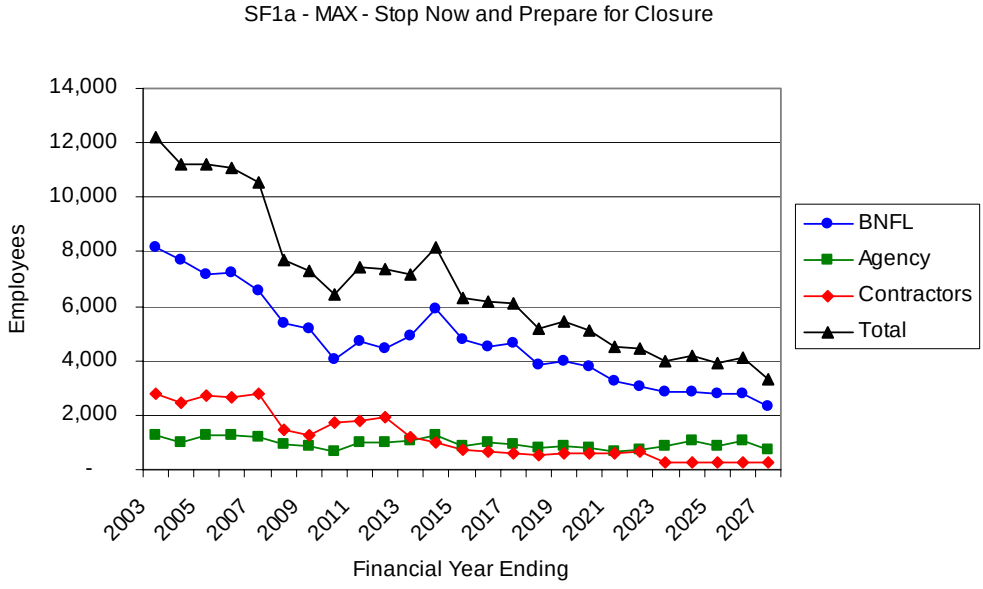


Figure 6.6 Site Employment Under SF1 – Maximum Plutonium Immobilisation Scenario



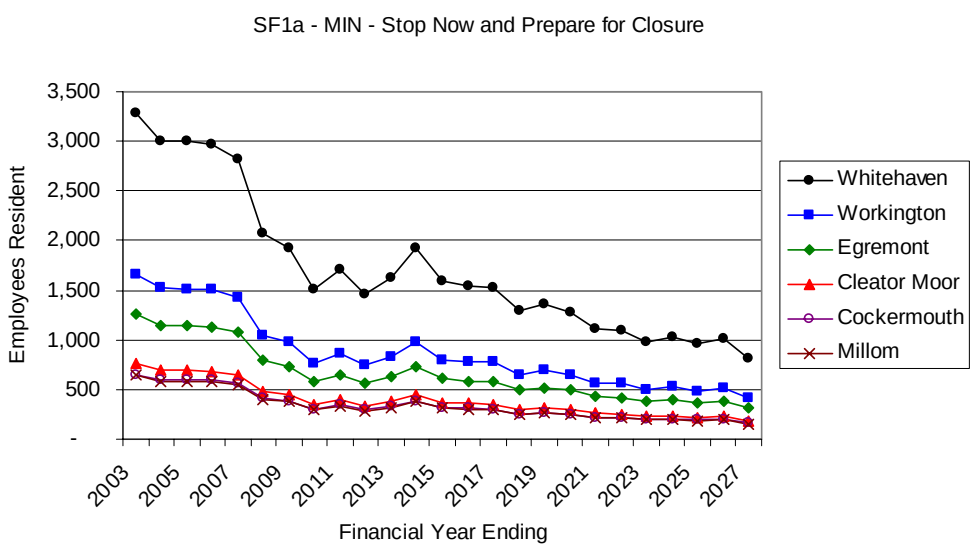
The majority of the indirect job losses are due to the consumer spending effects rather than through local industry purchases. In total, BNFL sourced around 30 per cent of its supplies locally in 1999/2000. When Agency staff are stripped out, this drops to about 20 per cent. Engineering and Business service activities such as car rental are typical of activities sourced locally.

Although the picture is one of general decline, on-site employment picks-up noticeably over the period 2014-2016 as decommissioning of THORP commences. The additional jobs are expected to go to both capital related contractors and BNFL employees.

6.3.2 *Location*

As discussed in *Section 6.2.4*, the different levels of reliance on BNFL employment across the study area means that the loss of jobs will have an uneven effect across West Cumbria. *Figure 6.7* shows how changes in site employment may impact at an area level for the minimum immobilisation scenario (the profile is very similar for the maximum scenario).

Figure 6.7 Selected Residential Locations of Site Workers – SF1 Minimum Scenario



The figure clearly illustrates that over the next decade Whitehaven in particular will see a significant decline in the number of residents who work on-site. Our estimates suggest that this decline may be as much as 2,000 within the next ten years.

6.4 *SF2A –CURRENT PLAN WITH ACCELERATED RETRIEVALS AND DECOMMISSIONING SCENARIO*

6.4.1 *Employment*

As the name suggests, this scenario represents current plan, but with the addition of the maximum level of waste retrieval and decommissioning permitted in technical terms. Further details of the scenario are provided in *Section 4*. Employment levels under this scenario are presented in *Figure 6.8* and *Figure 6.9.*

Figure 6.8 ***Employment Projections for the Current Plan With Accelerated Retrievals and Decommissioning Scenario – Minimum Plutonium Immobilisation***

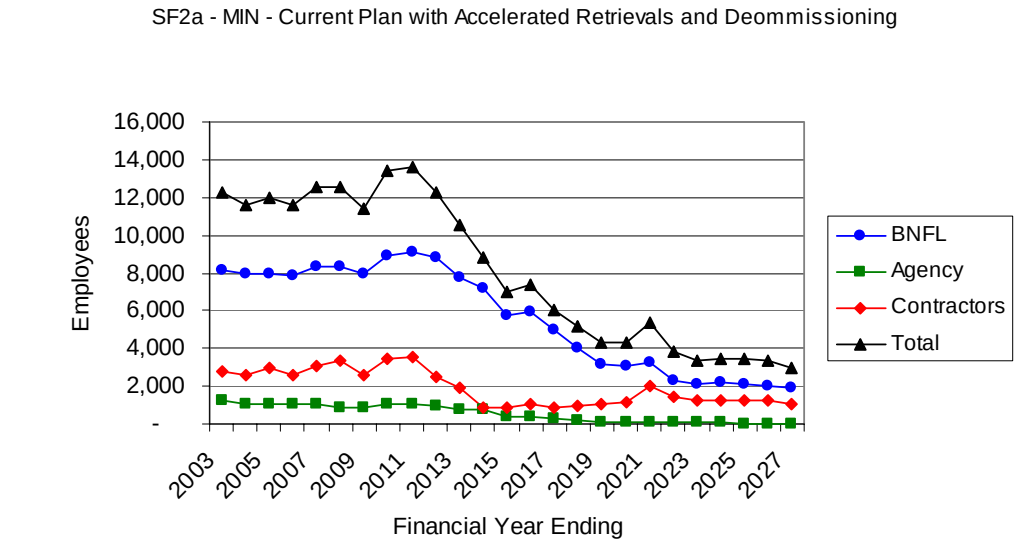
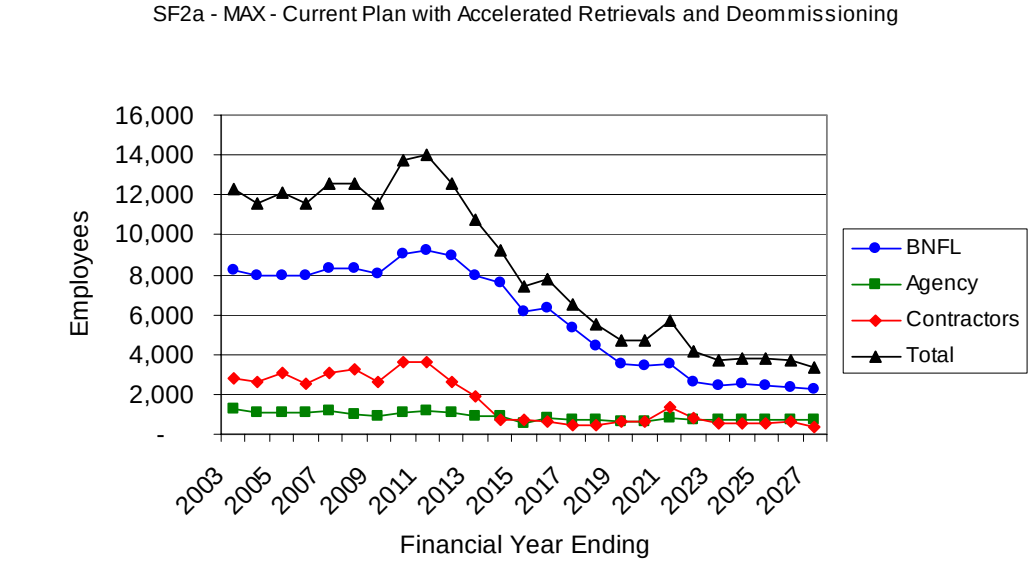


Figure 6.9 ***Employment Projections for the Current Plan With Accelerated Retrievals and Decommissioning Scenario – Maximum Plutonium Immobilisation***



Compared with SF2 Current Plan, this scenario represents an increase of almost 2,000 jobs on site by 2011 under minimum plutonium immobilisation and 2,250 under maximum immobilisation. However, these extra jobs are effectively "borrowed" from future years by bringing waste retrieval and decommissioning work forward. Therefore, by the end of the period employment under this scenario is about 1,000 jobs *lower* than under Current Plan. From a strictly economic development perspective, this is undesirable as

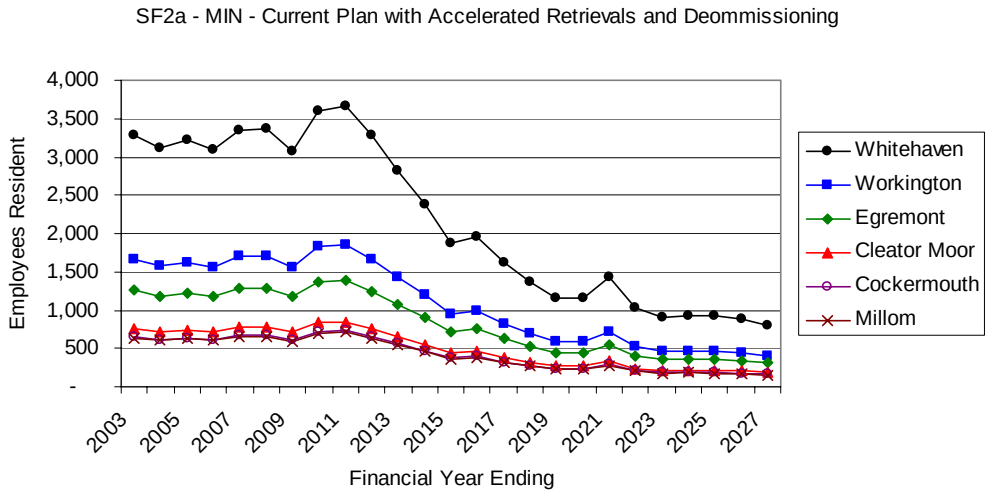
it creates a new, higher peak in employment, followed by an even more rapid rate of decline.

Given the 1.22 multiplier value, this will generate a further between 400 and 450 indirect jobs in the local economy at the peak of employment, but about 220 fewer indirect jobs at the end of the period.

6.4.2 *Location*

The SF2a scenario will exacerbate changes in BNFL employment in local communities. Whitehaven, for example, would see employment reach about 3,700 in 2012, which would fall to about 1,200 in 2020, a fall of 2,500 in just eight years.

Figure 6.10 Selected Residential Locations of Site Workers – SF2a Minimum Scenario



6.5 *COMPARATIVE EVALUATION*

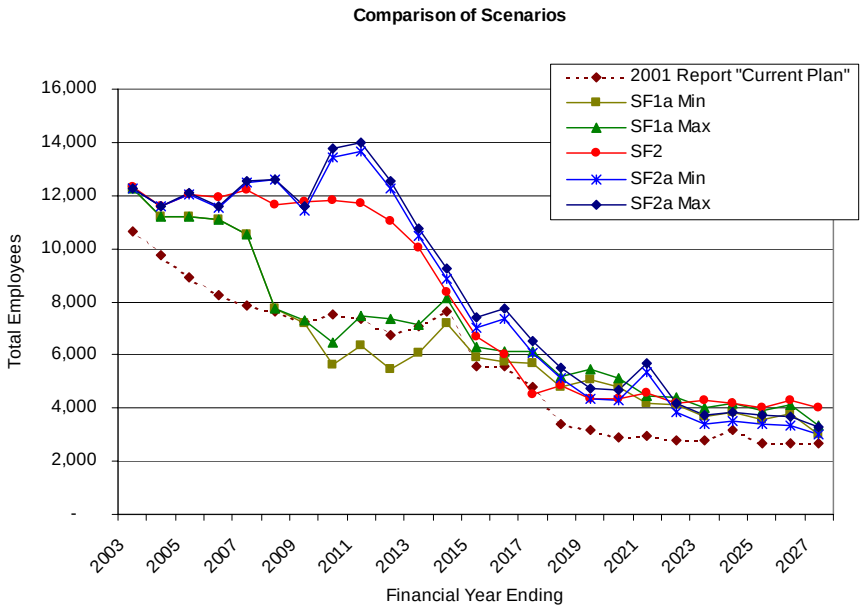
6.5.1 *Employment*

On-site Employment

Figure 6.11 below illustrates on-site employment under the five scenarios. As can be seen, the employment profiles vary greatly between the scenarios, and with the minimum and maximum plutonium immobilisation variants making only a small difference to the overall picture. However, all profiles tend towards a similar total of jobs by 2023 of about 4,000. To this loss must be added indirect employment loss of about 800 jobs.

It should be noted that there may be some scope for rescheduling activities in order to "smooth out" the loss of employment and make the decline slower (although the total of employee years and the final level of employment would remain the same). For example, employment related to plutonium immobilisation may be able to be deferred.

Figure 6.11 On-site Employment Under Each Scenario



Also shown on the figure is the estimated employment in the BNFL Current Business Plan from the 2001 *Socio-economic Study: West Cumbria* report. As can be seen, the employment loss forecast in 2001 has not materialised yet. This is due to BNFL operating in a very different business environment in 2002-3 than was the case in 1999-2000. The main causes for the difference between the 2001 report's and this report's current plan are:

- The 2001 report was based on econometric modelling undertaken using year 2000 data. These data were supplied before the impacts of the Team Inspection report were fully evident. One of the main impacts of this report was to increase staffing levels across the Sellafield site. Also, assumed staff efficiencies in the 2000 data are not currently factored into BNFL business planning.

- Magnox station lifetimes have been shortened, which reduces future workloads for Magnox fuel reprocessing, and the Calder Hall power station on site has been closed early.

- The construction and labour requirements of many of the decommissioning blocks are now much better understood. Many of these blocks were developed from scratch in a short space of time for the 2001 report, and continued development since then (in part linked to detailed preparatory work for the Nuclear Decommissioning Agency) has substantially improved knowledge about requirements.

- There has been an in-depth review of long-term asset management requirements since 2000, which has highlighted the need for major

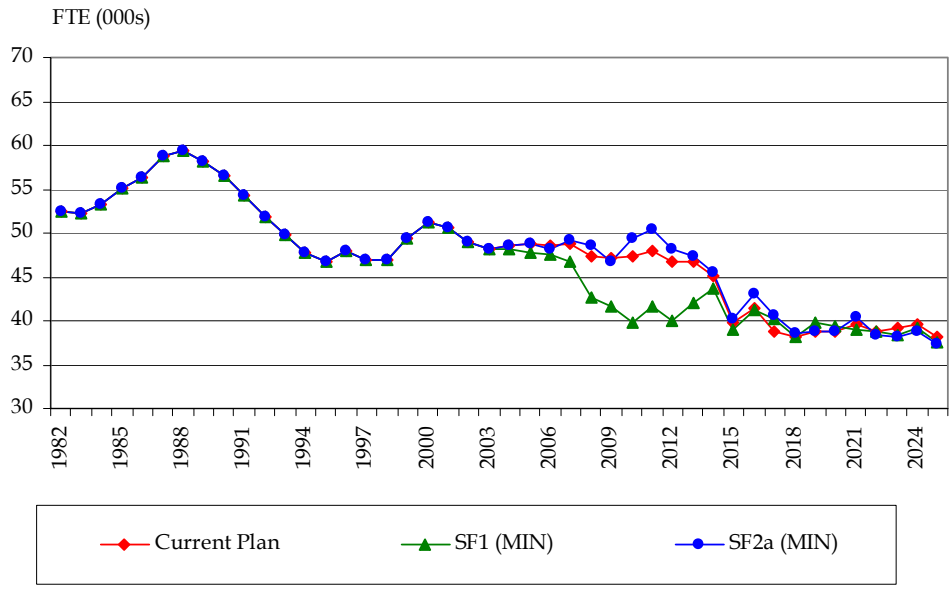
refurbishment and maintenance activity (such as replacing aging roofs on a number of buildings) going into the future.

Although the 2003 scenario results therefore differ from the 2001 report, it is interesting to note that under all scenarios the level of employment stabilises at between 3,000 and 4,000 by about 2023.

Figure 6.12 below shows forecasts of total employment in West Cumbria under the three main scenarios. The forecasts include the four elements that make-up local employment:

- on-site BNFL employees and Agency Staff;
- on-site Contractors;
- indirect jobs that are supported by site activities, with a *multiplier* of 1.2; and
- non-BNFL dependent employment.

Figure 6.12 Employment in West Cumbria Under Each Scenario



When the forecasts for FTE employment in West Cumbria under the scenarios are viewed against historical trends in employment, the over-riding picture is one of fundamental employment decline.

6.5.2 *Unemployment and Inactivity*

Against a backdrop of declining employment, we would expect unemployment to increase. However, this is not a one-to-one adjustment. When a job is lost in the local economy, either directly or indirectly, as site activity decreases, the individual concerned has a choice of one of four paths to take. They can:

- get another job (which means one less job for someone else to take);
- leave the area (migrate);
- become unemployed; or
- become economically inactive (retire, take long-term sick leave, return to education etc)

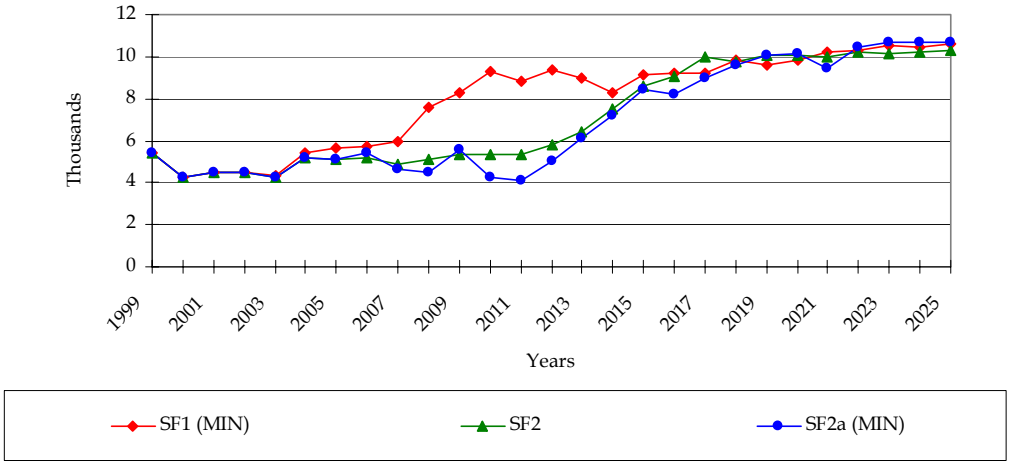
The employee survey sheds some light on this decision making process. The results from the survey show that, about 40 per cent of those surveyed said they would leave West Cumbria if they lost their job at Sellafield. The result for capital contractors is higher still, reflecting the mobility of such workers. This is far higher than results of previous studies although, given the isolation of the site and the difficulty for people to commute to jobs outside West Cumbria, this finding is not surprising.

Accordingly, assumptions have been made to examine the impact of changes in on-site employment on migration, unemployment, economic inactivity and the population of West Cumbria. These are set out below. For every 100 FTE jobs lost on-site:

- "indirect" jobs decline by 22 – Multiplier of 1.22;
- 60 percent of capital related contractors will migrate;
- 15 percent of BNFL employees will migrate;
- 10 per cent of "Other local employees" migrate; and
- of those people who do not migrate, 70 per cent become unemployed and 30 per cent become economically inactive.

Figure 6.13 shows forecasts of ILO unemployment under the three main scenarios(1).

Figure 6.13 Unemployment Levels by Scenario



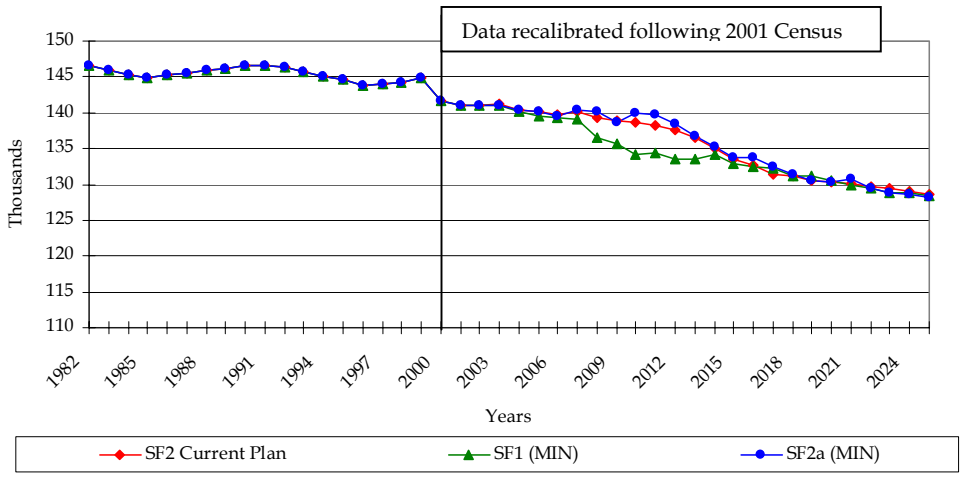
(1) The International labour Organisation (ILO) definition of unemployment covers people who are: out of work, want a jobs have actively sought work within the previous four weeks and are available to start work within the next fortnight; or out of work and have accepted a job that they are waiting to start in the next fortnight. It provides a more complete measure of unemployment that the claimant count.

As can be seen, even when taking account of out-migration and those who would become economically inactive (and hence who still represent a loss to the local economy), unemployment is projected to rise significantly under all of the scenarios once on-site employment begins to decline.

6.5.3 *Migration and Population*

Forecasts incorporating the impact of migration flow under the three main scenarios show that, with the notable exception of the SF1 Stop Now scenarios, population in the study area remains broadly constant within the 135,000-145,000 range over the next 10 years. However, under SF1, and in all scenarios after 2014, there is a marked population decline as employment decline on-site sets in. As *Figure 6.14* shows, the population of the area levels out at just under 130,000, or 10,000-15,000 less than the 2000 figure produced by the 2001 census. This population decline is accentuated when compared with employment loss because each employee is assumed to have 2.4 dependents. This is based on evidence from the employee survey that showed that the number of dependants for BNFL employee and contractors alike is around 1.4, which is in line with the national average.

Figure 6.14 Population Projections in West Cumbria Under Each Scenario



6.6 *CONCLUDING REMARKS*

The outlook for on-site employment at Sellafield is one of fundamental decline over the long term, although under the SF2 and SF2a scenarios this is postponed (albeit, in the case of SF2a, at the cost of jobs later). The minimum and maximum plutonium immobilisation variants to scenarios SF1 and SF2a make little difference to this overall picture.

The key decision is how to manage the decline over the short-to-medium term, as over the longer-term employment levels converge under the three scenarios, especially as the decline would be immediate under SF1 and

delayed but rapid under SF2 and SF2a. The age structure of the workforce should help any adjustment that takes place over the coming years through opportunities for early retirement (although new jobs will obviously still be required for new entrants to the workforce). Nearly 20 per cent of current BNFL employees are aged 50 years old or older.

The West Cumbria economy has adjusted to large shifts in employment in the past. This was witnessed especially during the mid-to-late 1980s, when the completion of THORP corresponded with a general slowdown in the national and local economies. Even without any site activity, West Cumbria would still function as an economy on the back of about 35,000 full-time equivalent employees spread across industries including the public sector, retail and tourism.

However, the adjustment required to take account of a large decline in employment at Sellafield would be traumatic -unemployment would rise, out-migration would occur and new replacement jobs would be unlikely to be of the quality of BNFL employment in terms of salaries, benefits or stability. It must also be recognised that impacts will not be uniform across West Cumbria. The nearby towns that have the heaviest dependence on BNFL (such as Whitehaven, Workington, Egremont, Cleator Moor and Millom) will feel the effects of any downturn in employment (and hence associated social problems) most strongly.

7 VISIONS FOR WEST CUMBRIA

7.1 INTRODUCTION

This section of the report sets out a range of possible initiatives that could help to mitigate any loss of employment at Sellafield as a result of declining construction and operational activity. To recap, the impact assessment found that:

- there were 12,100 workers on site in early 2003, with a further 2,630 jobs in West Cumbria being dependent upon the plant;
- approximately 36,000 jobs in West Cumbria are not BNFL related in any way;
- under all scenarios there is a forecast loss of employment in the long-term;
- whilst employment in the next five years will remain relatively stable, there is a precipitous decline under all scenarios by 2011 (by 2008 under SF1) which will be particularly difficult to manage;
- by 2025 all the scenarios converge to approximately 3,000 to 4,000 jobs on site;
- unemployment is forecast to decline over the next 25 years, as econometric models (used for the analytical work for this project) tend towards equilibrium over the long term – unemployment will actually fluctuate in line with the economic cycle;
- this decline in unemployment will be partly accounted for by working families moving out of West Cumbria to take advantage of employment opportunities elsewhere in the country, which will have adverse consequence for the level of public and private services that the area is able to sustain; and
- experience from other regions where there have been major job industrial losses suggest that, whist the social costs are enormous, economies do generate new jobs over time, although not necessarily of the same quality in terms of pay and conditions (see *Section 3*).

There is therefore an immediate need to plan for employment opportunities for the area in the medium to long term as all scenarios involve the loss of at least 8,000 on-site jobs. Failure to meet this objective will result in rising unemployment and a wide range of associated social costs.

The need to address a decline in permanent employment is dependent upon the scenario being considered, but is pressing under all scenarios in the medium to long term.

It should be noted that it is not the role of this report to set out a development strategy for West Cumbria, or to assess what level of funding might be required. However, it is clear that West Cumbria will need considerable assistance to adjust successfully to the decline in employment at BNFL, and that the need to adjust arises out of policy towards the nuclear industry, which is determined at national level. The local community will therefore be bearing the costs of changing national policy, and it seems reasonable that resources should be provided to help address the challenge of regenerating the local economy.

7.2 *APPROACH TO DEVELOPING VISIONS*

The initiatives proposed have been formulated after consultations with a number of stakeholders including:

- West Lakes Renaissance, the new Urban Regeneration Company for West Cumbria and Furness;
- Cumbria County Council;
- Copeland Borough Council;
- North West Regional Development Agency;
- the Sellafield Local Liaison Committee; and
- representatives of environmental campaing groups.

Following these consultations, a number of initiatives have been identified under four broad categories:

- nuclear industry;
- environment and energy;
- transport and communications; and
- economic development and regeneration.

The approach to identifying employment generating initiatives has been to:

- focus on those projects which meet a clearly defined business or public services need;

- generally assume no specific link between BNFL Sellafield activities and additional employment projects (except for BNFL initiatives), whilst at the same time acknowledging that a drastic cut in employment on site should provide a catalyst for greater public sector investment in the region;

- include only projects that have a realistic chance of implementation, ie they fall within existing policy commitments; and

- produce indicative estimates of construction and operating employment for the projects (using full-time equivalents in all cases).

In addition, we have only defined projects for the next five to ten years. There would be opportunities to generate further employment initiatives beyond the five-year time frame, and there is no reason to doubt that these could be of a similar scale to those identified below.

It should be noted that whilst all of the initiatives are feasible, their implementation will depend on a considerable political commitment to the area. Therefore, if many jobs are to be realised, partners from across West Cumbria and the rest of the county will need to lobby effectively.

7.3 NUCLEAR INDUSTRY

7.3.1 Introduction

Nuclear industry projects fall under two principle categories:

- BNFL initiatives; and
- other projects relating to nuclear industry education/training and the establishment of the Nuclear Decommissioning Agency's (NDA) principal office in West Cumbria.

7.3.2 BNFL Initiatives

For the 2001 report, extensive discussions were held with senior BNFL staff and a range of options were reviewed for boosting employment at Sellafield or elsewhere in West Cumbria in future years. Company options considered include:

- relocation of staff from other BNFL sites within the United Kingdom;
- further increases in purchasing from local suppliers;
- further attempts to spin-off internal units into free-standing businesses that can develop markets outside the company;
- Sellafield becoming an international centre of expertise for the decommissioning and clean-up of nuclear facilities; and
- land release for uses that might benefit from some aspects of Sellafield's infrastructure (in a similar fashion to the existing gas fired power station adjacent to the site).

It was concluded that the maximum number of jobs that might be created at Sellafield as a result of these initiatives would be approximately 200. Whilst this seems modest, it is explained by:

- There is believed to be little scope to increase local procurement because of the considerable efforts made to localise purchasing over the last five years.

- Investments already made at Westlakes, which houses a number of BNFL spin-off businesses. BNFL also note that the success of past spin-offs has been limited. Given the employment terms offered by BNFL, there are also a limited number of staff who are willing to give up secure, well remunerated employment for higher-risk entrepreneurial ventures.

- Much of BNFL's employment at other sites is operational, and is controlled to a great extent by regulatory and safety considerations.

- The great majority of employment associated with overseas sites that BNFL might be contracted to decommission / decontaminate would be located at the site, rather than at any BNFL facility in the UK.

Other possible actions by BNFL include investment in regeneration projects in the local community. BNFL is already very active in this area through:

- A five-year plan to provide £15 million to local regeneration agencies, including the West Cumbria Development Fund and the Cumbria Inward Investment Agency. Based on an annual spend of £3 million a year, approximately 50 to 100 jobs could be expected to be created per annum.

- Sponsorship of a number of local development initiatives, such as the Prince's Trust.

In addition to these initiatives, there is also currently discussion within the BNFL National Stakeholder Dialogue about the possibility of a systematic examination of a wide range of diversification opportunities. This would include options for diversifying both BNFL and the local economy (in addition to the increased local purchasing, encouragement of further spin-offs and local economic development funding provided by BNFL). This additional diversification activity could include:

- using BNFL skills to enter non-nuclear markets (for example renewable energy);

- using BNFL skills to extend the range of services provided to nuclear industry clients; and

- working with suppliers to help them develop new markets.

However, in the absence of detailed information about the feasibility and employment impacts of such opportunities, we have restricted ourselves to the original estimates produced for the 2001 report.

These projects give the following estimated employment:

- no construction employment; and
- 100 permanent jobs from initiatives within BNFL and with suppliers plus a further 75 a year from BNFL's economic development spending.

7.3.3 *Non-BNFL Initiatives*

In addition to BNFL's activities in West Cumbria, two other nuclear related initiatives are likely to bring additional employment to West Cumbria:

- Establishment of the NDA's headquarters in West Cumbria. The Government has announced that the proposed NDA will be headquartered in West Cumbria. This is likely to create about 200 jobs, with additional private sector employment likely if, as expected, key contractors opt to establish offices near to their NDA clients.

- Establishment of a nuclear industry education and training facility. There is a recognised lack of qualified staff for the nuclear industry, and this is projected to be an increasing problem in the future as fewer university students take courses that are relevant to the industry. There have therefore been proposals to establish an educational centre of excellence in West Cumbria. It is proposed that the centre would offer a mixture of residential and distance learning courses. The plans are not fully developed at present, but an estimate of about permanent 100 jobs appears realistic at present.

The projects give an estimate of:

- no construction jobs (for the purposes of this study it is assumed that these organisations would use existing accommodation); and
- 300 permanent jobs.

7.4 *ENERGY AND ENVIRONMENT*

There are a number of energy and environment projects that may be implemented in West Cumbria in the coming years. Work commissioned by Friends of the Earth in 1997 highlighted some of these options(1). Schemes that may make a significant contribution to local employment include:

- Development of approximately 180 MW of offshore wind energy. Licenses and planning permission for offshore wind farms off the coast of Cumbria have been granted and construction is due to start soon(2). Based on research undertaken by ERM on the economic impacts of wind energy, we estimate that this could create about 2,000 person years of construction employment and 120 permanent jobs during the operational phase. However, a large proportion of the construction employment relates to tower and turbine assembly, which are likely to take place outside West

(1) The Economic and Environmental Impacts of Alternative Investment Scenarios for the West Cumbrian Economy, Ecotec for Friends of the Earth, 1997. FoE's report assessed the potential employment impacts of £20 million worth of investments, which was 10 percent of the cost of the Rock Characterisation Facility that was proposed. The £20 million budget is much less than the potential expenditure on renewables set out in this report, hence ERM's employment projectsions are higher.
(2) See www.offshorewindfarms.co.uk for more details of UK wide sites

Cumbria, so we have only estimated that 25 percent of construction jobs are retained locally. There is also the possibility of further onshore wind farm development in West Cumbria, but plans for this are less well developed.

- Further renewable energy projects. For this report we have taken the development of biomass energy production as an indicative project. Other opportunities could include development of a tidal barrage or small hydroelectric schemes. Biomass energy production generates power from agricultural and forestry crops that are sustainably managed, and hence have lower carbon emissions. In common with other UK regions, the North West of England has a responsibility to develop renewables capacity over the coming decade. Research undertaken by ERM into the capacity for renewable energy in the region(1) suggests that about 20 MW could be developed in West Cumbria. This would generate 60 person years of construction employment and 180 in operation (including many in land management). Biomass energy could also form the basis of a new national forest adjacent to the Lake District National Park, which could generate significant employment in leisure industries.

These projects could generate an estimated:

- 560 person years of construction employment; and
- 300 permanent jobs.

7.5 TRANSPORT AND COMMUNICATIONS

West Cumbria is characterised by poor transport and communications infrastructure. This is reflected in the lack of good road access, poor rail services, a lack of modern information technology infrastructure and distance from major external gateways such as major ports and airports. Even compared with other regions of the UK that also suffer relative isolation, such as the North East, the South West, the Highlands of Scotland and Northern Ireland, West Cumbria is poorly connected. There is therefore plenty of scope for investing in local infrastructure. Potential projects include road, rail and sea transport projects:

- Upgrading of the A595 from Parton to Lillyhall. This £18 million scheme has recently received approval and work is due to start in 2003. The project will improve access to and from Workington from the A66. Given the construction cost, we estimate that 200 to 300 person years of construction employment will be generated by this project over two years.

- Further upgrades to the A595 and A5092. Although the Lillyhall to Parton upgrade will provide trunk road access from the A66 as far south as Whitehaven, to the south of Sellafield the road is particularly poor all the way to the junction with the A590. Two projects of a similar scale to the Lillyhall to Parton improvement and costing £36 million could be expected

(1) See www.etsu.com/nwre-study for more details of the ERM report

to create 400 to 600 person years of construction employment. Longer-term options that could be considered include a new crossing of the Duddon Estuary (possibly in conjunction with a tidal barrage), that would improve access between West Cumbria and Barrow-in-Furness and the M6, and also take through-traffic away from the southern boundary of the National Park. However, no cost data are available yet and we have therefore not attempted to assess employment impacts.

- Improvements to the rail infrastructure. There are a number of possible rail investments, including improving the coastal rail link and re-opening closed branch lines off the West Coast Mainline into the heart of the Lake District. We have not attempted to quantify the employment effects of such investments because it is unlikely that they could be implemented in the short to medium term, and because we are not aware of any cost data that could form the basis for economic impact calculations. However, the feasibility of such schemes should be considered in more detail.

Therefore, these projects could generate estimated employment of:

- 750 person years of construction employment (based on mid-point estimates); and
- no permanent jobs.

However, it should be noted that whilst these projects, in and of themselves, will not create significant additional employment, improved access will be essential if other projects, particularly those funded through the two regeneration companies operating in the county, are to fully realise their potential. Until road routes to the south of Sellafield are improved, poor access is likely to present a considerable impediment to regeneration within West Cumbria.

7.6 ECONOMIC REGENERATION PROGRAMMES

Considerable increases in the resources made available by Government to the Regional Development Agencies (RDAs) and the maturing strategies of North West RDA have greatly increased the resources available for the regeneration of the West Cumbria economy. In particular, two regeneration companies, one for rural parts of Cumbria and one for the primarily urban West Cumbria and Furness area (West Lakes Renaissance), have been established. At present, these companies are at an early stage in their development, and specific proposals have not been brought forward. However, it is known that West Lakes Renaissance, for example, has a budget of approximately £60 million for the next five years, with the potential of additional funds being provided. It should be noted however that:

- both the regeneration companies cover areas greater than just West Cumbria, and hence only a proportion of spending will be within the study area; and

- spending will vary in scale and nature from year-to-year, and it is likely that spend in early years will be below average.

For the purposes of this assessment, ERM has therefore made the following assumptions relating to spend:

- regeneration spending in West Cumbria will average £5 million a year from both the urban and rural regeneration companies;

- the current five year programmes will be extended for a further five years, but not renewed thereafter (on the assumption that the possible achievements will have been secured by then);

- the equivalent of one permanent job will be created for every £30,000 of spending by the regeneration companies (this is midway between typical values for urban and rural programmes – rural jobs are typically harder to create through public intervention than urban ones, due in part to lower demand for goods and services in rural areas); and

- every pound of public sector regeneration spending is matched by a pound of private sector investment (for example through public bodies undertaking site remediation, with private developers subsequently redeveloping brownfield sites).

Because of the ongoing nature of this spending, employment generated will increase for ten years, but the final estimate is a total of about 3,330 jobs being created through this spending after ten years.

7.7 SUMMARY OF POTENTIAL NEW EMPLOYMENT AND IMPACT ON THE WEST CUMBRIA ECONOMY

A summary of potential new job creation projects is presented in *Table 7.1* below.

Table 7.1 Summary of Potential New Employment

Category	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Nuclear Industry												
- BNFL redeployment and procurement	100	100	100	100	100	100	100	100	100	100	100	100
- BNFL economic development funding	75	150	225	300	375	450	525	600	675	750	750	750
- NDA HQ	200	200	200	200	200	200	200	200	200	200	200	200
- Nuclear industry educational centre	100	100	100	100	100	100	100	100	100	100	100	100
Sub-total:	*475*	*550*	*625*	*700*	*775*	*850*	*925*	*1,000*	*1,075*	*1,150*	*1,150*	*1,150*
Energy and Environment												
- Wind farms	250	250	120	120	120	120	120	120	120	120	120	120
- Biomass power station	60	180	180	180	180	180	180	180	180	180	180	180
Sub-total:	*310*	*430*	*300*	*300*	*300*	*300*	*300*	*300*	*300*	*300*	*300*	*300*
Transport and Communications												
- Parton to Lillyhall	125	125	-	-	-	-	-	-	-	-	-	-
- Two extra schemes of similar scale	250	250	-	-	-	-	-	-	-	-	-	-
Sub-total:	*375*	*375*	-	-	-	-	-	-	-	-	-	-
Economic Regeneration Programmes												
- West Lakes Renaissance and Rural Regen Company	333	667	1,000	1,333	1,667	2,000	2,333	2,667	3,000	3,333	3,333	3,333
Sub-total:	*333*	*667*	*1,000*	*1,333*	*1,667*	*2,000*	*2,333*	*2,667*	*3,000*	*3,333*	*3,333*	*3,333*
Total - All Initiaves	***1,493***	***2,022***	***1,925***	***2,333***	***2,742***	***3,150***	***3,558***	***3,967***	***4,375***	***4,783***	***4,783***	***4,783***
Multiplier Effect @ 0.1	***149***	***202***	***193***	***233***	***274***	***315***	***356***	***397***	***438***	***478***	***478***	***478***
Grand Total	**1,643**	**2,224**	**2,118**	**2,567**	**3,016**	**3,465**	**3,914**	**4,363**	**4,813**	**5,262**	**5,262**	**5,262**

Estimated value of civil engineering spend required to create one per year of construction employment	£ 72,000
Estimated regeneration spend required to create one permanent job	£ 30,000
Assumed duration of regeneration programmes	10
Leverage of regeneration spending: private investment as a perctenage of public	100%
Assumed regeneration company spending in West Cumbria (millions)	£ 5.000

These jobs are over and above the baseline figure produced by the econometric modelling

As noted above, job creation on this scale will require considerable lobbying for both resources and inward investments.

7.8 ADJUSTED EMPLOYMENT, UNEMPLOYMENT AND POPULATION IMPACTS

7.8.1 Introduction

The results of the economic modelling have been treated as an intermediate output that would be modified once the results of the visions phase were available. This section therefore sets out revised impact data based on the assumption that the employment generation outlined in *Table 7.1* is secured. As noted above, such an outcome would require considerable lobbying by partners in Cumbria.

The impacts are set out under:

- employment;
- unemployment; and
- population.

7.8.2 Employment

To assess the impacts of the additional employment creation projects we have compared site employment with site employment plus the additional jobs. *Figure 7.1* illustrates the impact that the new projects have.

The figure shows that *with* the additional job creation initiatives:

- Employment under the SF1 still declines relatively rapidly, although the pace of decline is obviously slowed.

- Employment under the SF2 and SF2a scenarios actually increases slightly to 2014, when the closure of THORP and other changes commences. After this point the decline is a rapid as with out visions because no further job creation initiatives are assumed. Clearly, if this assumption is not correct, then some of the remaining employment loss could be mitigated, although it is unlikely to be wholly successful either in terms of creating new jobs at the rate that BNFL dependent ones are lost, or by creating jobs offering similar employment terms.

7.8.3 Unemployment

The additional jobs created by the employment projects would clearly compensate for some of the employment that will be lost on site in the future. However, one job created does not equal one less unemployed person due to assumptions within the model about migration and multipliers. These are:

Figure 7.1 Total Employment Impacts of Additional Employment Creation Projects

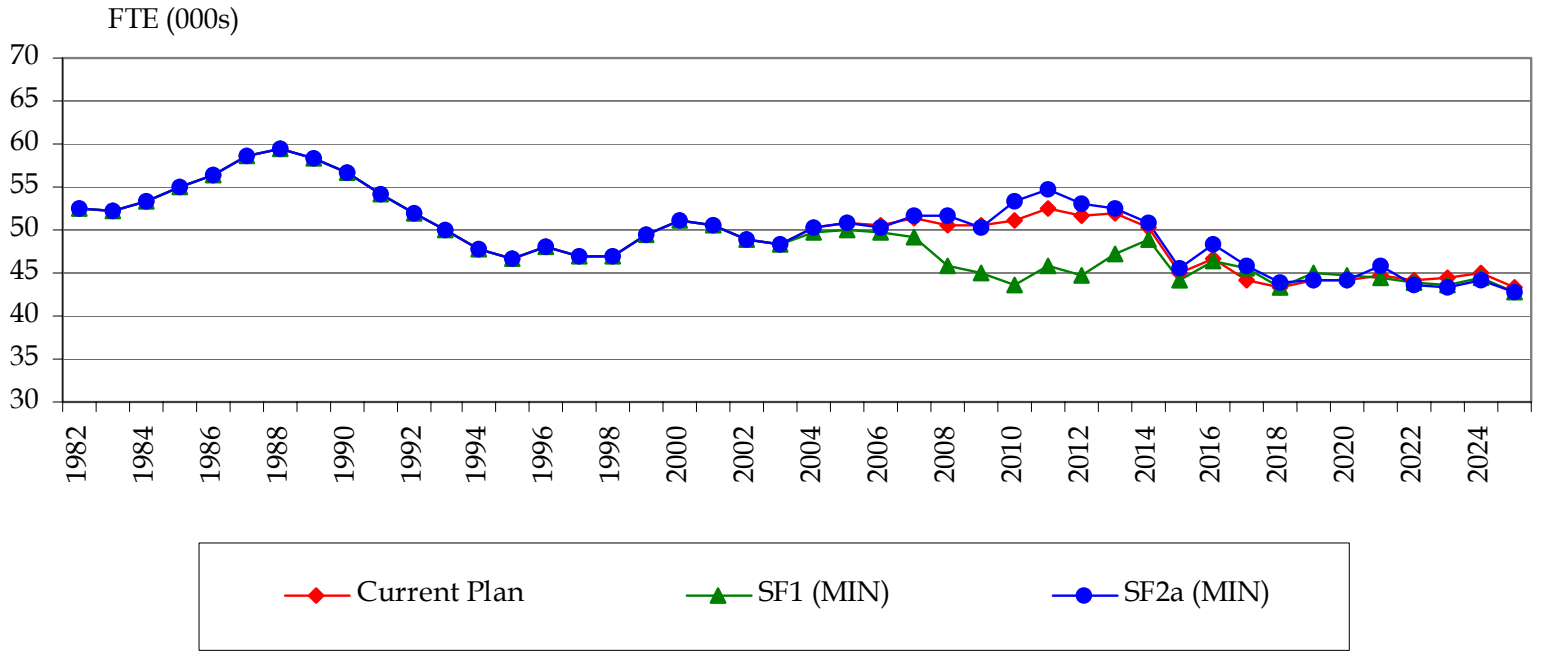
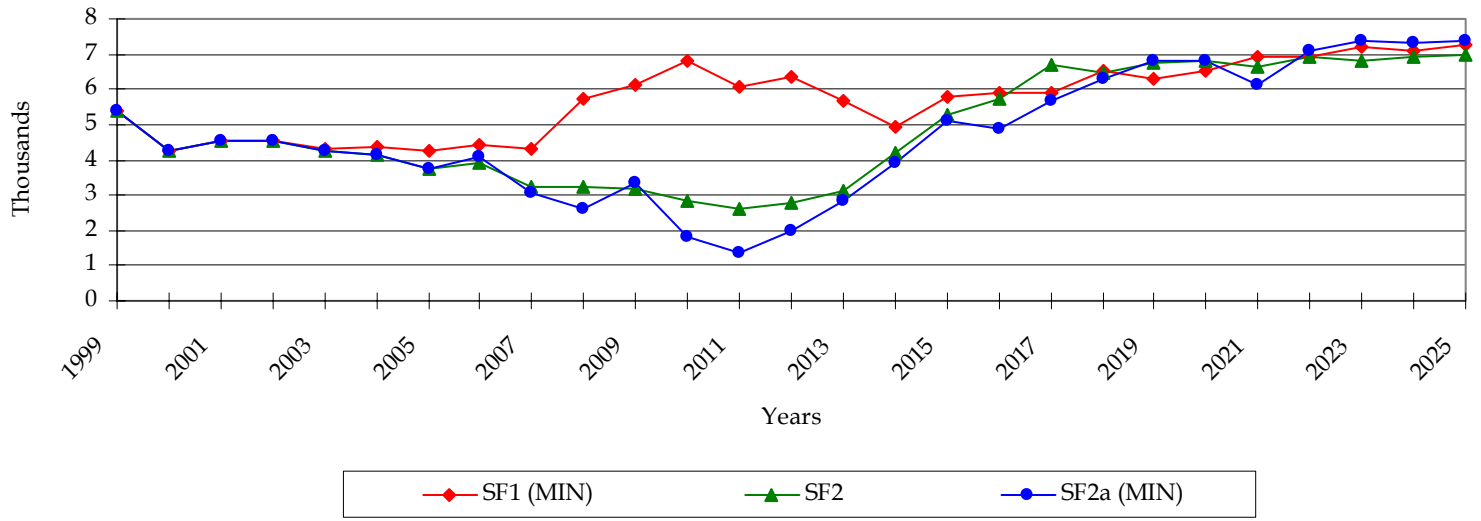


Figure 7.2 ***Unemployment Impacts of Employment Creation Projects***



- *Migration*. The model assumes that 60 percent of construction workers, 15 percent of BNFL employees and 10 percent of other employees will migrate if they lose their jobs. Therefore, new employment will in effect reduce the amount of out-migration, meaning that a new construction job leads to a decrease in unemployment of 0.4 jobs. Similarly, a new BNFL job will lead to a fall in unemployment of 0.85 jobs.

- *Multiplier effects*. This study has found that BNFL site employment has an employment multiplier of 1.2 in the local economy, ie every five jobs on site support one job offsite as a result of procurement and consumer expenditure by employees. The additional jobs will have a lower multiplier because it is unlikely that other employers will pay as well or will make the same efforts to purchase goods locally. Hence, we have assumed a multiplier of one indirect job for each ten jobs created through the initiatives.

As illustrated in *Figure 7.2*, the additional employment projects could make a significant difference to levels of unemployment in West Cumbria(1). Such schemes could, by ameliorating unemployment, have significant social benefits, for example in public health and levels of crime (see *Annex A*).

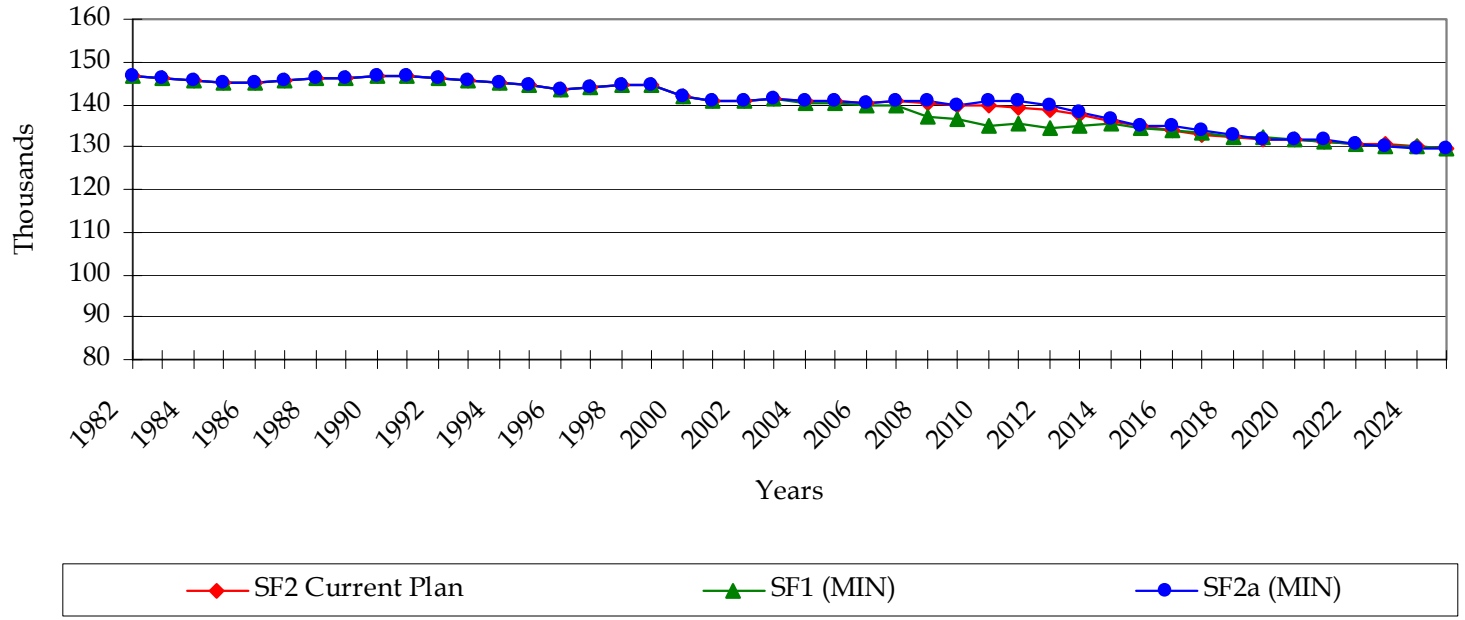
7.8.4 Population

The effect of changes in employment at Sellafield could have a major impact in the scale and quality of public services available in West Cumbria, and on the demand for housing. We have therefore produced adjusted population projections using the "other local employee" migration assumptions set out above (ie every ten new jobs attract one migrant), and have assumed an average household size of 2.4. The results of this analysis indicate that by 2014 the initiatives could have generated an additional 1,250 residents in West Cumbria which, under the SF2 and SF2a scenarios prevents employment loss until about 2014. However, under SF1, there is an immediate decline in employment. Once again, the continuance of successful job creation initiatives after 2013 would further protect the area against population decline.

Figure 7.3 illustrates the impact of the additional employment projects on population.

(1) The negative unemployment with additional projects would lead to in-commuting (and eventually immigration) into West Cumbria.

Figure 7.3 Population in the Study Area With and Without Additional Employment Projects



7.9 CONCLUDING REMARKS

The are a number of committed and potential projects that could help protect the employment base in West Cumbria. These projects will be particularly valuable in the event of a rundown in employment at Sellafield. The projects are varied, including:

- nuclear industry initiatives;
- ϖ• developments in the energy and environment sectors;
- improvements to transport and communications; and
- regeneration programmes.

However, it is likely that West Cumbria will continue to experience employment decline, partly as a result of long-term economic trends that have hit the area disproportionately hard, and partly as a result of a projected decline in activities at BNFL. This employment decline will not manifest itself fully as unemployment because of an ageing population, the out-migration of young workers and a decline in economic activity rates (not all of it voluntary). The decline in employment will have adverse social consequences, for example on health and crime and, therefore, should be avoided for both economic and social reasons to the extent possible.

Securing new investments to create additional employment opportunities will require careful planning and a concerted lobbying effort by leading stakeholders in the region to ensure increased and continued regeneration spending in West Cumbria. This process should be stepped up immediately as a major decline in construction employment on site has already commenced.

Annex A

Literature Review: The Impacts of Unemployment on Health and Crime

CONTENTS

A1 LITERATURE REVIEW: THE IMPACTS OF UNEMPLOYMENT ON HEALTH AND CRIME

A1.1 INTRODUCTION

The importance of employment in terms of well-being is difficult to assess. It may serve to define an individual's role in society and thus form a set of social relationships which provide a structure in life. A job loss may therefore lead to exclusion of an individual from the rest of society and have several adverse effects. Set out below are the findings of a literature review on the implications of such effects, in particular those of health and crime.

A1.2 HEALTH

A1.2.1 Available Research

Lewis and Sloggett (1998) assess the linkage between suicide, deprivation and unemployment. Although they find an insignificant and relatively low correlation between low social class and suicide, they identify a strong link with unemployment and permanent sickness, with the unemployed and permanently sick 2.79 times more likely than the employed to commit suicide (adjusted for bias from other socio-economic variables), as shown in *Table A1.1*. In addition, they suggest that *insecure* employment is linked with suicide.

Morrell et al. (1998) conclude that youth unemployment and youth suicide are strongly associated. They argue also that unemployment is associated with psychological symptoms, such as depression and loss of confidence. In particular, Morell et al. (1994) showed that unemployment amongst youth aged 16-25 was causally linked to a 50 percent increase in risk of psychological disturbance (see *Table 1.1*).

Junankar (1991) finds a positive *association* (his italics) between unemployment and mortality, also when adjusting for social class and region of residence within the UK. He notes the difficulty in disentangling the direction of causation, but suggests the link to be from unemployment to morbidity to mortality, with a long lag between the first and the last.

Bethune (National Statistics, 1999) finds that unemployment carries a risk of premature mortality, and that this risk is higher for men than women. She also states that women's own economic activity is of great importance as mortality was found to be lower than average even if their husbands were unemployed, and higher than average even if their husbands were in employment. Mortality from all major causes was found to be consistently higher than average amongst unemployed men. Bethune states that factors such as pre-existing ill-health, social class, or marital status cannot account for the raised mortality amongst unemployed, and therefore concludes that

unemployment has an independent causal effect on mortality (see *Table 1.1* for more detailed results).

Table A1.1 Health Effects of Unemployment - A Summary of Studies

	Type of health effect			
	Death (all causes) SMR+	**Suicide SMR+**	**Physical Illness**	**Mental Illness**
Morrell et al. (1994)[a]				150
Moser et al. (1987) & (1990)[b]	137			
Iversen et al. (1987)[b]	140-150			
Martikainen (1996)[b]	135-211 (M) 130-161 (F)		160-180[c] 200[d]	
Mathers (1994)[b]			200[c] 130-140[d]	
Junankar (1991)	124-139			
Bethune (1999)	125 (M) 121 (F)	187 (M) 312 (F)		
Lewis & Sloggett (1998)		279[e]		

Notes:

* Interpretation of table: Numbers are given as SMR (Standardised Mortality Ratio) ratios, eg 137 implies that an unemployed individual is 37 percent more likely to be subject to the health effect than an individual in employment.

\+ SMR is a measure of how much more or less likely a person is to die in the study population than someone of the same age and sex in the standard population.

(a) Source: Morrell et al. (1997)

(b) Source: Mathers & Schofield (1998)

(c) Likelihood to report poor health

(d) Likelihood to report chronic illness

(e) Odds-ratio rather than SMR

(M) Male

(F) Female

Isacsson (1999) warns, however, that there may be a bias in estimates such as those of Lewis and Sloggett (1998). He states that mental disorder rather than unemployment itself is likely to be the explanation, pointing at evidence of a fivefold increase in the unemployment rates in Sweden between 1990 and 1994 accompanied by a 14 percent fall in suicide rates.

Also Crombie (1989) is cautious in establishing a link between unemployment and health effects. He assesses the correlation between unemployment and suicide trends in Scotland between 1976 and 1986 and though he finds an association between the trends nationally, no such association is found when trends are analysed by health board areas or aggregates of local government districts. Crombie therefore concludes that the data do not support the hypothesis that the rise in unemployment is a direct cause of the rise in suicide rates among men.

A1.2.2 Concluding Remarks

Attributing ill-health and suicide to unemployment alone is, of course, simplistic. However, it seems likely that unemployment has some impact on suicide rates as well as physical and mental illness(1). Studies outside West Cumbria (including elsewhere in the UK as well as abroad) have estimated that mortality rates for the unemployed are 21 to 111 percent higher than amongst the employed individuals, and even higher if suicide is considered alone. It also seems likely that the likelihood of reporting physical illness or being mentally ill is greater too for unemployed individuals.

A1.3 CRIME

A1.3.1 Literature Review

All recorded crime reported by the British Crime Survey(2) fell between 1995 and 1997 by 15 percent, and again between 1997 and 1999 by 10 percent. In the context of property crime, BCS attributes part of the decline to the 'current economic cycle, with low levels of unemployment and relatively high economic growth' which have reduced the needs for the proceeds of crime(3).

This view is supported to some extent by the Home Office (1994), who found occasional correlation between unemployment and burglary, vehicle crime and theft offences. However, in their study, which analyses data from 1984 to 1992, no overall evidence was found to suggest that a consistent correlation existed between unemployment and recorded crime at the police force level.

Farrington et al. (1986) investigated the official crime rates of male youths aged 14 to 18 according to whether they were at school, unemployed or in full employment. They found that crime rates were higher during periods of unemployment than under employment. Unemployment was associated with a higher rate of committing crimes for material gain, but not with other types of crimes, thus indicating that financial need may be the link.

Chiricos (1987) reviewed the findings of 63 studies on the linkage between unemployment and crime. He concluded that property crimes, data from the 70s, and sub-national levels of aggregation produce consistently positive and frequently significant correlation. On the other hand, he found a negative correlation between unemployment and crimes of violence. Saying that the 'opportunity effect'(4) reduces the scope for crime, he concluded that the financial motivation effect is strong enough to show that there is a strong correlation between unemployment and crime.

Unlike many earlier studies, Raphael and Winter-Ebmer (1999) found a significant and positive effect of unemployment on property crimes as well as

(1) This is not biased by the transfer of unemployment benefit claimants to sickness beneftit claimants, as discussed in *Section 2* of the Draft Phase 2 report.
(2) BCS, 2000
(3) BCS 2000, p. 57
(4) This suggests that lower economic activity leads to fewer crime targets and brings about better protection of property.

crimes of violence. The latter has often been shown to be negatively correlated to unemployment, but the authors correct for what they call an omission of variables in those studies by including variables of 'crime fundamentals' such as alcohol consumption.

Table A1.2 Elasticities of Crime - A Summary of Studies*

	Type of Crime								
	All Property	**Burglary**	**Larceny**	**Auto Theft**	**All Violent**	**Murder**	**Rape**	**Robbery**	**Assault**
Avio & Clark (1976)a		0.4	0.17	0.16				0.08	
Holtman & Yap (1978)a		0.39	0.59					-0.29	
Chiricos & Norton (1982)a		0.17	0.33	0.35				0.58	
Mathur (1978)a		0.04	0.14	0.09				-0.01	
Avio & Clark (1978)a		0.76	0.67					0.86	
Furlong & Mehay (1981)a		1.57	1.53					1.46	
Raphael & Winter-Ebmer (1999)	1.38	2.03	0.99	1.72	0.62	-1.37	-0.28	1.12	0.58
Dickinson (1994)b		0.4							

Notes:

* A one percent change in unemployment brings about percentage changes in each category of crime as stated in the relevant columns, eg according to Avio and Clark, a one percent increase in unemployment leads to a 0.4 percent increase in burglary.

(a) Source: Chiricos (1987)

(b) Source: Home Office (1994)

Table A1.2 outlines the elasticity of crime with regards to unemployment. It is important to note that the numbers have been derived using different methods and types of data.

A1.3.2 Concluding Remarks

Although there is no consensus amongst authors as to whether unemployment has an independent effect on crime, its seems plausible to suggest that unemployment will increase at least some crime rates. In particular, there seems to be a strong link between unemployment and property crimes, where the elasticities across studies are quite similar.

A1.4 IMPLICATIONS FOR WEST CUMBRIA

A1.4.1 Health Impacts

The literature review identified studies that have found a correlation between unemployment and health. The studies suggest that mortality rates of the unemployed are 21 to 111 percent higher than amongst the employed

individuals, and even higher if suicide is considered alone. The unemployment forecasts set out above have been used to identify the possible impact on health in the community. Because the overwhelming proportion of any jobs lost on site will be done by males, we have used mortality data for men in preparing this assessment.

Data from National Statistics indicate that the number of male deaths per 100,000 of population for all causes in the North West is 1,039 per annum. To indicate what this might mean for West Cumbria, this figure must be divided by 100,000, multiplied by the increase in the number of unemployed and then increased by the estimated percent increase attributable to unemployment. The results are presented in *Table 1.*2.

Table A1.3 Possible Range of Impacts on Mortality by Scenario: Compared with Current Plan (Average Impact on Deaths per Annum 2001 to 2025)

Scenario	Impact of a 21 Percent Increase in Mortality	Impact of a 111 Percent Increase in Mortality
Current Plan	-	-
Blue Sky	-4	-21
Minimum	3.1	16.2
Stop ASAP	1.4	7.7
Impact of Additional Employment Creation Projects	*-5.2*	*-27.3*

Source: ERM analysis

The results in the table suggest that:

- the additional employment created under Blue Sky would reduce mortality;
- the lower employment associated with both Minimum and Stop ASAP would be likely to increase worker mortality; and
- the additional employment creation projects reduce mortality by more than either of the do-minimum scenarios increase it.

Although many of the studies reviewed did find a correlation between unemployment and mortality, other studies have argued that the correlation is not proven. Therefore, these results should be viewed with caution and treated as indications of possible scales of impacts rather than reliable forecasts.

A1.4.2 Impacts on Crime

The literature of the impacts of unemployment upon levels of crime has suggested a positive relationship between increasing crime and increasing unemployment. The correlations vary according to the type of crime, and to

the research methods used. For example, for every 1 percent increase in unemployment the estimates for the increase of:

- burglary are from 0.04 percent to 2.03 percent;
- car theft are from 0.09 percent to 1.72 percent; and
- robbery are from -0.29 percent to 1.46 percent.

Figure 7.2 illustrated that unemployment would vary considerably under different scenarios, and it therefore appears that scenarios could have a marked impact upon the incidence of crime.

Annex B

Employment at other BNFL sites

B1 EMPLOYMENT AT OTHER BNFL SITES

This annex presents a summary of direct employment at other BNFL sites. For comparison purposes, on-site employment figures for Sellafield have also been included.

Table B1.1 Employment at Other BNFL Sites

Site	Activity	Employment	Percent of TTWA Employment	Percent of TTWA Unemployment
Sellafield	*Waste Management, Decommissioning, Fuel Reprocessing, R&D etc*	*12300*	*25†*	*260†*
Risley	Headquarters and Engineering	2000	1.2	34.3
Capenhurst	Decommissioning and storage of Uranic materials	292	1. 3	18.9
Hinkley Point A	Magnox Power Station	220	0.7	20.4
Maentwrog	20 MW Hydroelectric Power Station	7	0.1	1.8
Sizewell A	420MW Magnox Power Station	450	2.3	73.3
Berkeley	267 MW Magnox Power Station	1200	3.9	134.8
Chapelcross	168 MW Magnox Power Station	423.5	4.2	121.7
Hunterston	500 MW Magnox Power Station	169	0.4	4.0
Oldbury*	434 MW Magnox Power Station	400	0.1	4.5
Springfields	Fuel Manufacture	1,724	1.0	39.8
Bradwell*	246 MW Magnox Power Station	277	0.1	3.1
Wylfa	980 MW Magnox Power Station	807	4.8	51.9

† Note that these figures relate to two Travel to Work Areas (TTWAs) – Workington and Whitehaven

* These sites were unable to provide an estimation of the numbers of contractors they use (eg Oldbury uses 48 companies and is unable to say total full time equivalent labour demands).

Annex C

Bibliography and Key Consultees

C1 BIBLIOGRAPHY AND KEY CONSULTATIONS

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Annex D

Glossary of Terms

D1 GLOSSARY OF TERMS

ACORN	A Classification of Residential Neighbourhoods
AEA	Atomic Energy Authority
AGR	Advanced Gas-cooled Reactor
BNFL	British Nuclear Fuels plc
BWR	Boiling Water Reactors
CACI	An income data service
CEGB	Central Electricity Generating Board, former name of the UK's state owned electricity generator
DETR	Department of Environment, Transport and Regions
DWG	Discharges Working Group
ERM	Environmental Resource Management
FTE	Full Time Equivalent
GCSE	General Certificate of Secondary Education
HLW	High Level Waste
ILO	International Labour Organisation
ILW	Intermediate Level Waste
KSO	A Swedish nuclear power company
LLW	Low Level Waste
LWR	Light Water Reactors
MDF	MOX Demonstration Facility
MOX	Mixed Oxide Fuel
MP	Member of Parliament
MWe	Mega Watte
NCHA	North Cumbria Health Authority
NCO	Non-commmissioned (military) Officer
NOMIS	National Online Management Information System
NGO	Non- Government Organisation
NVQ	National Vocational Qualification
ONS	Office of National Statistics
Pu (WG)	Plutonium (Working Group)
PWR	Pressurised Water Reactors
RDC	Rural Development Commission
SFMO (WG)	Spent Fuels Management Options (Working Group)
SMP	Sellafield MOX Plant
SRS	Savannah River Site (US nuclear installation)
SSEB	South Scotland Electricity Board (former state owned electricity generator for southern Scotland)
Thorp	Thermal Oxide Reprocessing Plant
TTWA	Travel to Work Area
UKAEA	United Kingdom Atomic Energy Authority
UNRECO	The UK's supplier of enriched uranium
VAT	Value Added Tax
VHLW	Very High Level Waste (radioactive)
VSEL	Ship builder at Barrow-in-Furness (now a part of Bae Systems)
WVP	Waste Vitrification Plant
WWG	Wastes Working Group

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