Erik Hansen and
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Environment and Living Conditions on the Kola Peninsula

Fafo

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Preface

The background to the present report lies more than five years back in time. In 1992, Fafo carried out the first living conditions survey on the Kola Peninsula at a time when Russia was only just setting out on the road to reform the planned economy into a democratic, market-oriented society. This was the first time that comprehensive living conditions data from this region became available for a Nordic audience, which previously had known precious little about their neighbours on the Russian side of the border. Now, five years later, cross-border contact between the Northern regions of Russia, Sweden, Finland and Norway have become formalised in the Barents Region cooperation, and has become next to routine. This has further spurred interest in the development of reform in Russia in all the Nordic countries. With regard to the social effects of the reform programme and the transformation of everyday life for the citizens, the only way to separate fact from fiction is to ask the affected population itself what their lives look like, and in the first part of this report the Kola population speaks through the figures presented. The purpose of this part is to present an updated overview of the living conditions of the population in the surveyed areas, and to give a systematic comparison with the figures revealed five years ago. In this manner, an impression of the effects of changes taking place in Russian society can be gained, although five years is a relatively short period to observe social changes. Our aim has been to make updated and reliable information on the social development on the Kola Peninsula available to the international community. Policy planners in governmental bodies, NGOs and private enterprises, as well as those with a personal interest in the region are among those for whom this report is intended.

In the Nordic countries, much attention has been devoted to the state of the environment on the Kola Peninsula. The region is heavily industrialised, and many have come to associate the peninsula with images of industrial wastelands, scarred by decades of unmitigated pollution, as portrayed by the media. Fewer are aware of the fact that the Kola Peninsula also contains enormous areas of pristine wilderness, with flora and wildlife close to being unparalleled in Europe. In the survey, the population was asked how they themselves perceive how environmental degradation in the industrial centres affects their lives, and in the second part of this report, their answers are systematised and presented.

The project has been carried out in cooperation between the University of Oslo, The Norwegian Radiation Protection Authority and Fafo – Institute of Applied Social Science, and financed by a grant from the Royal Norwegian Ministry of Foreign Affairs.

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Oslo, December 1998
Erik Hansen Arnfinn Tønnessen

Part I
Development of Living Conditions, 1992–1997

Chapter 1 Introduction

1.1 Purpose of and background to the report

The purpose of the present report is to describe the development of living conditions on the Kola Peninsula over the five-year period 1992–1997 on the basis of data from comprehensive living conditions surveys carried out during these two years[1]. These observations, which were made with a five-year interval, allow not only for snapshot-type descriptions, but also for the study of how living conditions have changed over the intermediate time, and how the economic and social dynamism has affected different population groups. This is the first time such data has become available specifically for this region.

The surveys were conducted according to a model which has become standard in the Scandinavian countries, where they are routinely carried out as part of the programme for social and economic monitoring of the population. Therefore, the data are to a large extent comparable also to similar data from the Nordic countries. In 1994, Fafo also carried out similar surveys in the Baltic area (Estonia, Latvia, Lithuania, St. Petersburg city and the Kaliningrad enclave) in cooperation with local institutions. The present report can therefore both be read in its own right, as well as be seen as a complement to the previous reports from Fafo in the field of monitoring living conditions in Western Russia and the Baltic countries through the reform period.

The availability of time-series data allows for a systematic review of how the population on the Kola Peninsula has responded to and adapted to ongoing reforms in Russia. However, it has not been the purpose of the author or anybody else involved in the survey to pass judgement on the reform policies of the government of the Russian Federation. The survey results are valid only for the very limited geographical scope of the survey area, and this is only one region in the vast continent which is Russia. The report sets out to show how households and individuals have adapted to the changing circumstances of life in this particular region, based on the prevailing industrial and natural preconditions.

[1] Both surveys are described in detail in Appendix 1.

1.2 Reform and social change

This said, it must be emphasised that the statistical measurement of living conditions in Russia does in fact pose a number of methodological and conceptual challenges, particularly when the analysis attempts to portray changes over the present period of reform. It is fairly evident that living conditions have changed considerably over this period, not only in terms of the quantity of welfare goods available to the population, but also in a qualitative sense. Even if the data sets from the two surveys by and large measure the same parameters, some phenomena which were prevalent and important in 1992 are no longer relevant today. There are no longer any palpable shortages of consumer goods, and the shopping queues have disappeared. Instead, the introduction of privatisation and a real, though still inflation-ridden money economy have brought real choices to the Russian consumer. On the other hand, unemployment was a crime under the still-existing USSR penal code in 1992; this situation has been replaced by labour conditions where unemployment is a real threat. These and a great number of other, similar fundamental changes in the organisation of economic and social life have redefined the entire framework within which people form their living conditions. In this context, the very meaning of many of the factors which constitute living conditions has changed. In addition, this redefinition of the value attached to these and other living conditions parameters has required a thorough psychological reorientation on the part of the population.

In many respects it seems fair to acknowledge the assertion many tend to make, namely that Russia in 1997 is a totally different society from 1992, and that the two really cannot be meaningfully compared. Most long-term observers of Russia will tend to agree, however, that this alleged change at least partly is a case of *plus ça change, plus ça reste la même*. The present reform drive can to a certain extent be seen as a modernisation effort, but unlike previous periods of modernisation in Russia, as witnessed by the collectivisation of agriculture and the introduction of the five-year plans in the thirties, present reforms have been remarkably non-violent and have left the fabric of society intact. The presently encountered insistence on the magnitude and speed of change can at least partly be ascribed to a certain selective attention on the part of the observers. New and unfamiliar phenomena are more keenly noticed than the old and familiar. Prime examples of the understandable effort to adapt new political solutions to pre-existing systems can be found both in industrial policy and in administrative practices, demonstrating the more or less unbroken consistency with previous periods.

These and several other manifestations of the reform process in Russia do not only infuse this process with a number of contradictions, paradoxes and

antagonisms; it is also a challenge to established ways of regarding social change. The "classics" of modernisation theory tend to emphasise how social change is generated from within the civilian society, mostly in opposition to an established order. Broadly speaking, the focus is put on how technological or organisational change leads to the emergence of new social classes, which rise to political power, displace former elites and establish new regimes. This structuralist view, which is based mainly on the Western European historical experience, contrasts with the reform process in Russia, which since its beginning with General Secretary Gorbachev's famous perestroika initiative typically has been initiated and instituted from "above" through the political sphere. Changes have been generated, planned and executed from within the political sphere proper, and subsequently foisted upon a largely unprepared population. Thus, the reform process has been an attempt to achieve social change and development by political design, with political change preceding the social. In this perspective, the present attempt to transform and modernise Russian society is "typically Russian", with several historical precedents, the most notable of which is probably Peter the Great in his efforts to break Russia out of what he saw as medieval backwardness, and turn the country into a modern European power.

The corollary to this is that most of the social change which has taken place in Russia since the start of perestroika largely takes the form of a *response on the part of the population to politically generated changes in the framework of economic and social action*. This does not mean that the changes have been minor, or that their impact has not been thorough; on the contrary, even a casual visitor to Russia cannot have failed to notice how the entire face of Russian society has changed over the period since 1992. However, fundamental social change, in the form of shifts in the power structure, social stratification, political cultures and administrative practices, modes of production and economic organisation is a much slower process. Social formations are by their very nature characterised by inertia and resistance to change, and in Russia political change clearly proceeds at a much faster pace than the transformation of structural traits of society itself. This transformation clearly happens very gradually and is formed by the adaptive and reactive behaviour on the part of the population to the new opportunities provided by political design.

1.3 Macro-Economic Changes 1992–1997: Shock therapy and beyond

Put very simply, living conditions are formed by the interplay between the accumulated resources held by individuals and households on the one hand, and the development of the economic context in society at large on the other. The prevailing state of the economic environment will influence the manner in which the households' resources are valued, as well as the availability of opportunities to convert these resources into welfare. In order to properly assess household and individual living conditions, these contextual elements must be taken into consideration.

Being the year of the notoriously famed economic "shock therapy" introduced by the newly-elected Yeltsin-Gaidar administration, 1992 is generally remembered by the Russian population as a fairly grim year. The first survey described in this report was conducted in the spring and summer of 1992, when the effects of this initial step on the road to reform were increasingly felt by the population, mainly in the form of price increases of products which formerly had been massively subsidised.

The "shock therapy" approach was based on monetarist principles, which have price liberalisation and abolition of state subsidies to industry as core elements. The idea was that when prices are allowed to float freely, the forces of supply and demand will balance prices at a level reflecting resource scarcity and thereby encourage new market entrants. Along with the removal of subsidies for consumer goods, which previously had kept the price of bread at the same nominal level for thirty years, price liberalisation caused most consumer prices to more than triple within the first month. Spiralling inflation could leave a life's worth of savings close to valueless almost overnight, and widespread hoarding of consumer goods and foodstuffs left shops even more empty than usual.

Prime Minister Yegor Gaidar based this economic policy mainly on the relatively positive experience gained in Poland with similar measures, and in the years following 1992 much has been said and written about the appropriateness of the "shock therapy" and its effectiveness as an instrument for economic reform. Mainly the critics have focused on the lack of attention devoted to institutional structures and the inherent rigidities in the monopolistic planned economy, which became the main obstacles to full implementation of the monetarist programme. Unlike in Poland, where prior to reform a small, but vital private sector had been in existence which could step in to fill the void, the Russian industrial monopolies were left without competitors, and could retain their hold on the domestic market, and offset production declines by just raising prices. However, on the positive side, the "shock therapy" policies can be said to represent a unified vision of the direction

of the reform, and a focused, goal-oriented approach, which has been less pronounced in the subsequent period.

After Gaidar resigned from office he was followed by Viktor Chernomyrdin who was also committed to continued reforms, though at a slower and less painful pace. Reforms towards market relations in the economy have progressed, though consistently hampered by a number of obstacles, both political and economic in nature. Most serious is the still patchy and contradictory legislation in the field of business activities. A great number of laws and decrees have been passed in the reform period, but due to the lack of a basic consensus over reform goals in the legislative assembly, these laws and regulations lack basis in a coherent industrial policy and a clear image of what the post-transition state of the economy should look like. As a result, a great number of the enacted regulations are in direct contradiction to each other, and many basic legislative tenets of a market economy are still lacking. Needless to say, this has made enforcement difficult and haphazard and has undermined respect for the letter of the law.

The Russian state has also inherited an economy with large social obligations and guarantees, prevalent in the Soviet system. In the reform period, several new types of benefits and allowances have been introduced in response to political pressure to ease the situation for selected groups. A recent overview of existing benefits revealed that close to 80 per cent of the Russian population is eligible for some type of benefit, ranging from direct cash support to subsidised telephone and public transport. In order to finance these as well as the other obligations resting on the Russian state, the government has been forced by fiscal necessity to raise the taxes levied on enterprises to extraordinary levels, while enforcement of the taxation regime has proven to be difficult. Actual tax collection has therefore been lower than projected, resulting in an ongoing budgetary crisis.

1.4 Privatisation

The factor which has been most consequential in transforming Russian society over the last five years is probably the growing privatisation of industry, trade and the housing market.

The private sector's share of employment had by 1996 grown to approximately 40 per cent of the total employed population. The share of GDP or value added generated in the private sector is not easy to estimate correctly due to the still remaining deficiencies of the reporting system, as well as the unclear legal regime surrounding private enterprises, though it is overwhelmingly probable that both

these indicators are well over 50 per cent of the total. One of the most outstanding and visible features of this development is the emergence of income inequalities on a scale unequalled since the days of the last Czar. The top of this income distribution consists of an openly wealthy class of people, generally termed the "new Russians", whose ostentatious display of their new-found wealth has become a media favourite, both in Russia and abroad. At the other end of the wealth scale, economic dislocation and structural adjustment in industry have created a growing class of underprivileged who are just barely getting by, or even living in abject poverty. This development has been a political problem in Russia during almost the entire reform period, as it is a cause of much understandable resentment in the population.

The transfer of industry from state ownership to private hands has also entailed the introduction of increasingly market-oriented principles in the labour market. Even though the initial fears of mass unemployment have so far proven exaggerated, the guarantees for a secure job and income provided in the USSR have been replaced by a situation where the continuation of a workplace and an income is dependent on the success of the enterprise in the marketplace. The amount of psychological reorientation with respect to attitudes to employers and their own work required of the workforce is sometimes difficult to grasp for foreign observers. Needless to say, market principles have still to be fully introduced in all Russian enterprises, and orderly labour relations will still take some time to organise, even if the main ramifications of both have been established in the short period which has elapsed since the reform process started.

Another effect of privatisation is the reorganisation and divestiture of the social infrastructure previously owned and operated by the state-owned enterprises. In the USSR the state bore the responsibility for virtually all aspects of the lives of its citizens, including their material and social welfare. In addition to paying wages, industrial enterprises were also used as providers of social benefits, both cash benefits as well as in the form of a large proportion of the social infrastructure, such as schools, childcare facilities, health care institutions, sports complexes and holiday homes. In fact, according to ideological tenets, it was envisaged that an increasing share of the population's needs should be covered in this latter form, and not through wages, as a way to "decommoditise" labour, i.e. gradually remove the sale-and-purchase relation between employees and enterprises with respect to labour. In addition, many enterprises responded to the perennial, though artificial labour shortage in the Soviet economy by investing in social infrastructure as a method to attract labour power. In particular, provision of enterprise-owned housing was virtually a necessity in order to attract sufficient labour in many regions, in the face of the desperate housing shortage which plagued the Soviet economy. Due to the constant shortages of food products in Soviet shops, many enterprises also established their

own systems for the distribution of groceries and manufactured goods to their employees, in addition to, or as a supplement to cash wages. The combined value of the social benefits could in many instances exceed the value of cash wages paid to the workforce.

Privatisation of industry has entailed a shift away from this method of benefits provision, as the privatised enterprises for obvious financial reasons are unwilling or unable to uphold these services, which should be borne by local or central authorities. However, the divestiture of these assets to local governments is far from straightforward, for both economic and legal reasons. In the meanwhile, a great number of questions pertaining to who should supply these services, and in what form, remains unsolved. The problems involved in this transfer of responsibilities demonstrate in a very illustrative manner the problems involved in the ongoing reform of the Russian economy.

Because of the often somewhat intransparent accounting practices used in Soviet industry, the full extent of enterprise control over social infrastructure in the USSR is difficult to assess. However, as of 1993, it was calculated that enterprises held close to 80 per cent of the assets related to vacation resorts and sports complexes, 61 per cent of the kindergartens, and 39 per cent of the housing mass, but only 10 per cent or less of schools, cultural facilities or institutions for health care (Lippoldt 1996, p.1). In the following years, these shares have decreased considerably, in particular kindergartens, which in addition to the financial pressures have been the subject of a World Bank-sponsored conversion project. Enterprise-held housing has been addressed by a presidential decree which mandates their transfer to local authorities.

As privatisation of industry started, enterprises began to cut costs, and the social infrastructure was an obvious target. Still, there are many obstacles to complete divestiture of these assets, in particular housing. These obstacles are found both within the enterprises as well as in the authorities. In the prevailing uncertain business climate, many enterprise managers pursue conservative strategies, and are reluctant to engage in full-scale asset restructuring. This pressure stems from several sources, notably the insider control of a number of privatised enterprises. During the first stages of privatisation, a controlling proportion of the shares of many enterprises was obtained by the employees, who are the direct beneficiaries of the subsidised enterprise-held housing. Conflict-avoidance strategies and unclear rules for taxation and regulation may also contribute in the same direction. Managers may also hold on to the social infrastructure, as it gives added leverage in negotiations with local authorities. On the other hand the authorities may often be reluctant to assume responsibility for such assets, due to the lack of public financial resources

for maintenance. Further, privatisation of the enterprise may have been made conditional on the continued maintenance of the social infrastructure.

Nevertheless, the number of enterprise-held social infrastructure assets has declined considerably during the reform period. In many cases, this has taken place through various partial measures. Some institutions have been closed down whilst in others user charges have been introduced, whereas others have been established as separate business units, particularly in the case of vacation resorts. Still, profitability is not the only consideration for managers facing a decision on divestiture of social infrastructure assets.

The value attached to these enterprise-supplied services by the workforce was demonstrated following the decision to close an amber mining facility in the Kaliningrad region. The workers claimed that they would rather stay in the company without cash wages, provided that the social infrastructure could be maintained.

The privatisation of trade has likewise had profound effects on the organisation of daily life, and has contributed to the transformation of the entire face of Russian society. Retail trade in consumer goods was a perennial bottleneck in the economy for almost the entire existence of the USSR. Retail trade shops were not market institutions, but served as points of distribution. Prices were set centrally, and their purpose was to meet financial balances and transfer income. Usually they did not reflect any resource scarcity. This meant that concepts such as supply and demand, or even cost of production were largely irrelevant to planning. Consumer preference had likewise neither any relevance nor any influence on production decisions. The resulting shortages of even the most basic consumer articles, coupled with a surplus of purchasing power resulted in the notorious and deeply resented queues for which the USSR was famous.

One of the very first effects of the "Big Bang" of reform, which hit the Russian population on 2. January 1992, was a near-tripling of prices of virtually all consumer goods. This represented a release of repressed inflation, as prices soared to make up for resource scarcity in the commodity market. Gradually, the market for consumer commodities has come to resemble forms more recognisable in Western countries, where the situation is the opposite from the one which prevailed in the USSR: there is an abundance of consumer goods available in the shops, but there is a shortage of money in the population. This situation is naturally also resented, although very few Russian consumers wish for the old situation to come back, as the new consumer opportunities actually provide a freedom of choice which was unthinkable in the USSR. The commodity-starved population embraced the liberalisation of trade wholeheartedly, and Russia is on her way to becoming a consumer society.

In the USSR, the infrastructure in the retail trade sector was severely underdeveloped, and in response to suddenly emerging trade opportunities, a number of

flourishing and wholly unregulated street markets sprang up after 1992 to complement the ordinary outlets which were few and far between. Mostly resembling oriental bazaars, these markets have since become a permanent and prominent feature of Russian city life. A large share of the traded goods in these markets are imports brought in by the so-called shuttles (*chelnoki*), private individuals who travel to neighbouring countries in order to purchase consumer articles for resale at home. This opening of the borders to international trade and the abolition of censorship has also exposed the Russians to the entire gamut of international popular culture, including mass advertising, and this has had a thorough effect in its transformation of the face of society as well as on culture and everyday modes of life.

Privatisation of the housing market has progressed at approximately the same tempo as in industry, and roughly 40 per cent of all dwellings are today privately owned, either by the household or by a private landlord. The conditions on which dwellings can be privatised have remained fairly moderate, and within the reach of most households. However, the voluntariness of privatisation has resulted in a situation where one may find a bewildering mix of different ownership forms within the same block of flats, and a consequent unclearness of responsibilities with respect to maintenance and distribution of cost.

The main policy objectives behind the privatisation drive in the housing market are related both to the inability of the overburdened Russian state to cope with the responsibility for construction and maintenance of the housing mass, as well as to the incentives provided by private ownership for improved care and upkeep of the worn and decayed residential areas typical of the Soviet era. As a consequence, many million Russian citizens have become property owners. In the longer term, this will tend to influence their lives decisively, in several respects. Firstly, a major wealth item such as a flat will necessitate long-term economic planning on the part of the household to an extent other than previously, when all citizens were simply tenants of the state. Secondly, the existence of a private housing market may tend to increase geographic mobility, which previously has been fairly low, mostly due to the shortage of available housing.

So far, available data indicate that the privatisation effort has produced little effect in terms of supply of new housing, as the construction of new flats has been hampered by the same lack of clarity in legislation which plagues both construction and manufacturing industries in Russia. Also, it seems as if the average cost of housing has been little affected by privatisation, which remains minor. However, both cost and supply are likely to change as a proper private housing market emerges.

1.5 Organised crime, corruption and the mafiya

One can often hear the allegation that as a consequence of the reforms, organised crime in Russia has grown to frightening proportions. However, it should be borne in mind that corruption and organised crime have had a long and distinguished history throughout the existence of the USSR, and part of the increase in reported crime can safely be ascribed to the fact that this implicit crime type has now become explicit. Corrupt USSR officials, who took bribes and sold positions for cash, were also referred to as the *mafiya*. Furthermore, the emergence of today's criminal networks into the open can partly be ascribed to the continuing alegality of business operations, described above. For example, because of the inconsistent framework of contract law, it is difficult for a business to turn to the judicial system or the police when facing a reluctant debtor. Instead, organised crime can provide an alternative form of contract enforcement, and it may therefore be perfectly rational for businesses to seek shelter under the "roof" (*krysha*), which is the name by which the organised crime groups providing "protection" are known.

Much in the same manner, the partial nature of the reform programme creates opportunities and incentives for both large- and small-scale corruption. Firstly, the remaining controls and regulations serve to perpetuate the monopoly position of the old system, and make it difficult for new competitors to challenge it. Secondly, as wages, particularly in the state sector, continue to lag behind, both in terms of wage level and in regularity of actual payment, the temptation to increase earnings by corrupt means will be present for those in the appropriate positions. (Leitzel 1995, p. 44).

Further, the term *mafiya* is generally applied somewhat indiscriminately in Russian everyday speech, as demonstrated in the following passage:

> "Everywhere I went in the Soviet Union, people simply called it the 'mafia', not literally meaning organised crime in the Western sense, but having that dark connotation. In Soviet parlance, the mafia is a stratum of society that includes powerful Party and government officials, economic managers and criminal elements, an amorphous, privileged layer held in popular contempt for its corrupt life-style and evil tentacles that reach into all walks of life. The 'mafia' is an epithet constantly on people's lips, but hard to get them to define with any precision; it almost always links political power and illicit economic advantages".[2]

This unspecific nature of the *mafiya* as a malevolent, unseen force lurking behind closed governmental doors and tinted car windows makes this type of organised

[2] From: Hedrick Smith: «The New Russians», Vintage Books, London 1990 (p. 91).

crime into a convenient scapegoat for economic hardship. As the distribution of income in a period of economic turbulence is likely to change rapidly, it is easy for those who find themselves at the loosing end to ascribe the success of others as being due to nefarious means. Also, the prevalence of ethnic hostilities and the perceived ethnic homogeneity of criminal gangs may also contribute to such charges (Leitzel 1995, p. 45). However, the pervasive fear of the *mafiya* is in itself harmful to the Russian economy, as it will deter many possible investors who fear that they will have to deal with organised crime. As a conclusion, it can be assumed that further progress of the reforms, with improvements in contract law and the removal of the legal vacuum in which businesses are forced to operate will decrease the scope for this particular type of organised crime (ibid.).

This said, there can be little doubt that the occurrence of "ordinary" (or "disorganised") crime, ranging from petty theft to armed robbery, rape and murder actually has increased in Russia, even if a part of the perceived increase can be ascribed to the publicity surrounding crime. The real increase in the frequency of criminal acts is not only due to the increase in poverty, but even more to the general breakdown of authority structures and the abolition of the authoritarian surveillance of the population.

Still, as in any other country there are large regional variations in the actual rates of the various types of crime. On the Kola Peninsula, there has been a near-doubling of reported violent crime since 1991, including murders, robberies and pre-meditated infliction of grievous bodily harm. Crimes against property (theft and larceny) have been remarkably stable over the last 5-6 years. Table 1.1 shows rates of reported crimes on the Kola Peninsula in comparison with Norway for 1995. It should be borne in mind that Norway is an untypically peaceful country with respect to crime.

As can be seen, the Kola Peninsula has higher rates of violent crime in the form of murders and robberies, as regards other types of crime, even peaceful Norway has a far higher occurrence. This is not to say that the news of soaring crime

Table 1.1 Crime rates. Registered crimes per 100,000 of population, 1995

Crime type	Kola Peninsula*	Norway**
Murder and attempted murder	12.8	2.5
Rape and attempted rape	4.3	10.62
Aggravated assault	42.8	56.7
Theft and larceny	715.7	4203.2
Robbery	92.6	24.9
Possession and use of drugs	9.0	234.4

Calculated from: * Goskomstat (1) 1996, p. 83 ** SSB 1997, p. 134-135

rates in Russia has been overstated, as a very large number of actual crimes are not reported to the police. In a survey carried out in St. Petersburg in 1994, a full 14 per cent of the adult population reported having been exposed to a robbery or "mugging" during the previous 12 months (Hansen 1996, p. 135). However, this demonstrates the large regional differences in the occurrence of crime, and is evidence that the crime situation in Russia has more nuances than is sometimes assumed.

1.6 Living Conditions Analysis and the Myth of Russian Differentness

As a student of living conditions in Russia, one often encounters the allegation that "Russia is so different that it is impossible for a foreigner to understand Russia and the Russians". Indeed, even the most casual visitor to Russia is likely to encounter this attitude in some form, and several foreign observers even subscribe to it. However, this attitude is not a new phenomenon; it has been prevalent for centuries, and was most vehemently voiced by the romantic writers of the 19th century. Russian literary history is full of this emphasis on Russia as a singularly unique and special country, following a "unique path" or *Sonderweg* through history, with one foot in Europe and one in Asia. The author Pyotr Chaadaev said that: "When speaking of Russia, one often believes that this is a state like any other; in reality, this is not so. Russia is a completely separate world". Konstantin Aksakov agrees: "Russia is in its most proper sense something quite separate, without the most remote likeness to the states and nations of Europe".[3]

Some authors have even coupled this belief in separateness to a particular Russian mysticism, a dimension of esoteric secretiveness and unfathomable holiness. The best known expression of this mystic view of Russia stems from the romantic poet Fyodor Tyuchev: "Reason cannot grasp Russia ... In Russia you can only believe". Dostoevsky likewise held that Russia is enigmatic and inscrutable to the rest of Europe: "The West will sooner invent the *perpetuum mobile* or an elixir of eternal life, rather than grasp the nature of Russianness, its mentality and temperament"[4].

This age-old Russian self-image is today perpetuated in the firm belief that the manifestations of the Russian transition model are so unique that nobody except

[3] Quoted from: Ryszard Kapuscinski: «Imperiet», Aschehoug, Oslo 1994.

[4] ibid.

the Russians themselves can understand and interpret them in a "true" manner. Needless to say, everybody has his or her own perception of what this uniqueness actually consists of, but the core idea that Russia is something very separate and unique is rarely questioned.

This deeply irrational faith is extremely seductive, and it is subscribed to also by several foreign writers on Russian affairs. Nevertheless, an attempt to analyse living conditions in Russia on the basis of Scandinavian methodology must necessarily challenge this truism. What is most often seen when the cold, numerical data are processed, is that these allegedly deep cultural differences tend to disappear. What is evident, however, is that living conditions in Russia as elsewhere are context-dependent, based on the historical premises created by the economic and political order institutionalised in the given country of study. As evidenced by the data presented in this report and many other similar studies, given similar circumstances, the Russians tend to respond in a manner very similar to those found in other parts of the world, and according to very recognisable rules of logic. Accordingly, in an analysis of living conditions, the effect of these contextual elements surrounding the given scores for living condition parameters must be kept carefully in mind. It would be premature to interpret statistical indicators of welfare in Russia under the immediate assumption that these carry the same values in terms of actual welfare as in a developed market economy, even if Russia today actually is moving in that direction. Present conditions in Russia ought to be interpreted on their own premises, which are formed by the transitional stage Russian economy and society are in. However, this type of "differentness" is probably not the one that Dostoevsky had in mind. Still, the analyst should bear in mind that "qui proficit litteris, sed deficit moribus, magis deficit quam proficit"[5]

1.7 Description of the Survey Area

The 1992 survey

For economic and practical reasons, it is near impossible to conduct a survey over the entire surface of the Kola Peninsula, so a choice of geographical delimitation of the survey area had to be made for both of the rounds described in this report. The 1992 rounds of interviews were carried out in Murmansk city, Severomorsk city and the settlement Nikel, including some surrounding rural areas.

[5] He who has knowledge in abundance, but lacks acquaintance with custom, loses more than he gains.

Murmansk is the major city on the peninsula and the administrative centre of Murmansk *oblast*. It is located at the southern end of the Kola Bay, approximately 45 kilometres from its outlet into the Barents Sea, and less than 150 kilometres (in straight line) from the Norwegian border at Kirkenes. The city is built on three natural terraces on the eastern side of the bay. Murmansk is a young city, founded in 1916 as a trade port and terminus for the railway constructed from St.Petersburg/ Petrograd in response to the need for an ice-free outlet to the sea during the First World War. The city grew very rapidly over the first decades of Soviet power, and growth continued even more intensely in the post-war years. Murmansk was one of the main ports for both fishery in the Barents Sea, the USSR merchant fleet and Northern Fleet of the Soviet Navy. In conjunction with the fisheries, the city also has a considerable shore-based fish processing industry, in addition to a varied industrial base in metalworking and other manufacturing. In 1996, the city had 398,109 inhabitants

Severomorsk is almost entirely a military settlement and the headquarters for the Russian Northern Fleet. It is located 40 kilometres north of Murmansk, on the eastern side of the Kola Bay. Even if the military character of the settlement dominates, it also has a civilian sector consisting of the support apparatus for the Navy, such as shipbuilding and repair, as well as schools, retail trade, etc. Severomorsk had 85,164 inhabitants in 1996.

Pechenga *raion* (municipality), with the settlement Nikel, stretches along the border whith Norway and Finland, with a total area of 10,470 km^2. In 1920 the area became part of Finland, but reverted to Russia in 1944. In 1934, the Finns were the first to start mining for nickel there, and life in the settlement has since been dominated by the large nickel mining and smelter facility. Nearly all families in Nikel depend on the nickel extraction for their livelihood. In the Norwegian media, Nikel has become infamous for the emissions of sulphur from the smelter, which have destroyed much of the sparse Arctic vegetation around the settlement. Still, Nikel remains a fairly well-functioning community, with 18,400 inhabitants in 1996. Pechenga municipality also has several military garrisons, manned mainly by border troops. The total population of Pechenga municipality (including Nikel) was approximately 50,000 in 1996.

The 1997 survey

In the preparations for the second round of interviewing, it was the aim of the survey designers to keep the design as close as possible to the first in order to maintain a high degree of comparability of results. However, in a presidential decree enacted in October 1996, Severomorsk was declared a "closed territorial formation", and was henceforth out of bounds for survey purposes. Following a suggestion from the

local survey partner, the towns of Apatity and Kandalaksha were included to replace Severomorsk. Settlement on the peninsula is broadly concentrated in a north-south belt roughly following the railway, and the 1997 survey therefore came to comprise a larger share of the industrial population.

Apatity, just like Nikel, takes its name from the local dominant industry. Mining of apatite ore and the production of apatite concentrate is the main employer. In addition, Kola Science Centre is located in Apatity, making it the major scientific centre on the peninsula. Apatity is the second largest town in Murmansk oblast, with 73,200 inhabitants in 1996.

Finally, Kandalaksha is located on the southern shore of the peninsula, on a bay in the White Sea. The town and surrounding area previously belonged to the Karelian Republic, only later to become part of Murmansk oblast. The main industry is aluminium production, as well as forestry and paper production. In 1996, Kandalaksha and the surrounding area had 71,700 inhabitants, whereof 48,300 in the town itself.

Chapter 2
Demography, population and migration

2.1 Comparing population figures 1992–1997

In recent years, the veil of secrecy which formerly shrouded many aspects of life on the Kola Peninsula has been lifted. This applies also to the simple fact of population figures and has given us new insights into the composition and distribution of the Kola population. In the early nineties, it was a known fact that the peninsula contained a number of secret towns, which did not appear on any maps, and where various forms of military-related activities took place. However, their exact location and population were still considered state secrets. Following the increasing openness of Russian society, new information on the population distribution has become available, and five of these formerly secret towns have since 1995 become included in the ordinary civilian statistical reporting system.

However, this complicates an exact comparison of population figures for various parts of the area over the elapsed period of time. According to official statistics, Murmansk city had a population of 472,900 in 1991, a figure which had fallen to 398,100 by 1996, or equal to a reduction of 74,800 or 16 per cent. A large part of this precipitous drop in population can be ascribed to the circumstance that the population in the secret towns in all likelihood were subsumed into that of Murmansk city, but did not appear in any official population register. According to available figures, this population constituted approximately 51,000 in 1995[1]. The remainder of the reduction in the population of Murmansk city seems to be accounted for through regular out-migration. To adjust for this, figures from the 1992 survey have been re-weighted during processing, but this has not given any significant changes in the final results. For the purposes of this report, the adjustment of population figures and concurrent weights concern only Murmansk city, as the 1992 survey did not include any other areas affected by the secret towns. Still, for population estimates concerning the whole peninsula over the last five-year period, a certain error margin is inevitable.

[1] The population in the closed towns increased to over 150,000 in 1996, when Severomorsk *rajon* and the town of Polyarny also were decreed as closed.

2.2 Overall population development

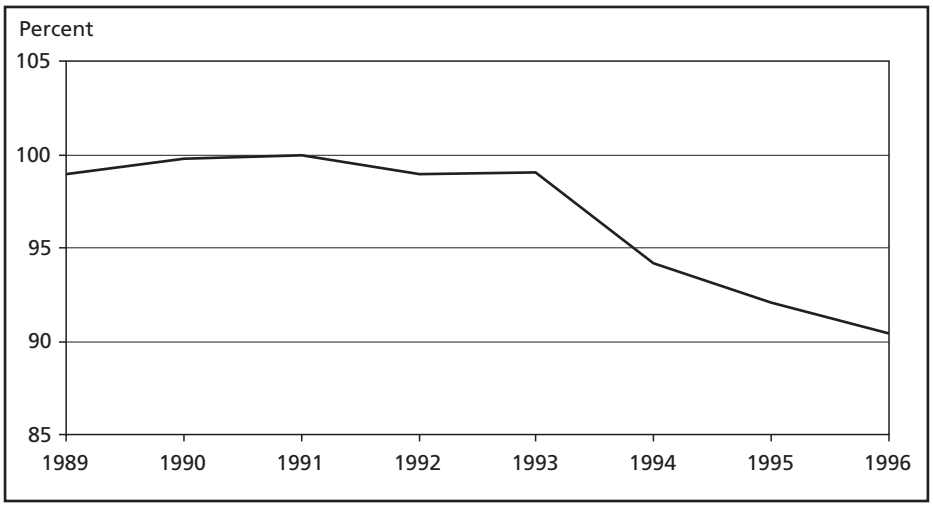
The total figures for population development on the peninsula over the period 1989–1996 are shown in figure 2.1.

As can be seen, the total population figure peaked in 1991, and has since decreased by approximately 20,000–30,000 inhabitants per year (equal to approximately 2–3 per cent), though at a sinking rate. All the northern areas of Russia have seen a tendency towards decreasing population figures, even if this trend is much more pronounced in the Siberian areas, where population decline in some places has reached 10 per cent annually. The decrease is attributable both to net natural population decline and to out-migration, both of which will be given a more detailed description later in this chapter.

The exact population of Murmansk city is more difficult to ascertain, due to what probably has been a reassignment of population figures from the secret towns, described above. It seems, however, fairly reasonable to assume that population development has been approximately equal to that of the peninsula as a whole.

Due to the relatively low average age of the Kola inhabitants, one would expect the birth rate to be higher than the national average, as the share of women in the fertile age is thereby higher than in the country as a whole. However, fertility is correlated also to several other factors, for example urbanity, which in most countries is negatively correlated to fertility. A general observation is that the drop in fertility observed in Russia has been even more pronounced on the Kola Peninsula than nation-wide. A characteristic of the fertility situation in Russia compared

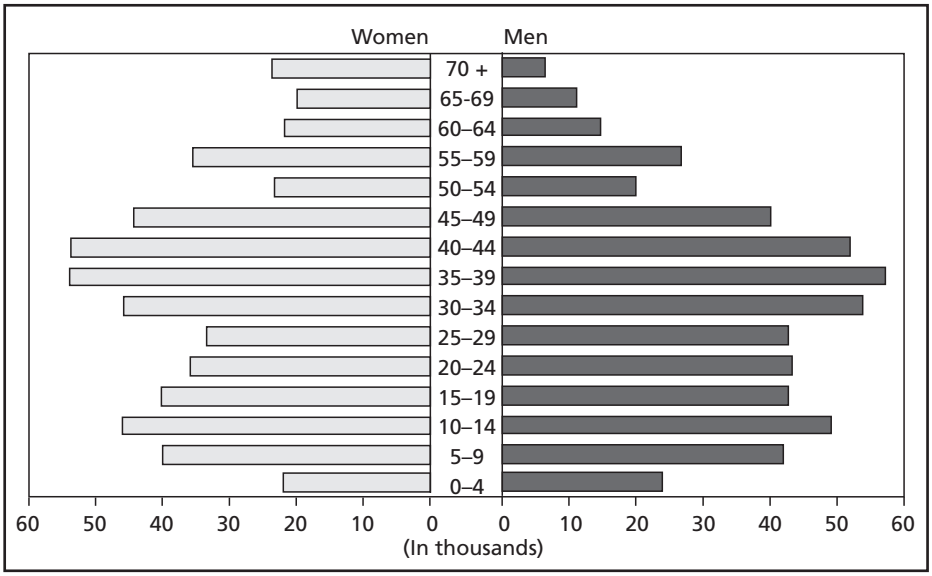
Figure 2.1 Population development 1989–1996, the Kola Peninsula



Source: Goskomstat (1) 1996, p. 14.

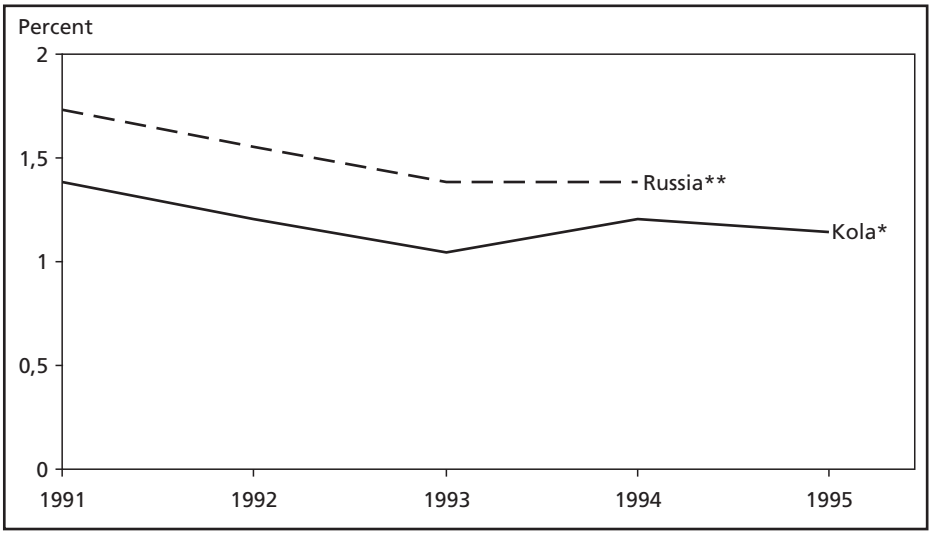
to other low-fertility countries is also the observation that low fertility in Russia is mainly attributable to the reluctance of women to have more than one child. In comparable countries, low overall fertility is caused by the increasing number of women who do not have any children, but those who do, have a greater probability of a

Figure 2.2 The Kola population, 1996



Source: Goskomstat (3) 1996, p. 10-11

Figure 2.3 Fertility rates



Sources: * Goskomstat (1) 1996, p. 19 ** Vishnevsky 1996, p. 41

second or third child. In Russia, a second or third child occur in a relatively smaller number of cases, as demonstrated by the fertility rate, giving the total average number of children born of women over their fertile age interval. Figure 2.3 shows total fertility rates (i.e. the number of children born per woman in the fertile age interval) for Russia as a whole and the Kola Peninsula for the period 1991–1995.

It emerges that total fertility rates on the Kola Peninsula have been lower than national averages throughout the first half of the 1990's, and the trend seems to be continuing. The same trend is discernible in the age-specific gross birth rates (the number of children born in a given year, per 1,000 women in the given age group). Fertility has decreased in all age groups, but to the highest extent in the age groups over 25, causing births to be increasingly concentrated in the lower age intervals (below 20 and 21–25), further increasing the number of children born to teenage and unwedded mothers.

2.4 Mortality

During the 1990's there have been repeated reports of a "mortality crisis" in Russia. According to all available figures, mortality has risen dramatically, particularly among males, and the life expectancy of a Russian male has decreased to below 57.7 years. There Increased mortality rate has also been recorded among females, though somewhat less dramatic.

In Russia, life expectancy for men has gradually decreased since the mid-sixties However, from this trend there has been one exception, observed in 1986 and –87, when life expectancy suddenly increased (Meslé et al. 1996, p. 17). This development has mainly been attributed to the effects of the anti-alcohol laws enacted by General Secretary Gorbachev. Available data suggest that direct alcohol-related deaths decreased by two thirds from 1985 to 1987. Simultaneously, the number of deaths from traffic accidents was almost halved (Goskomstat 1993, p. 138). In the subsequent period, gross mortality figures have increased, and life expectancy dropped to an even lower level than before 1985, and this drop has to an overwhelming extent been on the part of males.

Exactly as in the case of fertility, these nation-wide demographic tendencies make themselves felt on the Kola Peninsula to an even higher extent than in the rest of Russia. Since 1991, age-specific mortality rates (the number of deaths per 1,000 persons in each age group) for males on the peninsula have doubled for the age groups 20–35 and 50–64, and tripled for the intermediate age groups 35–50 (Goskomstat (1) 1996, p. 19). For females, mortality rates have gone up by a smaller margin evenly over most age groups, and remain at nearly half those for males over

all ages, except for the highest (ibid.). On average, a Russian woman lives 13 years longer than a Russian man, and this is presently the highest difference in life expectancy between the genders currently observed anywhere in the world. Mainly, this is caused by the excessive male mortality in the intermediate age groups, which has remained a structural peculiarity of the age distribution of mortality in Russia over the last three decades (Meslé, et al. p. 78).

The most notable causes for this increase are cardiovascular diseases, the occurrence of which has nearly doubled, and deaths from violent causes, which have more than doubled on the peninsula since 1991. In 1995, these two causes accounted for close to 70 per cent of all deaths on the peninsula, for both genders. (Goskomstat, (1) p. 20). Diseases of the respiratory organs and the digestive tract have also more than doubled in occurrence, but account for a smaller share of the total (6 per cent combined). Deaths caused by malignant neoplasms have not increased significantly more than what can be explained by normal demographic processes (aging of the population), and accounted for 12 per cent of all deaths on the peninsula in 1995 (ibid.).

The debate among academics and policy-makers over the causes for this mortality crisis in Russia remains inconclusive, and no final explanation for this sudden jump in mortality has yet been found. The phenomenon has been subject to extensive investigation in both Russia and abroad, but the explanations launched have so far been partial at best, and no comprehensive understanding of this situation has so far been reached.

2.5 Nationalities and indigenous peoples

In many ways Kola society is very much a product of the Soviet period. Before the October Revolution, the settled population in the area numbered some 13,000, and the indigenous Saami population has been estimated at some 2,000. During industrialisation in the 1930's, and also in the post-war period, the area attracted a high number of in-migrants from all over the multi-ethnic USSR. In spite of this, the ethnic composition of the peninsula is fairly homogenous. According to a microcensus of the population carried out in 1994, 86 per cent of the population were ethnic Russians, 7 per cent were Ukrainians, and 3 per cent Belarussians. Thus, the three main Slavic-speaking nationalities of the European ex-USSR accounted for 96 per cent of the population. Furthermore, almost 75 per cent of the ethnic Ukrainians and Belarussians considered Russian to be their mother tongue. (Goskomstat 1995, p. 16-17). Other nationalities listed by the microcensus include Tatars (0.9

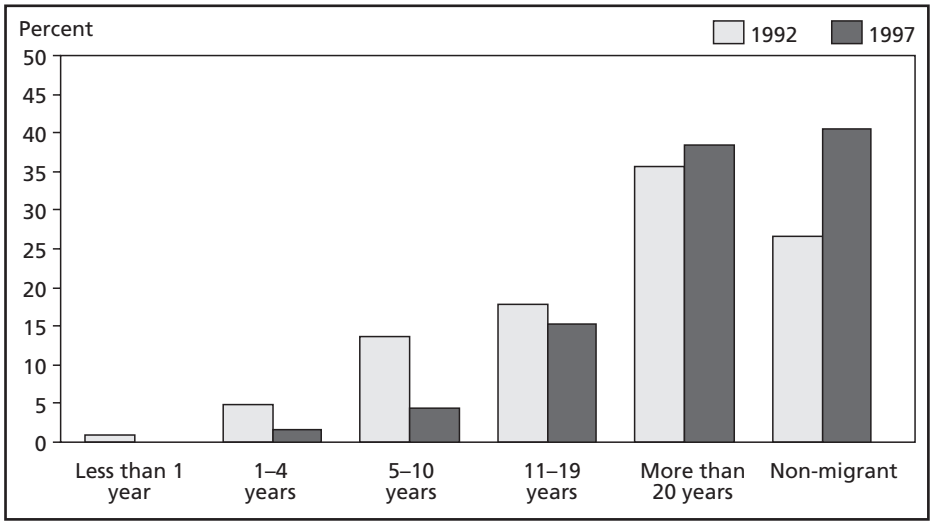
per cent), Mordva, Karelians, Chuvash and Azeris, but among these only the Tatars accounted for more than one half of a per cent of the total.

The last nationwide census of the USSR, carried out in 1989, counted 1,944 individuals belonging to indigenous peoples on the peninsula, whereof the Saami accounted for 1,614 individuals. Nearly all (98 per cent) persons of Saami nationality in Russia live on the peninsula. Even in villages with a concentrated Saami population their share of the total does not exceed 5 per cent (Goskomstat (2) 1996, p. 3). The number of individuals belonging to the Saami nationality has remained fairly constant throughout this century, even if also this ethnic group seems to have undergone a certain russification; during a survey of the Saami population conducted in 1995, more than half of the interviewed persons reported considering Russian to be their mother tongue (ibid., p. 18).

2.6 Migration

The Kola Peninsula has throughout this century been characterised by dynamic migration flows. In the post-war period, the peninsula as a whole had an annual in-migration surplus of 20,000–30,000. Towards the end of the 1980's, this inflow of migrants slowed down, and since 1990, the peninsula has had a negative net migration balance. This annual outflow of population was at its highest in the period 1992–1994, when negative net migration equalled more than 20,000 persons per year (Statistics Finland 1995, p. 6). This loss of population through net out-

Figure 2.4 Length of time of residence on the Kola Peninsula, percentages



migration slowed down in 1994 and 1995, though it is too early to say whether this trend will continue. The negative migration balance is chiefly due to a constant out-migration of approximately 50,000 persons per year, and a falling number of in-migrants. Combined with decreasing fertility, this has entailed a net population loss on the peninsula over the period 1992–1997 equal to approximately 8 per cent.

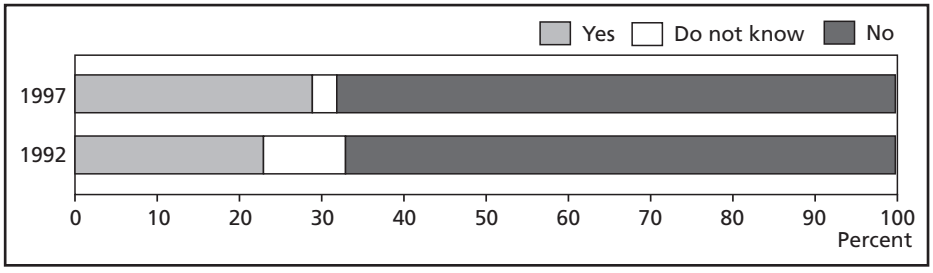
Against this general background, respondents were polled about their previous migration history, as well as future plans to migrate out of the peninsula. A five-year period is a relatively short time for an investigation of possible shifts in the propensity to migrate among different segments of the population, though certain trends can be identified.

Figure 2.4 shows how the investigated population is distributed according to their length of stay on the peninsula.

Firstly, the share of non-migrants would seem to have increased strongly over the inter-survey period. However, it should be borne in mind that the surveys cover different areas, which may vary with respect to the migrant status of the inhabitants. In particular Severomorsk, included in the 1992 figures, had a higher share of transient population, with close to 86 per cent of the respondents being migrants, due to the military character of this settlement. However, the exclusion of military areas in the 1997 figures has not caused a very significant upward bias; only 3 per cent of the change in observed migration status is due to the exclusion of the military areas. A plausible explanation is that inhabitants who are in-migrants are more likely to migrate out again than those who were born in the area, and hence have deeper roots in the local community. The overall trend towards reduced in-migration is further reflected in the smaller share of recently arrived inhabitants with less than 4 years of residence on the peninsula.

Whereas it is fairly simple to record the previous migration history of respondents, an assessment of what future migration behaviour will look like is a lot more complicated. In both surveys, respondents were asked whether they had any plans to migrate out of the area. This should not be interpreted as an estimate of what actual future migration levels will be, as it is impossible to say whether the

Figure 2.5 Plans to move to another place of residence, percentages

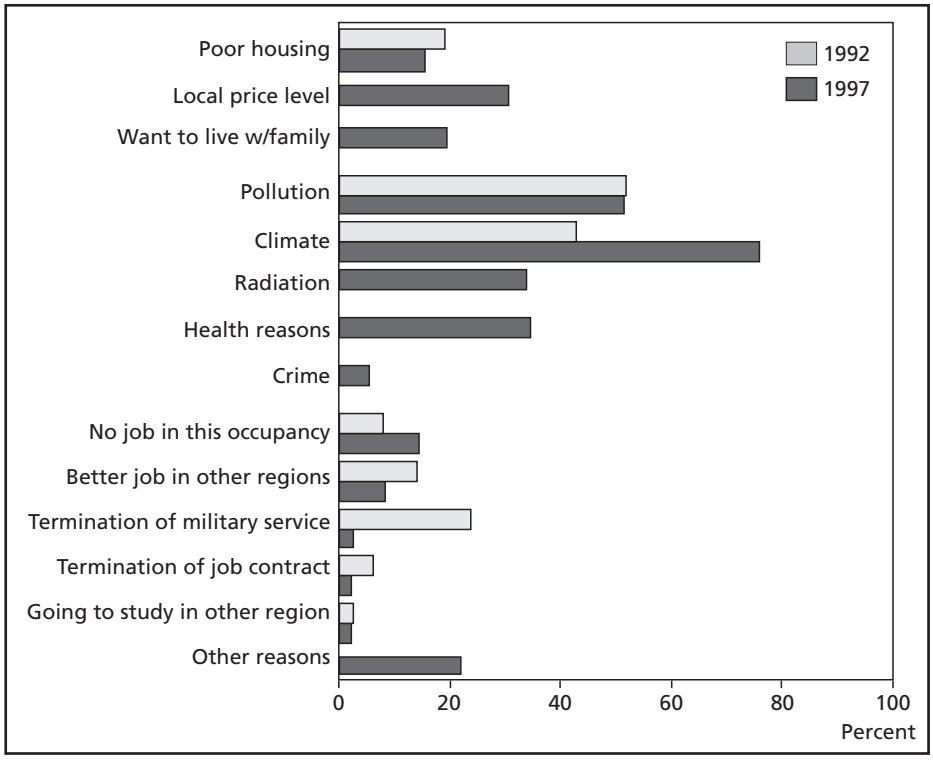


respondents actually will go through with their plans or not. Rather, it is an expression of whether respondents regard migration as an appropriate alternative in their present situation. Responses to this question are summarised in figure 2.5.

As can be seen from the figure, the propensity to migrate is fairly constant among the population. The increase in affirmative responses is mainly due to a reduction in the undecided category. A cautious conclusion to this finding would be that out-migration is considered as an option by a fairly constant share of the population, indicating that the migratory pressure is likely to remain constant at present levels for the coming two to three years. If this estimate turns out to be correct, the inhabitants will continue to leave the region at the same rate as seen in the period 1993–1996, i.e. by approximately 50,000 persons per year.

The reasons why people want to change their place of residence may also vary strongly, and there will often be several reasons working in combination that make somebody finally choose to pack their belongings and settle somewhere else. In both surveys, respondents with plans to move away from the peninsula were asked

Figure 2.6 Reasons stated for the desire to migrate among respondents with plans to migrate, percentages. Multiple answers possible.



*The list of possible responses was expanded in the 1997 survey.

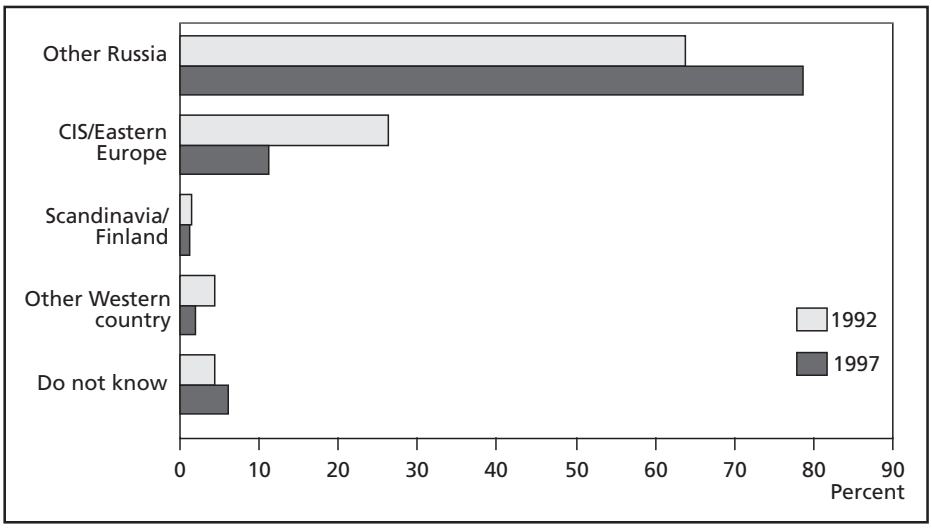
to identify the reasons for wanting to do so from a list of set alternatives. The responses are displayed in figure 2.6.

The listed reasons can roughly be grouped into two different types: whereas the top eight categories broadly can be described as related to "quality of life" the bottom five (except the "other" category) are more directly related to the economic position of the individual and the household. The factors which are mentioned by far the most often are the climate and local levels of pollution, followed by health reasons. The fear of radiation is also prominent when a decision to migrate is made. The four reasons for migration mentioned most often are thereby related to "quality of life", rather than to dire economic necessity, e.g. unemployment. This overall composition of factors which drive civilian migration has remained constant over the inter-survey period, and seems to have not been much influenced by the vagaries of economic reform. Movement of military personnel is driven by other factors, and whereas the discharge of service personnel was a major factor among the survey population of the 1992 survey, this is virtually absent from the 1997 figures, obviously because of the different geographical distribution of the sample, with the primarily military areas excluded.

When these respondents were further queried about their preferred destination, responses were distributed as displayed in figure 2.7.

At both survey points, the overwhelming majority of the migration-prone respondents quite naturally wished to go to another part of Russia. This share has also grown, mainly at the cost of those who reported in 1992 that their preferred destination was in one of the CIS countries or somewhere in Eastern Europe (outside

Figure 2.7 Migration target, respondents who hold plans to migrate, percentages



the former USSR). Many persons of Ukrainian or Belorussian nationality will have an attachment to their home country in the form of family or relatives, and will have these countries as natural destinations. Quite typically, and in accordance with surveys carried out in other parts of Russia, only a very small share of the respondents expressed any desire to emigrate to other parts of the world. The nearby Scandinavian countries and Finland are, despite their closeness, probably not considered to represent an available alternative. Other Western countries in Europe, United States, Canada and Australia, which have traditionally been a destination for emigrants likewise seem to hold little attraction. Even if emigration, in contrast to the previous situation has become legally available as an opportunity, very few seem to favour this as a solution to possible economic problems, or as an attractive alternative to employment at home.

2.7 Who are the migrants?

Other interesting insights into the nature and character of migratory processes can be gained from further investigation of this migration-prone population to see whether they in any way are different from the rest of the inhabitants. This may reveal tendencies in the social composition of the migrant group which will not only shed further light on the dynamics of migration itself, but also on any possible long-term effects of migration on the composition of the human capital on the peninsula.

By using a combination of logistic regression techniques and bivariate correlations, the correspondence between a number of social background variables and the reported proneness to migrate could be investigated. As it turns out, the single strongest predictor of migration-proneness is level of education, followed by age. The proclivity to migrate increases significantly with each added level of education, and reaches 40 per cent in the highest educated group, against 15 per cent among the lowest educated. Those desiring to migrate are thereby systematically better educated than the remainder of the population. A higher level of education tends to be further positively correlated to other social characteristics as well as to a generally higher level of personal resourcefulness.

The tendency to report plans to migrate is also higher in the middle age groups – from 30 to pre-retirement age. The oldest (above retirement age) and the youngest (below 30) report less of a desire to migrate. In other words, the potential migrants tend to belong to educational and age groups who are likely to be well established and in demand in the labour market as well as being relatively financially secure.

This can be further tested against the available indicators of the economic position of the household which partly validates this profile of the potential migrant. If the possession of consumer durables in the household is taken as an indicator of the financial position,[2] a significant positive correlation emerges, meaning that the well-off are more likely to migrate than the financially less endowed. On the other hand, when measured against perceived levels of hardship, no significant correlation with the proneness to migrate is evident, but this can be explained by the evident heterogeneity of the highest educated respondents on this index. In neither of the two survey rounds do reported health, type of household or employment status yield any significant correlations with the reported proneness to migrate.

This social profile of the migration-prone population can thereby shed further light on the reasons this group reports for their desire to migrate. It will be remembered that economic factors seem to play a minor role as a determinant for migration, and the explanation seems to be that those who desire to move are among the most financially secure, as well as more highly educated. Thus, they are in a position of being able to choose where they want to work and live without being forced by circumstances. This freedom of choice puts them in a position where factors related to quality of life – such as the local climate – are allowed to play a more prominent role. What is seen is that people with higher levels of mobility are generally more resourceful than the remainder of the population, and this group also tends to be more concerned about the environment. The correlation between the proneness to migrate and concern for the environment is thereby more convoluted than would appear at first sight. People do not primarily move away from the peninsula because they are concerned about the detrimental effects of pollution on their health; it is rather the other way round – people who move out are more likely to be preoccupied with environmental matters than the non-movers. Moreover, they tend to be less economically vulnerable, hence their focus on non-economic factors as a reason for moving.

In this light, migratory processes on the peninsula become in certain respects similar to those found on the other side of the border, in northern Finland, Sweden and Norway. In spite of the obvious differences in industrial structure, population size and density, these regions have also had a consistent tendency to population loss through out-migration over the last decades. In particular, it has been difficult to attract and keep highly skilled personnel in key posts over longer periods, in spite of above-average wages and benefits. In Murmansk, the Arctic benefits package provided during the Soviet period proved sufficient to attract a high number of migrants, though it would seem as if the relatively higher wage levels which still prevail in the northern regions are increasingly insufficient to weigh up for the

[2] This indicator is described in more detail in chapter 8: "Poverty and Wealth".

discomfort caused by the Arctic climate and local pollution levels. The peninsula therefore seems to be slowly losing in the competition with other regions in Russia for highly skilled personnel. Needless to say, this drain on the pool of skills will influence unfavourably the composition of the human capital on the peninsula in the long term. Experience from the Nordic countries, as well as from survey findings indicate that this process is difficult to control, even with large doses of economic incentives, because economic factors play such a minor role when a decision to move out is made.

Chapter 3 Households

3.1 Economic transition and the changing role of households

As stated in the introduction to this report, the economic transition in Russia has affected all levels of economic organisation, including households. In formal terms the household serves as a primary economic unit, which organises the immediate economic environment of the individuals, as well as the joint resources held by its members. As an economic unit, the household will seek to deploy these resources in order to generate income and hence welfare for its members. However, the households will have very varying types of resources at their disposal, in the form of education, ability to work, savings and property. On the other hand, features of the surrounding society and its various markets will determine what opportunities the household will have to convert these resources into income and welfare. The latter features include demand for various types of skills in the labour market, public redistribution and income policies, etc. which all have a direct bearing on the value of the resources held by the household, as well as the economic framework within which the household operates. Characteristics of the household will also determine the opportunities available for various types of self-help strategies which are not market-based, in the form of exchange of services in family- or community-based networks and other informal economic activity.

As a general hypothesis, it is reasonable to assume that the importance of the households as an economic unit and provider of welfare is likely to have increased in Russia as a consequence of the economic reforms. In the Soviet period, the ultimate responsibility for the welfare of the individual was held by the state, and the households themselves had in general little economic freedom. Housing, employment and care for the children and the elderly were all administered to the individuals by the state. As the Russian state at present is divesting itself of these tasks because of a lack of means, as well as a part of its democratisation and market-orientation, a larger share of these roles has now been put on the individuals themselves and organised through the households. The amount of resources held by the household will thus decide what opportunities the household will have to come to grips with these added tasks, as well as in general adapt to a market-oriented social framework.

The economic situation is for most individuals closely linked to that of their household. Most definitions of 'household' usually include the precondition of jointly pooled resources in some manner, indicating that resources are transferred inside the household from breadwinners to dependents. In socio-economic terms, the household serves as a primary welfare arena, and as a mechanism for the redistribution of income. Some household members, usually those in the most productive age groups, may contribute more in order to support others, and this role distribution will vary over the life-cycle of the household members. In terms of a study of living conditions in a given society, it will be crucial to distinguish between those parameters of welfare which pertain exclusively to the individual on the one hand, and those which the individual can assess through the household on the other. In both surveys, an attempt was therefore made to investigate patterns of household composition. This is not only an important feature of welfare in itself, but in addition this chapter will outline the basic features of a typology of households which will be used as a background variable for the other analyses to be made later in this report.

3.2 Household size

The size of the households in a country or region is determined by a series of influences, such as fertility patterns, mortality, tradition, culture and religion. In addition, fertility is influenced by economic trends, as the decision made by young couples to have a child, or in particular a second or third child will to a certain extent depend on how the economic future is perceived. It has likewise been claimed that the increased mortality among males in Russia can be ascribed to the social dislocation caused by the economic reforms (cf. e.g. Cornia et al. 1995, p. 32ff.). However, this remains a disputed position.

Because the distribution of household sizes is mainly influenced by demographic factors, it is likely to change only very slowly. Household size and composition seem to have little effect on migration-proneness, and survey findings do not indicate that mobility patterns vary significantly according to household type. Hence, migration has little effect on the distribution of household types, as is seen above. It is therefore reasonable to assume that the distribution of households of different sizes has remained more or less constant over the period between the two surveys, or that any changes have been within normal statistical margins or error.

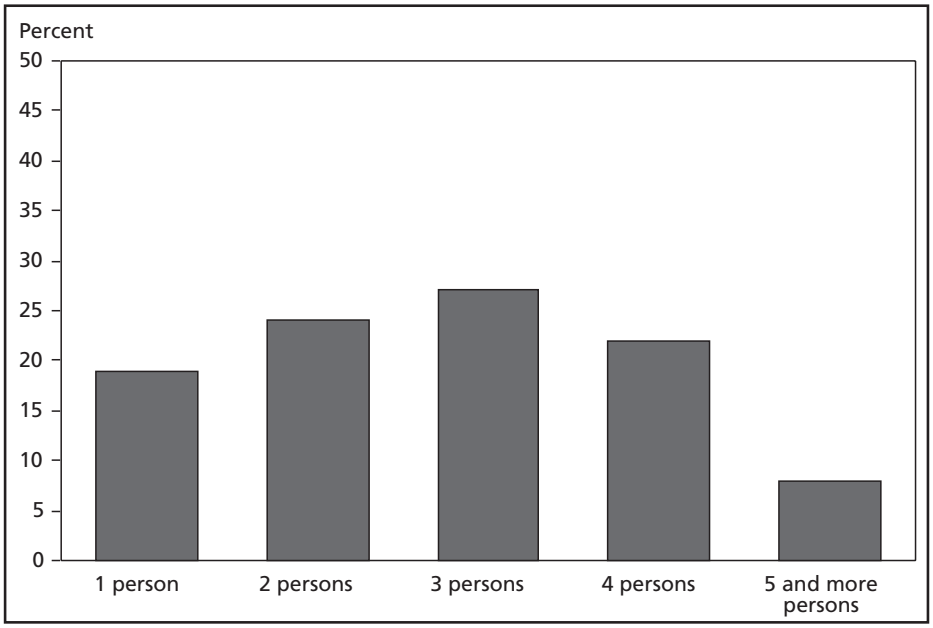
However, investigations conducted in the manner of the 1997 survey are likely to overestimate the true size distribution of households for the simple reason that when an interviewer walks from door to door, he or she is more likely to encounter somebody at home at any given time in a larger household than for

example in a one-person household. One-person households therefore have a higher probability of becoming a drop-out, even if the household is visited up to three times on different days. The household distribution has therefore been corrected for size using information from a mini-census carried out in the region in 1994 (Goskomstat 1995, p. 33).

This taken into account, the surveyed households on the Kola Peninsula were distributed as shown in figure 3.1.

On the whole, households tend to be relatively small. Average household size was 2.76 persons, and the modal value in the distribution is 3 persons per household. However, households on the peninsula tend to be larger than in, for example Norway, where average household size in 1990 was 2.4 persons, with one-person households as the modal value (SSB 1997, p. 70). Children under 18 years of age are found in just over half of all households on the Kola Peninsula. Among these, 58 per cent have only one child, 36 per cent two children, and 6 per cent three children or more. Thus, the one-child family remains the norm, as it has been in most of the post-war period in Russia. In addition, Russia has a higher share of extended nuclear families than Scandinavia for example, as many households contain elderly relatives. This will be further described below.

Figure 3.1 Size distribution of households. Percentage of households in each category, the Kola Peninsula 1997



3.3 Household types and dependency patterns

Households differ not only in size, but also in composition. In terms of welfare analysis, one of the main characteristics of a household will be the dependency pattern, i.e. the relationship between economically active members and dependents, who receive their livelihood from the others. Households can accordingly be grouped into some broad categories based on main dependency patterns. A "dependent" is here counted as a person outside normal working age, i.e. women above 55 and men above 60, as well as minors under 18 years of age. Children can further be divided into those of school age (7 to 17) and pre-school age (0 to 6 years). As will be seen later in this report, a certain share of the retirees continue in the labour force, though mostly at a reduced rate of labour intensity, and retirees can in all cases be considered at least as potential dependents, given their high propensity to fall out of the labour market for reasons of disease, disablement or exclusion.

In order to compare different types of households with respect to their dependency load, each household can be assigned a dependency ratio, defined as the share of persons of dependent age as a proportion of total household size. Table 3.1 shows the distribution of the main dependency types, with the average dependency ratios for each type.

The categories in this typology are mutually exclusive. However, in order to visualise different types of dependency, some concessions had to be made to consistency in two respects: firstly, with regard to how households are grouped according to the age of children. The category "households with children under 7" may also contain children above 7. Respectively, the group "households with children 7–17" have only children in this age interval. Secondly, single-headed households will contain children in any age under 18, as will most of the three-generation households.

Table 3.1 Typology of households, the Kola Peninsula 1997. Percentages in each group and group averages

	Per cent of total	Dependency ratio
Single-person household	19	.5157
Couple without children	13	.3996
Household with dependent children 7-17 years of age	22	.3828
Household with dependent children under 7 years of age	10	.4147
Single head of household with dependent children	8	.5232
Three-generation household	9	.4701
Two-generation household, no dependent children	18	.2065
Other types of household	1	.2437
All	100	.3999

This taken into account, the table reveals some facts about the composition of households on the Kola Peninsula, and their concomitant dependency patterns.

The dependency ratio of the one-person households means that just over half of all households of this size consist of persons in dependent age, i.e. retirees. Given the low level of pension instalments, this group of elderly people without attachment to a larger household is likely to form an economically vulnerable group. The media tend to perpetrate a rather harsh picture of the situation of the elderly in transitional Russia, though it ought to be borne in mind that even the lowest pensions actually are higher than the minimum wage in industry, making the retirees not necessarily those worst off. However, neither the lowest pension, nor the minimum wage exceed the officially stipulated subsistence minimum, though only a very small share of the retirees receive just the legally stipulated minimum.

The absolutely highest dependency ratios are not surprisingly found in single-headed households, which in a large majority of cases consist of a single mother with dependent children. This household type is likely to have less resources available, and hence fewer opportunities for adaptation to changes in the economic environment than larger households.

The recent drop in fertility, described in a previous chapter, is reflected in the data, as only 10 per cent of the households have any children in the age group 0–6 years.

So far, the economic position of the households has been investigated in terms of their gross dependency load. Arguably this is a somewhat imprecise measure, because it does not take into account any contributions to the household economy made by persons of theoretically dependent age, and it does not differentiate between the inequal dependency load on the household presented by unemployed or otherwise non-working adults as opposed to children. Further insights about the composition of the households can therefore be gained if this measure is decomposed for the two main types of dependency.

A total of 48 per cent of the households of all types in the sample comprised dependent children (below 18 years of age). One child was found in 32 per cent of the households, two children in 14 percent, and three children or more in only two per cent of all households. Only 16 per cent of all households comprised children below school age (0–6 years), and only one per cent comprised two children below school age. This is a reflection of the recently observed drop in fertility rates described in a previous chapter. The observed distribution of dependent children is further a reflection of the typically Russian fertility pattern. The low fertility levels in Russia are mostly due to the reluctance of women to have more than one child, even if the number of women who actually give birth is higher than in comparable Western low-fertility countries. In these latter countries, low fertility is mainly at

the expence of women who have no children, whereas the probability of a second or even third child is higher among those who actually become mothers.

At the other end of the age scale, at least one dependent adult was found in 32 per cent of all households. Households consisting only of dependent adults (one- and two-person households) comprised 15 per cent of the total, whereas multi-person households with at least one dependent adult accounted for the remaining 17 per cent. Only 27 per cent of all households comprised no persons of dependent age, i.e. neither children, nor retirees.

Still, the fairly minimal level of pensions is a partial explanation why so many persons beyond formal retirement age continue in the workforce, as seen in another chapter of this report. Further, those retirees who do not have any additional income from labour remain to a large extent dependent on household-based forms of welfare, and pooling of income within a larger household. Both due to tradition as well as because of the perennial lack of available housing, it has been the norm in Russia for several generations to live together. As seen above, 9 per cent of the households in the sample consist of three generations. It should be added that this is considerably less than in St. Petersburg, where nearly 15 per cent of the households were of this type in 1994 (Hansen 1996, p. 37). Another 18 per cent of the households consisted of two generations with no children of dependent age. Among persons beyond formal retirement age in the 1997 sample, 32 per cent lived in one-person households, the remainder lived either with a spouse or other family members.

However, the tendency for several generations to live together in Russia, though mostly borne out of necessity, demonstrates that households in Russia have retained features of a "care nexus", in which elderly family members in particular are taken care of to an extent which otherwise would have been impossible, were they to live alone. Elderly family members in turn perform tasks central to the maintenance of the household, e.g. care of children which may free the other members of the household to intensify their income-generating activities. It also explains how pensioners can survive on monthly pension instalments which are below the subsistence minimum. Further, as the elderly are entitled to a number of social benefits and reduced payment for services etc., many of these benefits tend to "spill over" onto the other family members. Examples are the reduction in payments for telephone or subsidised groceries, allowed to the elderly, both of which will benefit all members of the household with an elderly person in it. In some situations, to have a healthy, elderly family member in the household may therefore be an asset rather than a liability for the remaining members.

This contrasts with the typical Scandinavian household, which has turned into more of a "cash nexus", uniting its members chiefly through a joint economy, and where care of the children and the elderly is left to institutions outside the household.

Chapter 4 Health

The five-year period which has passed between the two surveys described in this report would usually be considered a too short period for any considerable changes in public health on the aggregate level to occur, excluding severe epidemic and/or pandemic situations. However, the five years in question do not constitute a "normal" period, as it has seen major changes in the life of the ordinary citizen, as well as in the organisation of public life. It bears some investigation to take a closer look at how this may have affected the general state of public health.

As mentioned in chapter 2, the impact of the reforms on everyday life in Russia has been blamed for the registered increase in male mortality, an increase which also has been noticeable on the Kola Peninsula. Consequently, the argument goes, the strains and impoverishment imposed on the population by the reform programme have resulted in drastic reductions in the state of public health in Russia. However, the relationship between mortality, illness and public health is somewhat more complex, and in this chapter, these relationships will be subjected to a closer scrutiny, in the light of official statistics and survey findings.

4.1 A note on methodology

There are several methodological challenges involved in the design of a health module within a living conditions survey, related to its scope, content and goals respectively. The scope of a health survey is determined by the number of factors considered to be analytically relevant for the study of health in the given context. The scope can thus be narrow or wide, depending on the number of factors included in the concept of health. The World Health Organisation typically employs a very wide definition of health, and includes all factors in the individual's surroundings which contribute to a state of physical, mental and social well-being, in addition to the mere absence of disease. Even if this definition is well suited to the purposes of formulating health policies, the actual measurement involved in a living conditions survey requires that a somewhat narrower focus has to be chosen. The content design of a health module in a survey firstly has to address clearly the difference between "disease" and "illness". Whereas the former denotes a specific condition, identifiable

by a separate set of symptoms resulting in a medically defined diagnosis, the latter describes the impact on the carrier's health in terms of his or her "being ill", and the reduction in physical or social ability to function associated with this state. There are several reasons why interview surveys generally are not very well suited to measure the occurrence of "disease" in a population. Firstly, this would normally require actual examination of the respondent by a specialist. Further, the respondent may or may not know the exact name of his or her condition, or may have forgotten it. Furthermore, respondents may be reluctant to divulge information on certain diseases they may have, or may consider their health to be nobody else's business.

On the other hand, interview surveys tend to be able to provide satisfactory information on 'illness', provided that the questions are carefully worded, and that objective, non-offensive indicators are used. In the interview, the respondent voluntarily transmits verbal information to the interviewer, who more often than not will possess no medical training. This in itself infuses the health information provided in the interview with a strongly subjective slant. This subjectivity expresses itself in several ways. Firstly, there are obvious differences in the manner in which individuals perceive the effects of illness. Even medically identical conditions will be perceived as differently bothersome and consequential for everyday life by different individuals. Secondly, in most cultures there are differences in reporting cultures between men and women with regard to their respective proclivity to report any limitations as a consequence of illness, with men being much less prone to report any such limitations than women. Thirdly, reporting of any reduction in health is strongly dependent on whether the respondent "feels ill" or not, and this is as much a mental as a physiological state. Fourthly, reporting on health is context-dependent, as every individual will rank daily tasks in a more or less conscious "problem hierarchy", in accordance with their acuteness. Thus, if daily existence is dominated by economic problems, this may overshadow a health problem, in particular if the latter is relatively minor or only periodically recurring. The reporting threshold may therefore vary considerably, between individuals, gender or contexts.

What the analysis is left with is health as a socially, more than medically defined category. We are concerned with the social effects of illness, more than the disease from which the respondent may suffer. In terms of a living conditions analysis, health is a basic individual resource, which determines the possibilities the individual will have for generating income and welfare, as well as being able to take part in a social life.

4.2 Prevalence of illness

In the following, the reported rates of long-lasting illness among the respondents at the two survey points will be compared, in order to arrive at a rough estimate of the trend in public health on the Kola Peninsula. In both surveys, respondents were asked to report whether they suffered from any ailments, illnesses, after-effects of injuries, handicaps etc. of a lasting or chronic nature. This is an often-used indicator of the overall state of public health, and the lasting nature of the ailment is also emphasised, because these are indicative of the graveness of the condition, as well as being more consequential for the individual than mere passing inconveniences. Response distributions from the two surveys are given in table 4.1.

What emerges from the table is that overall reported rates of chronic afflictions have been drastically reduced over the five-year period. Quite contrary to common belief, the population reports lower rates of experienced illness, and concomitantly – one would believe – an improved state of the overall public health. Not only are the reported rates of chronic afflictions much lower in 1997 than they were in 1992, they are also considerably lower than in, for example, the neighbouring Scandinavian countries with their allegedly superior health care systems, workplace environment regulations, healthy diets and sporting lifestyles. This somewhat puzzling result may have several explanations, and deserves some more detailed investigation.

These reportings are in their nature strongly subjective, and are highly dependent on whether the respondent feels "ill" or not. These figures can therefore be complemented by other, more objective indicators of the ability to function physically and socially in everyday situations. The scores for these indicators are given in table 4.2.

Table 4.1 Reported rates of lasting illness, Kola Peninsula 1992 and 1997. Percentages

	1992		1997	
Age group	Men	Women	Men	Women
18-19	19	41	7	15
20-29	18	41	10	13
30-39	27	48	7	14
40-49	38	58	18	28
50-59	46	68	30	34
60-69	66	66	42	53
70 and above	61	83	53	68
All	36	56	17	28

When more specific and objective indicators of the ability to function in everyday situations are included in the analysis, as in table 4.2, the picture of how illness is distributed in the population becomes more varied. As the occurrence of illness and the condition of individual health are both closely connected to age, public health on the aggregate level is closely related to the demographic composition of the population.

When the findings illustrated in table 4.2 are compared to similar figures for the neighbouring countries, in this case Norway, two features become appar-

Table 4.2 Prevalence of illness and functional impairment, the Kola Peninsula 1997. Percentages of respondents within each group

	Men					Women				
	All	18–29	30–44	45–60	Over 60	All	18–29	30–44	45–60	Over 60
Strongly reduced ability to work	4	0	2	7	13	8	1	2	7	28
Reduced mobility indoors	4	0	1	7	21	12	4	3	13	42
Reduced mobility outdoors	3	0	0	5	20	8	3	2	6	32
Reduced participation in activities	5	1	1	9	22	12	6	3	11	41
Functionally impaired	8	1	3	13	44	22	5	10	26	64
Reduced ability to walk	5	0	1	6	30	12	1	4	11	50
Reduced ability to carry	4	1	1	6	20	15	3	7	13	49
Sight impairment	1	0	0	1	6	3	1	1	2	10
Hearing impairment	1	0	1	1	1	2	1	1	2	6

Strongly reduced ability to work: Respondents who report that they have an illness or infirmity which strongly reduces their ability to find or hold paid employment

Reduced mobility indoors: Respondents who report that they have an illness or infirmity which strongly reduces their ability to live at home or move around in the home.

Reduced mobility outdoors: Respondents who report that they have an illness or infirmity which strongly reduces their ability to leave home without help.

Reduced participation in activities: Respondents who report that they have an illness or infirmity which strongly reduces their ability to join social organisations or take part in other leisure time activities.

Functionally impaired: This group comprises respondents who have either of the following functional problems: i) strongly reduced ability to work; ii) reduced mobility, or iii) impaired eyesight, hearing or ability to carry.

Reduced ability to walk: Persons who report that they cannot climb stairs without difficulty, or go for a brisk five minute walk.

Reduced ability to carry: Persons who report that they cannot carry a five-kilogram object for a distance of ten meters without difficulty.

ent. Firstly, that the overall level of illness and functional limitations in the population is lower on the Kola Peninsula. In Norway, a chronic illness was reported by 52 per cent of all men, and 58 per cent of all women during the nationwide 1995 Level of Living Survey (SSB 1996, p. 122-123). As seen in table 4.1, scores on the same indicator on the Kola Peninsula were 17 per cent for men and 28 per cent for women. However, in both countries, the majority of reportings were found in the higher age groups, which are much less numerous on the Russian side of the border. The lower overall number of persons in higher age groups accounts for the majority of this difference in gross figures. However, there are certain types of illness which are considerably more prevalent in Scandinavia than in Russia and which are connected to specific age groups: these also contribute to the higher rates of illness among Scandinavians. In Norway, nearly one fourth of all persons in the age group 16–29 suffer from chronic ailments of the respiratory tract, in particular different types of allergies (SSB 1997, p. 108).

Further, whereas the scores for actual functional limitations in everyday situations for the younger and middle age groups are roughly the same in both countries, the scores for the older age groups diverge. In Norway one can observe that the scores for the indicators of illness and functional limitations gradually increase from the age of 67 onwards, and peak above 80 years of age. In Russia on the other hand, scores increase rapidly in the age groups approaching the lower limit of the average life expectancy, which has now fallen to below 60 years for men, and remains around 70 years for women. In the population on the Kola Peninsula, there are consequently very few individuals in the age group above 80, which in Norway accounts for the peak scores on the illness indicator.

Summing up the above, one could say that as far as the health of individual people is concerned, there are few drastic differences between the Kola Peninsula and Norway as far as the younger and middle age groups are concerned. In Russia however, health deterioration associated with the higher age groups sets in at an earlier point, and the lower average life expectancy accounts for a very small number of persons in the oldest age groups. According to official statistics, out of a total population of approximately one million on the entire peninsula, there were only 6,307 men aged 70 or above in 1996 (Goskomstat (3) 1996, p. 10). This leaves the Kola Peninsula simply with fewer persons in age groups with significantly increased average levels of illness, and this tends to pull average scores for the entire population down.

This demographic factor accounts for the lion's share of the difference between the Kola Peninsula and Norway, but still leaves us with the question of what has caused the difference in reportings of health scores on the peninsula between the two survey periods.

One objection to this finding could be that the data themselves are faulty, and the samples are biased.There is nevertheless ample evidence to believe that both samples are representative, as the composition of the survey population now can be compared to official statistics, as well as checked for consistency with other parameters which are verifiable with complementary data. This is done in further detail below. Another objection could be that the term "illness" is interpreted differently. The Russian term used in this questionnaire item ("*bolezn*") is commonly translated as both "illness" and "disease", exactly as the term used in the Norwegian survey ("*sykdom*"). The explanation for this seeming improvement in public health ought to be sought rather in a combination of medical, psychological and economic factors.

Firstly, the mortality factor may have played a role, though this will account for a much smaller share of the difference between reportings in the actual 1992–1997 time series than between the two adjacent regions.

Secondly, figures for illness are particularly prone to both deliberate and non-deliberate under reporting, by men and women to varying degrees. There are likewise very clear differences between cultures as to what is considered to be an "illness".

Thirdly, it should be borne in mind that the Kola Peninsula is a society of transients, and less than half the population was actually born in the region, the remainder consists of in-migrants who may have maintained links with their native region. Health problems were a frequently stated reason for the desire to migrate away from the peninsula in the 1992 data, as described in a previous chapter. There is a possibility that differential migration has influenced the composition of the population with respect to health, as the peninsula has had a consistently negative migration balance since 1991-92. However, separate multivariate analysis reveals no significant correlation between reported health and proneness to migrate in the 1997 data set. The effects of migration on the composition of the population is further described in more detail elsewhere in this report.

Fourthly, it should be borne in mind that in 1992, even if economic inactivity and unemployment no longer were considered as crimes under the prevailing legislation there was still a considerable social stigmatisation connected to unemployment. Rather than admitting to being unemployed, some may have resorted to illness as an excuse for not working.

Fifthly, a possible psychological explanation can be related to the more or less conscious "problem hierarchy" people tend to establish, described above. There is indeed evidence that the reforms have entailed considerable hardship for a large number of families, and that economic worries dominate the problem horizon of the respondents to an extent where less grievous illnesses tend to be forgotten. These worries may entail people feeling that they cannot afford to be ill, and push health problems out of their minds.

4.3 Use of health services

Given this level of overall health in the population, further insights can be gained by looking at the use of health services. In the period between the two surveys, major changes had occurred in the organisation of health services in Russia. In the USSR all health services were in principle free of charge and available to all citizens. The health care system was in many ways the pride of the USSR, with 13.1 hospital beds for every 1,000 citizens in 1986, compared to 4.1 in the United States (Rowland & Telyukov 1991, p. 73). In spite of this, the USSR spent only 3.4 per cent of its GDP on health services, compared to 11.4 per cent in the United States (ibid.). However, it might be added that the practices for national accounting used in the USSR made direct comparisons of GDP volumes difficult, and there are also indications that USSR figures for GDP were inflated. In practice, the health care system in the USSR was plagued by the same types of shortages as the other parts of the Soviet economy, and were in the same vein not entirely free from the omnipresent corruption. With the demise of the USSR and the budgetary crisis experienced during the reform process the health care system has suffered particularly from the financial setback, and today there is a very acute lack of certain pharmaceutical products, as well as of some types of medical equipment. Directly dependent on transfers from the strained state budget, the health sector has also to a certain extent been marked by wage payments arrears. Recent legislation has allowed for a

Table 4.3 Contact with health care institutions for 1997. Shares of male and female respondents with different types of contacts during the two weeks preceding the interview, per 1,000 of population

	Men	Women
All types of contact	157	225
Of which:		
Telephone consultation	3	3
Visit to general practitioner	19	34
Company doctor	73	97
Specialist	83	121
Hospital*	26	27
Nurse	8	9
Other	4	11

* For outpatient treatment only

Note: Some respondents have had more than one type of contact. The figures for all types of contacts are therefore lower than the sum for the types of contacts reported.

two-tier system of health care, and private services for payment have been introduced.

In the 1997 survey, respondents were asked to identify all contacts with any types of institutions for health care during the two weeks preceding the interview. Results were distributed as shown in table 4.3.

It emerges that even if reported rates of illness are low, people tend to have frequent contacts with the health care system. The reported rates of contact with such institutions are for example somewhat higher than those revealed during equivalent living conditions surveys in St. Petersburg and Kaliningrad in 1994 (Hansen 1996, p. 70). People on the Kola Peninsula also tend to turn to the health care system just as frequently as their neighbours in Scandinavia, who report significantly higher rates of chronic illness. However, it is not immediately evident what a "natural" yardstick for use of health care services should be, and this is not automatically an indication of "overuse" of such services, and it may have several explanations.

Firstly, some of the uses of health services may be related to an acute state of reduced health, such as injuries, poisonings, infections, etc. and respondents were therefore asked to report whether they had suffered any such illnesses during the two weeks preceding the interview, regardless of whether they had seen a doctor for it or not. Responses were distributed as shown in table 4.4.

Thus, a considerable share of the population reported having been exposed to some form of acute illness or injury during the reference period, with women in a small majority. Separate analysis shows that acute illnesses are likely to account for approximately one third of the contacts with the health care system in the reference period. Persons with chronic diseases account for another third of the contacts, and the final third have been in contact with such institutions for other reasons.

A possible cause of acute illnesses and injuries is accidents. According to official statistics, workplace accidents causing the victim to lose one full working day or more numbered 1,233 incidents, or equal to 3.2 per 1,000 employed in 1995. The occurrence of workplace accidents has decreased to almost half the level seen

Table 4.4 Occurrence of acute illnesses, Kola Peninsula 1997. Percentages

Age group	Men	Women
18–29	6	12
30–44	10	10
45–59	10	15
60 and above	8	24
All	9	14

in 1991 (Goskomstat (1), p. 41). Still, close to half of all men and one fourth of all women employed in manufacturing are considered to work under conditions which are either harmful or dangerous (Goskomstat (6) 1996, p. 18). Workplace accidents with a fatal outcome numbered 44 in 1995, or equal to 9.46 for every 100,000 employed (Goskomstat (1) 1996, p. 41). In comparison, there were 60 fatal workplace accidents in Norway in 1996, equal to 2.81 per 100,000 employed (SSB 1997, p. 112). Acute injuries or poisonings of all types constituted the second largest group of registered illnesses on the Kola Peninsula in 1995, with 75,312 reported cases, preceded only by respiratory infections, including colds and flu (Goskomstat (1), p. 78).

Further, there may be seasonal variations in the level of illness, as well as in the use of health care. The data were collected in April and May of 1997, following an exceptionally cold winter, which lasted unusually long, with snow cover on the ground well into May on most parts of the peninsula. This may have caused a seasonal upswing in certain types of acute illnesses, particularly common colds and influenza-type ailments, for which people have contacted some form of medical institution.

Chapter 5 Education

The market-oriented reforms in Russia have entailed drastic changes in the composition of demand for educated personnel in the economy. Not only has the demand for skills required in the emerging private sector increased, but it has also entailed a thorough devaluation of skills which were in high demand in the command economy. To mention just one example, management and accounting is a totally different matter in a state-owned enterprise in a planned economy than in a private business operating in the market. However, to effect a significant change in the educational composition to an extent where this has a palpable effect on the availability of various skills in the labour market will inevitably take considerable time. Until then, the supply of skills will remain characterised by the peculiarities of the USSR educational system.

In this chapter, some main characteristics of the distribution of various types of education among the Kola population will be examined. The relatively short period which has elapsed between the two survey points will allow for only minor expected changes in the educational profile of the population. However, the correlation between different types of education and other living conditions parameters is likely to have been affected following the changes in demand, and the effect of educational status on other living conditions parameters will be examined in the respective chapters in the report. However, it should be added that the composition of local industries will tend to create a particular profile in the demand for skills in the local labour market. The supply of skills may also be influenced by migration, because different skill groups may have a varying proclivity to migrate, as seen in a previous chapter of this report.

The educational system which was established in the USSR was characterised by the demands of the planned economy for various types of technical skills, and had a strong emphasis on vocational training. The state-owned enterprises employed a large number of manual workers and technical personnel at intermediate skill levels who were required for the execution of the pre-determined plan. At the time of the break-up of the USSR, compulsory schooling lasted for 11 years, and consisted of the primary level (4 years) followed by elementary-grade level (4 years) and secondary level (3 years). Completion of the two first levels, which were undifferentiated, resulted in an incomplete secondary education, which is still the final level reached by many who completed this level before full secondary education

became mandatory in the 1970's. Differentiation started from secondary level, into a general secondary education (similar to a baccalaureate) or vocational training, giving a common secondary education certificate. Education beyond the compulsory stage could consist of higher education at university level or similar, or further vocational specialisation. A particular category consists of persons with an "unfinished higher" education. This group mostly consisted of persons who have been involved in evening or distance learning, and have not yet completed the full set of courses for a formal diploma. These are still recognised as a separate educational category.

The USSR school system undoubtedly achieved a real equalisation of educational opportunity, even if strong regional differences remained, both in terms of the availability and type of educational opportunity beyond secondary which existed in the local region or union republic (Titma & Saar, 1995, p. 37).

Direct comparisons of educational systems and educational attainment across boundaries are usually quite complicated, and the peculiar nature of the Soviet educational system makes a meaningful comparison with prevailing Western systems nearly impossible. A general impression, however, is that the Soviet educational system tended to favour fact-learning to a higher extent at lower ages than was usual in particular in the Scandinavian countries, and Russian schoolchildren tend to outperform Scandinavian children for example in direct comparisons of mathematical and conceptual skills up to secondary level, after which scores tend to even out.[1]

The present Russian educational system broadly follows the Soviet pattern, even if present legislation foresees educational reforms to bring both curricula as well as management and financing of the educational system closer to the demands of a market economy.

Table 5.1 Educational distribution, percentages

	1992	1997	1994 microcensus *
Primary	4	4	6
Incomplete secondary	10	10	17
Common Secondary	18	33	34
Vocational	35	35	25
Unfinished higher	5	3	1
Higher	28	15	14

* Source: Goskomstat 1995, p. 20. Note: Microcensus figures comprise persons aged 15 years and older, and the entire peninsula. Survey figures comprise persons 18 years and older, and only the respective surveyed areas.

[1] According to reports from parents and teachers with experience from mixed schools, and results from international schoolchildrens' contests.

Table 5.1 shows the educational profile of the respondents in the 1992 and 1997 surveys according to the highest attained level of education at the time of the survey, compared to results from a microcensus carried out in 1994.

The time which has elapsed between the two survey points is too short to have considerably affected the educational profile of the population to any extent. Table 5.1 should therefore rather be read as an illustration of how education is distributed over various regions of the peninsula. The high number of survey respondents with higher education in the 1992 survey can largely be accounted for by the inclusion of Severomorsk, where the resident middle and higher military officers would be considered to have reached this education level. The major educational category in the population in the surveyed areas is some form of vocational training, reflecting the need for this type of training in local industries. When the more rural areas are included, the modal point in the educational distribution shifts downwards to only compulsory level.

Even if the actual composition of the educational scores for the population do not seem to have changed considerably, the value of a given type of education to the holder is likely to have changed more drastically. As the demand for particular skills is reflected in remuneration systems, and there is actual competition among enterprises for persons with particular skills, education and training become crucial for the competitiveness of individuals in the labour market. An emerging market economy is likely to require a considerably larger number of professionals, like lawyers, managers, marketing experts, etc. Conversely, certain types of skills acquired in the planned economy may be regarded as obsolete as technological innovations are introduced and management principles become market-oriented.

The demand for new types of skills is partially reflected in enrolment rates in higher seats of learning, of which there are two on the peninsula. Enrolment in these institutions for the academic year 1995-96 was 27 per cent higher than in 1991-92 (Goskomstat (1) 1996, p. 66). The enrolment in university-type institutions has increased to a much higher extent than in specialised vocational institutions (ibid, p. 67).

To a great extent this tendency can be ascribed to increasing real and expected relative rewards to be gained from education, as an increasingly market-oriented economy accounts for a higher degree of differentiation in terms of remuneration than the planned economy. Further, the planned economy did not reward personnel with narrow specialisations, but rather preferred to have a large number of employees with a broad range of semi-specialised skills, who could be redirected to various tasks depending on where in the cycle of planned output the enterprise was at any given time. Also, the – largely artificial – shortage of labour power which plagued the planned economy served to push up wages for unskilled personnel relative to skilled. As an example, a professor's nominal salary remained constant from

the 1960s until the late 1980s, whereas the average wage increased by 2.5 times in the same period (OECD 1995, p. 8). As a consequence, the ratio of the top to the bottom decile of the wage distribution fell from 7.2 in 1946, to 3.0 in 1990 (Shcherbakov 1991, p. 228-229). At the time of the break-up of the USSR, the highly educated on average still earned more than the unskilled, though by a shrinking margin.

Instead of the traditional difference between white collar and blue collar occupations, industry-specific wage differences had instead become more pronounced, and in the 1992 survey the mining and smelting sector on the Kola Peninsula had left all the others behind with wages around three times the average (Hansen 1993, p. 79). In the surveyed regions of the Kola Peninsula in 1992, the ratio of the top to the bottom decile of the wage income distribution was 5.6. In 1992, the Soviet wage system still applied, making wages in the northern regions considerably higher than in the rest of the USSR, and average monthly wages in the surveyed population was approximately 8,000 roubles, equal to about USD 40 at the prevailing rate of exchange. The highest wage income reported in the 1992 survey was 130,000 roubles, equal to USD 260. This sum still had a very considerable purchasing power in the local context.

Further investigation of the bivariate relationship between education and income at both survey points shows that this relationship is heteroscedastic, meaning that the variance in the income variable increases with higher educational scores, reflecting the increasing differentiation in remuneration systems and levels, described above. In other words, the highly educated are more heterogeneous with respect to income levels than the lower educated, even if the average income level still is somewhat higher. The result is that the highly educated have a very differentiated welfare situation, and in this respect, Russia is different from for example the Scandinavian countries, where the correlation between education level and material welfare tends to be more systematic. This situation is likely to have several causes. Firstly, market reform may have tended to make certain skill types which were in high demand in the planned economy obsolete, and no longer required to the same extent as previously, while new types of educational groups and skill profiles have come into high demand. To take one example, an economist in a market-oriented company possesses very different skill from the equivalent in a Soviet-type, state-owned enterprise. Both these skill groups will be counted in the highest educational category, but they will have greatly differing incomes and concomitant levels of economic well-being. Secondly, it should be borne in mind that both the 'higher' as well as 'vocational' education categories comprise a broad range of occupational fields, and these may be in varying degrees of demand in the local labour market, resulting in greatly differing types and amounts of rewards. At present, there is competition among employers for personnel with particular skills, and this is expressed

in the wage levels offered. However, the types of skills which are in particular demand in a given region will be a function of the character of local industries, and is hence not necessarily focused on the highest-ranking university or similar level of education.

Nevertheless survey data suggest that there is a consistent correlation between level of education and employment rates, meaning that having higher education serves as protection against unemployment and exclusion from the labour market. Employment rates increase systematically with higher levels of education, in much the same manner as. in the Scandinavian countries in spite of the variation in remuneration levels.[2] Partly, this shows that increased education has another set of effects on the total life-situation of the individual in the form of the personal resourcefulness it provides in terms of improved cognitive skills and a sense of mastery of life's problems. The higher educated are consistently more active, both in terms of labour force participation as well as with regard to geographical mobility, as seen in previous chapters of this report; in this respect, the Russian data are also consistent with findings in most other countries.

[2] This correlation is described in further detail in Chapter 7: "Employment".

Chapter 6
Housing and Residential Environment

The housing mass on the Kola Peninsula can in many ways be seen as a manifest documentation of various epochs of Soviet housing policy. Kola society was almost in its entirety built up during the Soviet period, and this historic heritage lends a uniqueness to the peninsula, even in a Russian context. Further, a centralised command economy is probably the only politico-economic social organisation form which could attempt – and succeed – in stamping a major city out of the ground in what is essentially an Arctic tundra.

In spite of an adverse climate, with long winters and an mean temperature in July of only +8°C degrees (in Murmansk city), the population grew at an astonishing rate, particularly in the post-war period. Attracted by generous wage incentives, migrants streamed to the area at a net rate of 100,000–150,000 for every five-year period. To accommodate these newcomers, a very dense housing mass was built, allowing for coverage of only the most basic housing needs. Any visitor to Murmansk city cannot fail to observe the effect this has had on the city's overall appearance, which apart from in the very centre seems to consist mainly of eleven- and thirteen-storey blocks. The housing mass on the Kola Peninsula bears further witness to the centralised and standardised nature of Soviet housing construction policy. Housing types and the outline of the flats contained therein found on the peninsula are immediately recognisable as similar to those found in other parts of the former USSR, down to the placement of the kitchen sink.

In the following, a description of the changes which can be observed through the survey data in housing conditions, ownership and residential environment will be given. It should be borne in mind that this is a relatively short period over which to observe changes in the housing mass.

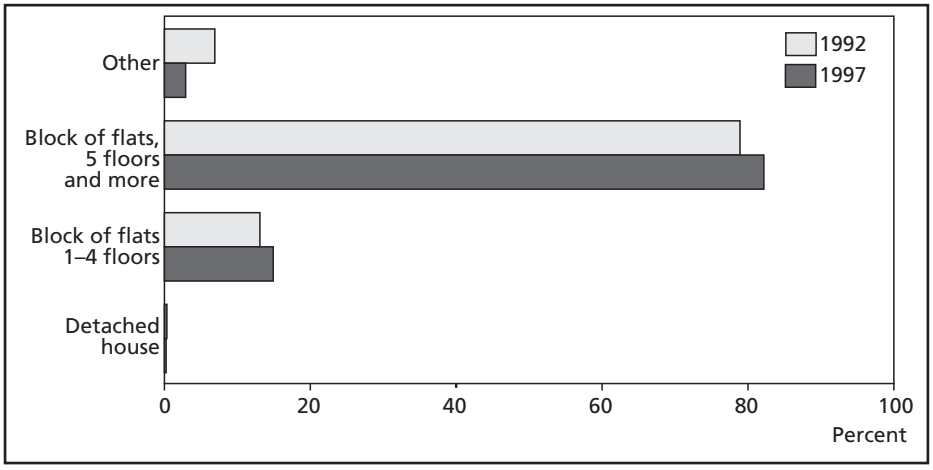
6.1 Housing types

Figure 6.1 shows the distribution of the different types of housing at the two survey points.

Quite as expected, the data indicate that there have been no significant changes in the composition of the housing mass with regard to construction types on the Kola Peninsula during the reform period. Housing construction has gradually slowed down over the survey period, with only 1,400 new housing units finished in 1995, down from 8,700 in 1991 (Goskomstat (1) 1996, p. 160). Construction of new flats therefore plays quite a minor role and has not influenced the composition of the existing housing mass to any palpable degree. As mentioned in an earlier chapter of this report, a net out-migration surplus and sinking birth rates have probably entailed a loosening up of the previously very tight housing market.

In addition, the different housing types are more or less equally represented in the housing mass in all the surveyed areas, with the exception of Pechenga, where most dwelling units (close to 80 percent) are found in low-rise blocks. In all the other areas, high-rise blocks account for 80 – 90 per cent of the total housing mass. Detached houses are virtually non-existent (less than 1 per cent of the total) in the areas described in this report, and most of these are likely to date from the period before the October Revolution or the very earliest years of Soviet power.

Figure 6.1 Housing types 1992 and 1997. (1992 figures recorded to 1997 categories). Percentages



6.2 Ownership of housing

Even if very few changes have occurred in the physical housing mass, the privatisation drive contained in the reform program has entailed a large-scale transfer of housing assets from the state to private individuals and households. The conditions for privatisation have remained favourable, and tenants in state-owned flats can usually take over their dwelling at a quite affordable cost.

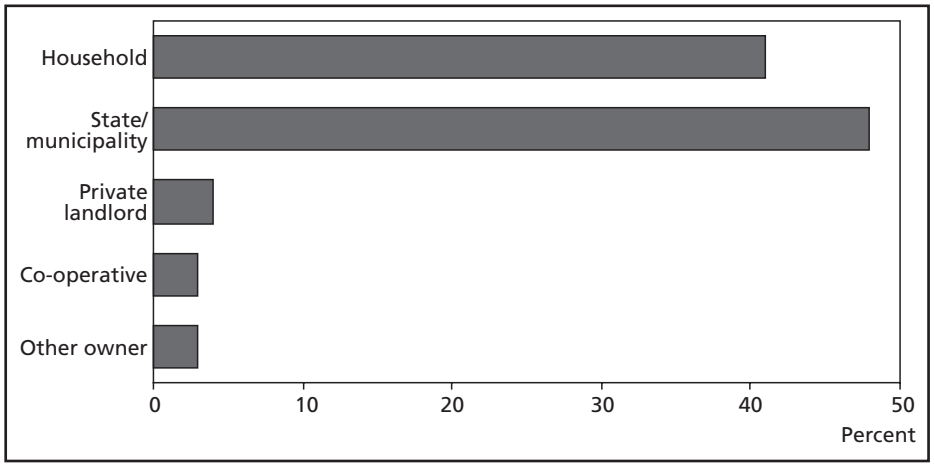
In 1992 however, at the time of the first survey, Soviet property laws were still in force, meaning that it was illegal to individually own property in the form of real estate. The only available alternative to state ownership of housing was co-operative ownership, and this property type accounted for two per cent of the housing mass in the surveyed areas in 1992, the remainder being state or municipal property. Housing held by state enterprises or the armed forces was also by definition considered state property.

By 1997, the composition of ownership forms with respect to housing had changed into the distribution shown in figure 6.2.

The volume of the state-owned dwelling units has been reduced to half in only five years, which is testimony to the desire of the population to own the apartment they live in. Since the privatisation programme started, close to five per cent of the dwelling mass has been privatised per year. This gradual privatisation is likely to continue, though the conditions on which privatisation can take place are likely to change in the future.

Company-owned housing is still quite common in areas on the peninsula. Typically, close to one fourth of respondents in Pechenga live in such company-owned housing.

Figure 6.2 Ownership status of housing units, 1997. Percentages of dwelling units

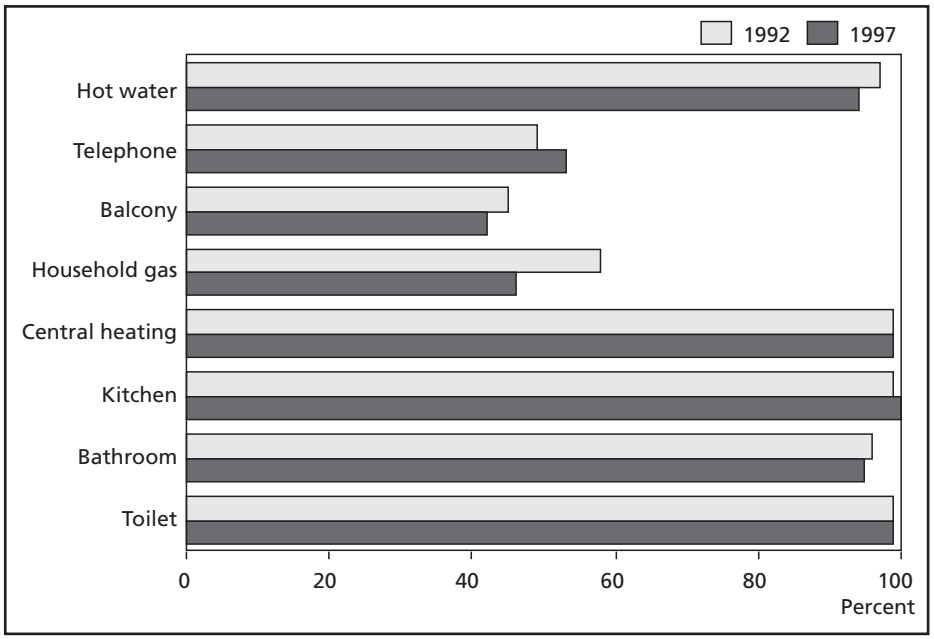


It should be borne in mind that figures for private ownership are prone to some underreporting on the part of the respondents, and the share of private flats is likely to be somewhat higher than the figures suggest. Because registration of property still is deficient, some respondents are reluctant to admit that they own the flat they live in, for fear of falling victim to an "apartment robbery". At the time of the survey, there were still stories circulating in Russian mass media about criminals who would break into privately owned apartments and force the tenants at gunpoint to sign the deed of the apartment over to them, in which case the tenant had no possibility to retrieve his or her flat. True or untrue, this was reported to happen particularly to elderly and single persons, and many of these are likely to have played it safe by reporting that the flat they lived in was state-owned rather than exposing this item of wealth to a stranger.

6.3 Amenities

As seen above, there have been very few, if any, changes in the physical composition of the dwelling mass in the areas studied over the five-year period between the surveys. This is likely to be the case also with regard to the basic equipment and

Figure 6.3 Amenities 1992 and 1997. Percentages of households reporting owning the item



amenities found inside the dwelling units. This very parsimonious hypothesis is supported by survey findings with regard to the presence of basic sanitary and other equipment in the dwellings, as seen in figure 6.3.

In 1992, nearly all dwelling units in the surveyed parts of the peninsula were equipped with basic amenities, such as indoor toilet, bathroom, kitchen, central heating and hot water supply. Improvements of this score beyond the 99 per cent level is rarely possible, and neither has there been any deterioration of these scores over the five-year period. The deviations between the two survey points on telephone coverage and use of household gas are to a large extent due to the different geographical coverage area of the two surveys; no significant changes in any scores were detected in Murmansk city, for example. It seems to be a safe conclusion that for these scores, there neither has been any significant deterioration, nor any improvement of the quality of the housing mass, as measured by these scores. Any such changes would have been highly unexpected, as the period between the surveys is too short for any major deterioration to occur, even given a total lack of maintenance in the meanwhile. If anything, with increasing privatisation one would expect maintenance levels to have improved.

6.4 Dwelling space and crowdedness

Given the small amount of change observed in the composition of the housing mass, it seems safe to assume that the distribution of dwelling space per household unit and per person to have remained roughly the same. Average reported sizes of housing units, and the calculated volume of dwelling space per capita is illustrated in table 6.1.

With the exception of Apatity, all surveyed regions seem to have a fairly uniform housing mass. However, separate analysis suggests that the variety in the size of dwelling units is higher in Murmansk city than in the other areas, meaning that the larger city has both more very large as well as more very small flats.

Table 6.1 Average dwelling size, sq. m.

	Per housing unit	Per inhabitant
Murmansk	46.4	20.2
Apatity	52.1	22.4
Kandalaksha	46.0	20.1
Pechenga	47.3	20.9
All	47.2	20.6

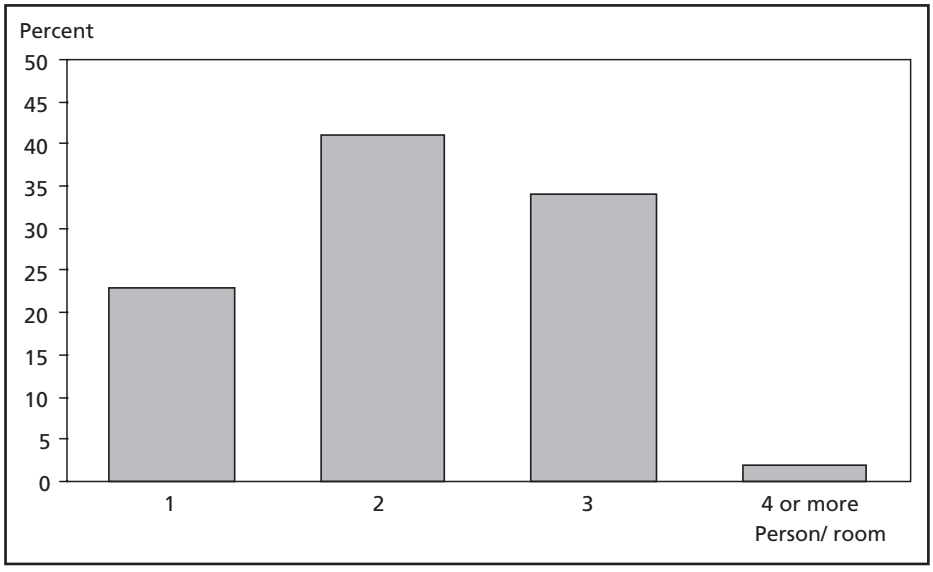
Available official statistics for housing report a slightly smaller average size of both dwelling units as well as housing space per capita for the surveyed regions, as well as higher variations in dwelling space between regions. This may have been caused by different reporting frames, of gross versus net dwelling space, as respondents were asked to include all available space in their dwellings, and not just the net usable floorspace (e.g. including walk-in closets). Further errors may have been caused by upward rounding, or the respondent may not have known the exact measurements. Still, the standard errors of the reported means suggest that the average figures have been fairly well estimated.

Another measure of the composition of the housing mass is the distribution of dwelling units with unequal number of rooms. The figures quoted above suggest that the housing mass is dominated by small flats, and this is confirmed when the dwellings are grouped according to the number of residential rooms (i.e. not counting kitchen, hall, bathroom and small rooms under 6 m^2), as shown in figure 6.4.

The most common type remains the two-room flat, in which close to half of all households live. This share of two-roomers in the building mass is equal to that found in similar surveys in St. Petersburg and Kaliningrad in 1994, showing the conformity with nation-wide USSR building norms (Hansen 1996, p. 47). Large apartments, with four rooms or more are still close to non-existent on the peninsula, as they are in comparable regions.

However, the size of a dwelling unit should more rightly be considered in relation to the number of inhabitants. A small flat may be large enough for a single

Figure 6.4 Distribution of dwelling units by number of rooms, 1997

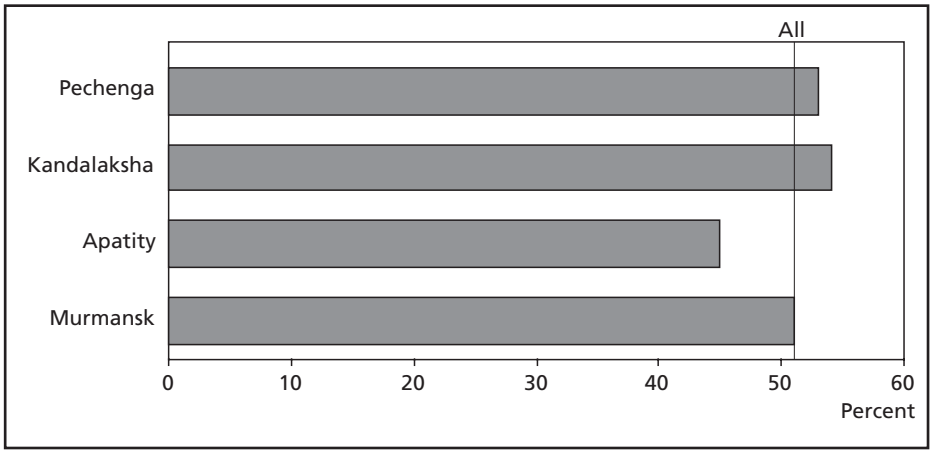


person, but too small for a family. However, there are no universally accepted norms of what constitutes crowdedness in a flat, but a cursory measurement can be obtained if the number of rooms in the flat is divided by the number of household members. If the household has more members than they have dwelling rooms (i.e. not counting the kitchen, bathroom and hall), meaning that there is more than one person per room available, the flat can be defined as crowded. Conversely, if the number of household members is equal to or less than the number of rooms, the flat can be described as spacious or moderately spacious.

According to this very rough measurement, approximately half the households on the Kola Peninsula can be said to live in crowded dwellings. In comparison, 7–8 per cent of all households in Norway live in crowded dwellings, even using a wider definition of crowdedness (one-person households having only one room are also defined as crowded) (SSB 1996, p. 134).

There is little reason to assume that the degree of crowdedness in the housing mass on the Kola Peninsula has changed to any significant degree in any direction during the period between the two survey points, as there has been almost no observable changes in the composition of the housing mass, and five years is a much too short time to observe any changes in the average household size, in spite of developments of both fertility and mortality. Average sizes of housing units vary somewhat over the surveyed regions, though not by a very large margin. The "best", i.e. least crowded housing situation is found in Apatity, while the other regions have approximately equal scores on this indicator of residential crowdedness.

Figure 6.5 Crowdedness, percentages

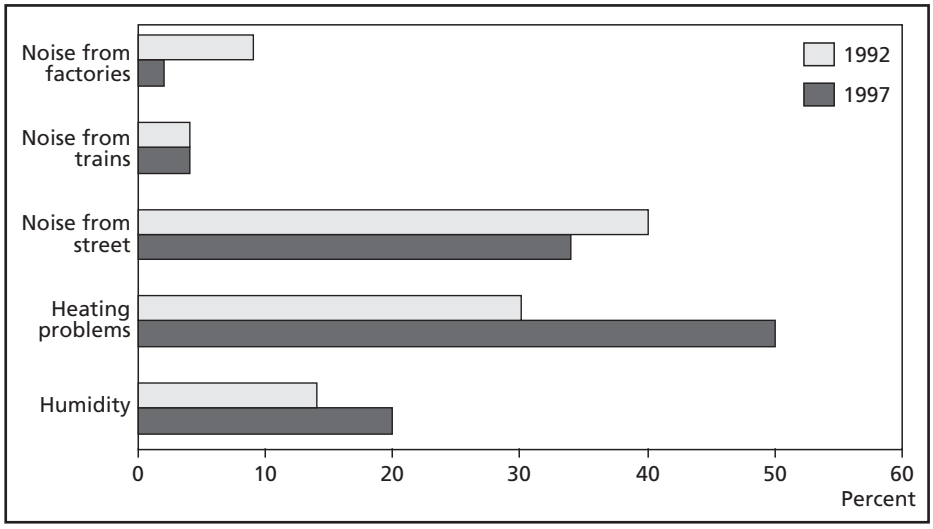


6.5 Indoor environment

The housing mass on the Kola Peninsula is under constant attack from the Arctic climate. In addition, the houses themselves have rarely been specifically adapted to the particular climate, but are mostly of the same type and construction as those found in residential areas all over the former USSR, and one would expect that this would have an effect on indoor climate and temperatures. This is corroborated by both surveys, when respondents were asked to report whether their dwelling had at least one room with a tangible humidity problem, or was hard to keep sufficiently warm during the winter season. Responses are displayed in figure 6.6.

Judging only from the respondents' answers, housing quality in terms of humidity and insufficient thermal insulation would seem to have deteriorated considerably in the five-year period. However, in the interpretation of this finding there are several modifying factors which ought to be borne in mind. Firstly, the data were collected in a period when temperatures were unseasonably low, and at a time when spring normally has set in. This may have influenced perceptions of the magnitude of the heating problem. Secondly, many tenants may have little influence over the heating level in a given residential house, as this is mostly regulated from the central boiler-house which delivers heat to whole residential areas. Thirdly, the introduction of direct payment for heating, albeit low by Scandinavian standards, may have caused tenants to reduce heating levels for economic reasons. In the Soviet period, tenants in state-owned housing only paid a symbolic sum for rent, electricity,

Figure 6.6 Indoor residential environment, 1992 and 1997. Percentages of households reporting experiencing the problem



heating and gas, in most cases less than one per cent of their income. And fourthly, opinions may differ as to what constitutes a "comfortable" indoor temperature. In the period when energy still was cheap in Russia, heating levels tended to be very high, and indoor temperatures of 25°C or more were not rare in the winter season.

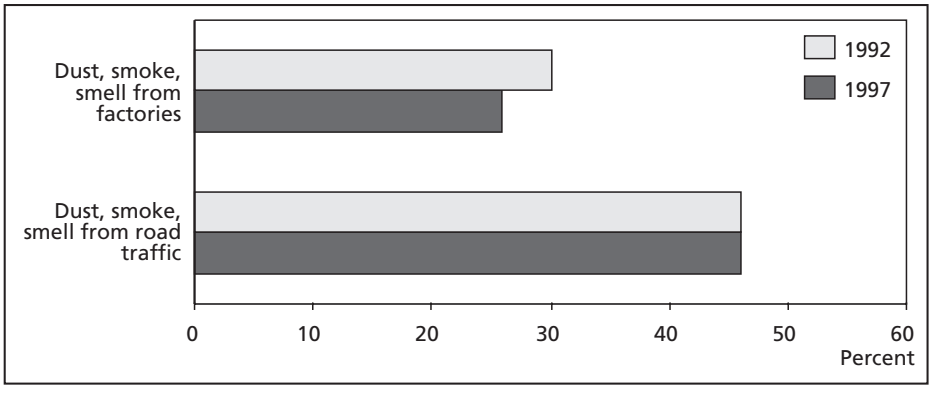
All these factors should be kept in mind when the figures for dwelling quality are interpreted. Nevertheless, it is fairly well known that the Soviet-era housing mass in general is not characterised by very good construction quality, in particular with regard to thermal insulation. In a period when energy was abundant and cheap, this could be counteracted by increasing heating levels; whether this made sense in economic terms was not really relevant for USSR accounting practices. However, in a situation where this cost must now be borne by the tenants themselves who face energy costs which rise at a very uncertain speed, heating the dwelling to 18°C or more may become an unaffordable luxury.

In terms of exposure to unpleasant levels of noise in the dwellings, there seems to have been little change over the five-year period.

6.6 Outdoor environment

The immediate surroundings in the residential areas are also a major component in the total dwelling environment. As described in the introduction, the mono-industrial towns on the Kola Peninsula have been built up around a large factory or mine, and this will tend to characterise most aspects of the local environment. Respondents were asked to report whether they were exposed to unpleasant levels of

Figure 6.7 Residential environment, outdoors 1992 and 1997. Percentage of households reporting being exposed to the problem



dust, smoke, smell or other fallout from local industries or from road traffic. Responses were distributed as displayed in figure 6.7.

The exposure to smoke and fallout from industry will naturally vary over the peninsula according to the character of the local industries. Because of the different geographical coverage of the two surveys, figures are therefore not entirely comparable. However, it will come as no surprise that the highest reportings of exposure to industrial pollution in the residential environment were found in Pechenga, where 93 per cent of the respondents reported being exposed to smoke from local industries. The lowest figures were found in Murmansk city, with only 13 per cent. Respondents in Apatity and Kandalaksha reported intermediate levels of exposure to such nuisances (33 and 43 per cent respectively) in the 1997 survey. The average figures thereby conceal wide variations in the actual level of exposure to industrial pollution in residential areas.

However, it should be borne in mind that such reportings contain a strongly subjective component, related to the perceived levels of pollution. There may also be seasonal variations in both absolute levels of emissions, as well as in how acutely these emissions are perceived. Furthermore, public awareness of environmental problems may be an equally strong influence on these reportings as are the emissions themselves. On the other hand, it is exactly this perceived nuisance from pollution which influences the living conditions of the population, as they may be a daily source of worry or irritation particularly for people with increased sensitivity caused by allergies, for example.

Reported exposure and attitudes to environmental pollution are analysed in further detail in Part II of this report.

Chapter 7 Employment

In spite of its Arctic location, the Kola Peninsula is heavily industrialised as well as urbanised. In addition to the fisheries and the merchant navy, exploitation of the rich mineral deposits in the interior of the peninsula has formed and still forms the basis for the local economy and settlement, and many of the towns are built around one single mine or smelter plant. The town of Apatity takes its name from the main industry, apatite mining, which is the core of local industrial life. The township of Nikel is equally dependent on the nickel smelter, and Kandalaksha was built around a major aluminium plant, exploiting a local deposit of aluminous clay. In these towns, the wealth and welfare of the citizens are especially closely linked to the character and success of the local plant.

Comparisons of employment data over time are further complicated by the fact that before the enactment of the currently active Law on Employment of 19 April 1991 the provisions of the USSR penal code stated that it was a punishable offence for an able-bodied adult to be out of work for a total of more than four months over any twelve-month period. This effectively precluded unemployment of any kind, by simply outlawing it, as unemployment had no place in a planned economy. Likewise, it was unlawful to be economically inactive, as everybody had a duty to work, with exemptions given only to the disabled, retirees, students and women with children up to the age of five. In addition to the outright illegality of unemployment or economic inactivity, the structural features of the planned economy also created a very particular situation in the USSR labour market in other ways. In the Soviet economy, labour was not only a very cheap item for the enterprises, but these were in fact rewarded for overuse of labour. Further, most enterprises would effectively attempt to hoard labour power in order to have a reserve to draw on in tight periods of the cycle of planned output. For long periods each month, a considerable number of those formally employed did in fact perform very little work, apart from showing up in the morning and collecting pay, and many others were employed in name only. Soviet factories were consequently in general greatly overstaffed, resulting in comparatively low productivity.

In the years since 1993, increasing privatisation and the imposition of hard budget constraints and profit-oriented management also in state-owned enterprises, coupled with market-oriented labour legislation have changed the framework for economic activity into forms more recognisable to Western countries. These

structural changes which have occurred between the two survey points may make comparisons not very meaningful. Even if the 1997 figures (which are based on the ILO model of measurement) seem to reflect real levels of employment to a fairly accurate extent, comparisons with figures for 1992 should be made with caution.

Other changes contribute to complicate the comparison of employment figures between the two survey points, concerning the relative value one should attach to employment as a social welfare component. This valuation has two main aspects: Firstly, in the command economy the employed received a guaranteed weekly or monthly wage packet, but the scarcity of consumer commodities made it difficult to convert these wages into welfare in the form of consumption goods. In the present market-like context by contrast, wages have become scarce, but there is an abundance of consumer goods available. Consequently, the acquisition of daily necessities no longer involves the added cost involved in queuing for several hours.

Secondly, as described in the introduction, access to a number of social benefits in the Soviet context was regulated by attachment to a particular workplace. These could be kindergartens for children, subsidised food supplies, better housing conditions, and many others. Particularly in the mono-industrial "company towns", almost the entire social sphere could be owned and regulated by the local enterprise, which in many cases managed it in cooperation with the trade union and local authorities. This practice seems to be still in effect in many enterprises on the Kola Peninsula, though in a much more irregular fashion than earlier. In newly established private enterprises, the lack of such non-cash benefits seems to be compensated for by a slightly higher wage level. Nevertheless, the haphazard distribution of these company-based social benefits may mean that the value inherent in being attached to a workplace may vary according to the existence of possible "invisible" benefits provided by the company and not reflected in the wage levels.

7.1 Overview of the labour market

By way of an introduction, this section will contain a presentation of the main features of the labour market, and a grouping of the survey population into broad labour force categories as recommended by the International Labour Office.

Within this labour force framework, the adult population is grouped into three main categories with some sub-groups. The main categories used are i) employed, ii) unemployed and iii) not in the labour force. Persons are categorised according to their activities within a short reference period (usually one week, as done in the 1997 survey), by using a specific set of priority rules.

To be "employed" is defined in terms of paid employment or self-employment; paid employment covers persons who during the reference period performed some work (for the duration of at least one hour) in return for a wage or salary, in cash or in kind, as well as persons with a formal attachment to a job, but temporarily not at work. Self-employment covers person who during the reference period performed some work for profit or family gain, in cash or in kind, or persons owning an enterprise, but temporarily not at work.

The standard definition of "unemployed" covers persons who during the reference period: a) did not perform any paid work; b) were available for work; and c) actively sought work. The unemployment rate is calculated as the share of unemployed persons in relation to the entire labour force, consisting of the sum total of persons employed and persons unemployed.

The "not in the labour force" category comprises persons who are not economically active, i.e. who are without paid employment, without a job attachment and are not seeking and/or available for work.

The regional distribution of gross employment figures as revealed by the 1992 and 1997 surveys is displayed in table 7.1. In the survey area as a whole, approximately two thirds of the adult population are employed, though there are some regional variations in the employment pattern. Taken as a whole, this is considerably lower than in 1992, when more than 80 per cent of the population reported being permanently employed. On the other hand, this employment rate is higher than more comparable figures revealed by the NORBALT survey carried out by Fafo in St. Petersburg and Kaliningrad in 1994, where the gross employment rate was 60 per cent of the adult population (Hansen 1996, p. 89). In 1995, the gross employment rate in Norway was 70 per cent of the adult population, though with a considerably higher retirement age (SSB 1996, p. 68-69).

Further, unemployment also seems to show considerable intra-regional variation, to an even higher degree than does employment. This points to two features of the labour market on the peninsula: Firstly, it is yet another demonstration of the dependency on a single enterprise in the "company towns" in the interior of the peninsula. Secondly, the relatively high unemployment rates, combined with an overall high rate of paid employment accounts for an over-average labour force participation in the surveyed areas relative to Russia as a whole. This can be partly explained by the relatively low average age of the population, and consequently there are fewer persons of retirement age.

The survey also reveals that the highest rates of unemployment are found in the youngest age groups. More than one in four men in the age group 18–20 is an unemployed job-seeker, and unemployment gradually decreases with increasing age, for both genders. Unemployment is less common among women than among men,

mostly on account of the lower rates of labour force participation on the part of the female population.

Following the liberalisation of labour legislation, rates of economic inactivity has risen by approximately 10 per cent, which seems to be less than in other parts of Western Russia for which data are available. Nevertheless only about one fourth of the population is outside the labour force, though with significant gender differences. Economic inactivity is twice as common among women, with one in three women outside the labour force, as opposed to one in six men. Partly this can be explained by the fact that there are more women than men among the retired, though economic inactivity is lower for women in all age groups.

Table 7.1 Main labour market categories 1992 and 1997, including unemployment rate by district, both genders. Percentages

	Employed	Unemployed	Not active	Unemployment rate
Murmansk	64	12	24	16
Apatity	61	17	21	22
Kandalaksha	67	5	28	7
Pechenga	75	7	17	8
All 1997	64	12	24	15
All 1992	81	-	19	-

Table 7.2 Main labour market categories by age group and gender 1997, all regions

	Men			Women		
Age group	Employed	Unemployed	Not active	Employed	Unemployed	Not active
18–19	22	26	52	22	15	64
20–29	74	19	8	60	14	27
30–39	84	15	1	73	12	15
40–49	76	17	7	80	10	10
50–59	57	10	33	47	3	50
60–69	37	-	63	25	-	75
70 and above	21	6	74	7	-	93
All	70	15	15	59	9	32

7.2 The employed population

When studying possible changes in the composition of the working population on the Kola Peninsula over the five-year period, it should be borne in mind that the two surveys do not cover exactly the same areas, and employment patterns may vary over the different parts of the region as described above. In order to achieve consistency and separation of the economic effects from the regional, in several of the analyses presented below are figures from Murmansk city presented separately, as this is the only survey area where the 1992 and 1997 data sets have complete overlap.

When interpreting these figures , it is essential to bear in mind that the retirement age for women at both survey points was 55, and for men 60. After that has been taken into account age-corrected employment rates were nearly identical for both genders in 1992. Facing the general obligation to hold work, employment rates remained close to the maximally possible for the younger and middle age groups. This is also a reflection of the position of the peninsula as a place of temporary residence for very many inhabitants. Those who could not work for reasons of disability, etc., would be most likely to move to a place with a more favourable climate.

Figures for Murmansk city for 1997, however, indicate that overall employment rates have decreased by approximately 10 percentage points for males, and nearly 20 percentage points for females. Moreover, this decrease has mainly come at the outer ends of the age scale, i.e. among the oldest and the youngest. The most productive middle age groups have remained the most active, as might be expected. This said, it is not easy to determine what should be regarded as a "natural" age distribution in the labour market. There can be little doubt that the employment figures seen in the Soviet context contained several persons who in all likelihood

Table 7.3 Age composition of the employed population, Murmansk city. Percentage employed in each age group

	1992		1997	
Age	Men	Women	Men	Women
18–19	45	48	26	23
20–29	79	83	72	55
30–39	94	94	80	70
40–49	96	96	75	81
50–59	80	57	64	43
60–69	26	12	33	27
70+	35	15	32	8
All	81	75	70	58

were employed in name only, and labour force participation was artificially high due to the coercive nature of prevailing labour legislation.

The most striking feature of the present distribution is that labour activity does not drop off suddenly following the retirement age limit. Rather, there seems to be a gradual "phasing out" of workers, starting in the pre-retirement age groups with a minor shift downwards at retirement, and a continuing trend of labour activity of persons beyond formal retirement age. Thus, a considerable number of retirees continue to have some form of employment, where they collect pay in addition to the legally stipulated pension, which is received irrespective of any labour income. The gradual "phasing out" of workers approaching retirement could be an indication that these are subject to exclusion mechanisms in the labour market, though there are no other data to support this hypothesis. Employment rates have dropped considerably for women in the immediate pre-retirement age interval (50 – 54 years), from 71 per cent in 1992, to 53 per cent of all women in 1997. From the data, it also seems as if a number of persons tends to take early retirement for reasons of health or the like. It will be recalled that the average life expectancy for men in Russia is actually lower than the male retirement age. Nevertheless approximately one third of all men and one fourth of all women continue in paid employment during the period after having reached retirement age. It has been relatively common for those who are formally retired to continue in the workforce, though labour activity among pensioners seems to be gradually decreasing. In the 1992 survey nearly half of all men and close to 40 per cent of all women beyond formal retirement age reported having some form of paid employment. Similar figures were revealed also by the NORBALT survey in St. Petersburg and Kaliningrad in 1994. (Hansen 1996, p. 91).

Whereas the reduction in employment rates for the elderly has mainly resulted in higher economic inactivity, the reduction in rates of employment among the younger age groups has almost entirely been at the expence of higher unemployment. In 1997, as in 1992, approximately half of all young people continue in the educational system after ending their compulsory education, and half join the labour force. A large proportion of the latter group end up in unemployment, as will be seen below. Entrance barriers to the labour market for young people without education beyond compulsory level seem to be high, and close to one fourth of the persons in the younger age groups are unemployed job-seekers. It should be added that the opportunities to obtain higher education on the peninsula are mostly limited to those specific sectors which prevail in local industrial life, e.g. shipbuilding, fisheries and mining. Those who opt for other types of education have to leave the region to find suitable seats of learning.

7.3 Working hours

The number of hours worked every week is an expression of the intensity of the labour activity of the population. Rather than focusing on formal work schedules, the 1997 survey attempted to capture the actual number of hours worked by the population during the reference week, which is likely to be a realistic estimate of the hours people work during any week of the year. Respondents were asked to state the total number of hours they had worked during the reference week, including overtime and hours worked at home. In this manner, the work schedules of self-employed persons could also be captured, as these do not comprise schedules stipulated by law or union-employer agreements.

However, recent labour legislation stipulates that working hours for women employed full-time are 36 hours per week as opposed to 40 hours for men. Consequentially, women work nearly one hour less per day than men and with full pay. This provision has clearly been intended as a social benefit for working women, who in most cases also tend to be charged with the responsibility for housekeeping and childcare. On the other hand, as the Russian labour market moves towards more and more market-like forms, this provision will raise the cost of female labour relative to that for men, but it remains to be seen whether it will produce a gender-based bias in employment patterns. From the table, it also emerges that many women actually work more than the full-time schedule of 35-36 hours per week.

Table 7.4 Working hours, percentages in each category

Men	Percent	Women	Percent
Short part-time (1–20 hrs.)	5	Short part-time (1–20 hrs.)	6
Long part-time (21–39 hrs.)	15	Long part-time (21–34 hrs.)	10
Full-time (40–42 hrs.)	55	Full-time (35–36 hrs.)	53
More than full-time (Over 43 hrs.)	25	More than full-time (Over 37 hrs.)	31

7.4 Sectoral distribution of employment

Following Gorbachev's famous *perestroika* initiative, certain forms of semi-private enterprises became legal in the USSR in 1987. The main forms were co-operatives, which formally were worker-owned, joint ventures between a state enterprise and a foreign partner, and so-called leased enterprises in which the workers rented a facility from a state-owned enterprise for a fixed sum and were free to operate it at profit. However, there were formidable obstacles of both a bureaucratic and legal

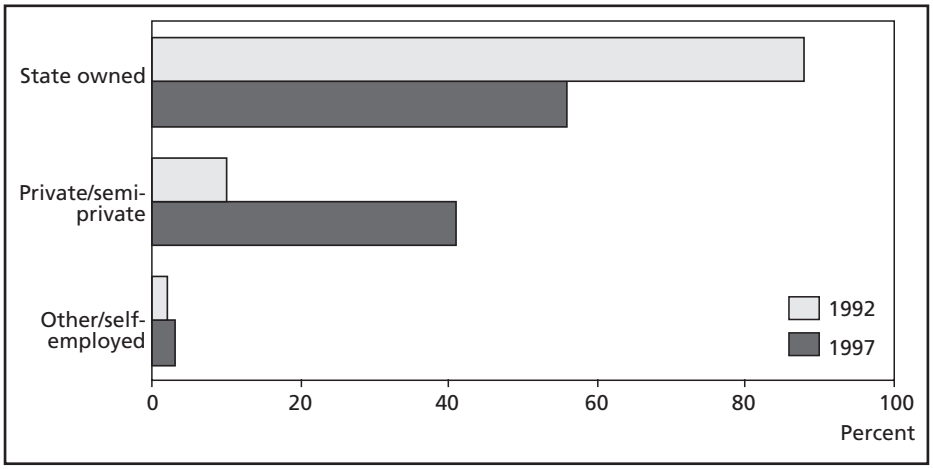
nature to be overcome before a business could be established. Although private enterprises and ownership of production facilities were made fully legal in 1991, most of the legislative framework on which a market economy is built was lacking in 1992, and partly still is. In spite of this sluggish start, the private and semi-private sector accounted for as much as 12 per cent of all employment in the survey area in 1992. It should be borne in mind that this was the situation only six months after the "Big Bang" on 2. January 1992, and only one year after the legalisation for private businesses. In the first years of private trade, many of the emerging businesses were driven by unproductive, but highly profitable rent-seeking, exploiting the price differences between the regulated state sector and the unregulated private one. However, with the deregulation also of the state enterprises, this practice gradually disappeared.

The present privatisation programme, which was launched by the Gaidar administration in late 1992 and has been continued by the present Russian administration has involved enterprises in all sectors of the economy with the exception of certain industries considered to be strategic or related to defence sector production. The present private sector consists of both formerly state-owned enterprises which have been auctioned off, as well as newly-established private small and medium-size enterprises.

The development of employment in the private sector can be followed in figure 7.1.

In the area covered by the 1997 survey, private sector employment had risen to 44 per cent of all employment, according to respondents' answers, and also comprised many employees in firms of the mixed ownership form. This is a substantial share, when taking the industrial structure on the peninsula into account.

Figure 7.1 The employed population 1992 and 1997: Sectoral distribution



The enormous *kombinaty* would probably be considered over optimal size by western economic standards, and most of them are in dire need of major technical overhaul to bring them up to a technological standard where they can compete effectively in world markets, and meet environmental standards. In addition, these enterprises are responsible for social infrastructure, and in the final instance for the livelihood of entire towns. They are therefore not easy objects for privatisation, and are likely to remain state property for a considerable period of time to come.

State employment therefore still dominate in manufacturing, in addition to budget sector employment in education, health-care and the armed forces. Private employment is most widespread in trade and services, which were the first industries to "go private" immediately after legislation allowed for private enterprise. Retail trade and distribution had been the perennial bottlenecks in the Soviet economy for the entire existence of the USSR. In addition to providing a spacious market niche, the establishment of a trade and services enterprise requires less investment and provides for faster returns than for example manufacturing. Deficient legislation and property rights also served to discourage investments in the productive sector, and to a certain extent still does.

The same trend is discernible on the Kola Peninsula as in other parts of Russia, namely that employment in the private sector is dominated by men. As much as 65 per cent of all employment in the private sector is made up of men. Among all employed women, 66 per cent are employed in the state sector, against just under half of all men. Self-employment accounts for approximately 2 per cent of both men and women. In a welfare perspective, this difference is of some importance, as wages in the private sector tend to be higher than in state enterprises. To a certain extent this difference is offset by the higher volume of non-cash benefits in the state sector, though the provision of these benefits has become increasingly irregular and was not investigated in the 1997 survey.

7.5 Employment by industries

The main industries in terms of employment on the peninsula remain industry, trade, public services (health care and education) and the armed forces. In the areas surveyed, the respondents employment was distributed among industries as shown in table 7.5. It should be noted that these are self-reportings, and thus a certain error margin is inevitable. It may also be not entirely clear what industry a particular respondent should be assigned to. If a person drives a truck, his or her work actually comes under transport, but if the company he or she works for is a construction company or a mine, the truck driver should more rightly be considered employed

in these latter industries. In self-reporting, this type of classification error is inevitable, and the table should therefore be regarded as a rough indication of the composition of industrial employment. Even if the two surveys do not cover exactly the same areas, it would seem as if there have been few, if any, dramatic changes in the relative position of different industries, and that the reduction in employment rates described above has affected most industries to an almost equal degree. However, there are very considerable margins of error connected to this estimate, and hence it should be read with some caution. Nevertheless the observed lack of any major changes corroborates other findings in this report which also indicate a rather slow pace of economic restructuring on the peninsula.

Figures from the 1997 survey coincide fairly well with official employment statistics, according to which approximately 30 per cent of all civilian employment on the peninsula as a whole lay within manufacturing, 20 per cent in health care and education, 12 per cent in trade and services and 10 per cent in transport and communication, including the merchant fleet (Goskomstat (1) 1996, p. 25).

Survey figures are corroborated by official statistics which document the existence of a highly gender-segregated labour market on the peninsula. According to official statistics for 1995, women accounted for only 30 per cent of employment in manufacturing, against close to 90 per cent in health care and education, and over 80 per cent in trade, information-related services and culture/art (Goskomstat (1), p. 27). All these figures relate to civilian employment only, and do not in-

Table 7.5 Employment by industry, both genders, 1992 and 1997

	1992	1997
Agriculture, fishery	5	5
Armed forces, police	17	10(*)
Heavy industry/mining	5	6
Light industry/food processing	4	3
Energy supply	3	3
Construction	6	5
Trade/services	10	14
Transport	11	13
Finance	3	2
Public administration	2	2
Health service/education	20	25
Culture	2	2
Other	9	10

(*) Insecure estimate, cf. below

clude the armed forces sector. As will be seen below, this uneven pattern of employment accounts for a number of gender-based differences when it comes to adaptation to the labour market.

7.6 The armed forces sector

The armed forces continue to be a major employer on the peninsula, although the reduction foreseen in the volume of standing forces in Russia will in all likelihood also comprise both naval and land forces on the peninsula. However, the volume of the military presence on the peninsula continues to be kept as a state secret, and the armed forces do not appear in any official statistics. Settlements and election districts which were primarily under the control of the armed forces were off limits to the 1997 survey, and a reliable estimate of military employment can therefore not be made.

In the 1992 survey, the armed forces, which accounted for approximately 20 per cent of all employment, though with strong regional variations, was the single largest employer in the area surveyed. The armed forces accounted for close to 30 per cent of all gainfully employed males in Pechenga, and at the naval base of Severomorsk the Navy accounted for over 75 per cent of all male employment and close to one third for females. However, this should not be regarded as a valid estimate of military employment on the peninsula as a whole. Military employment tends to be strongly concentrated in the garrison towns and naval bases, some of which do not even appear on maps of the peninsula.

In the net sample (i.e. those who answered, interviewed in purely civilian settlements) comprised by the 1997 survey, approximately 10 per cent of the respondents reported being employed in the armed forces sector or the police force. Assuming that police officers most probably account for approximately one or two percentage points of this total, this is most certainly too low as an estimate of the true volume of military employment in the survey area. Most likely, the group of military persons comprised by the survey consist of middle- and high-ranking officers assigned to the local forces on a long-term basis, as well as some persons employed in civilian-type support occupations, but within the military sector. Because respondents were interviewed at their place of residence, the 1997 survey figures seem to give a reasonable estimate of the sectoral distribution of employment among persons who live in the civilian settlements included in the survey, but the limitations inherent in the exclusion of the military settlements ought to be borne in mind when employment patterns in the regions surveyed are interpreted.

7.7 Additional employment

In the face of an overall low wage level, a possible strategy to improve household incomes is to engage in secondary employment, i.e. to hold down a second job for some hours in the evenings and at weekends. The prevalence of secondary employment among the employed population is displayed in table 7.6.

Table 7.6 "Do you have an additional job?" Percentages affirmative. 1997

	Men	Women
Murmansk	7	5
Apatity	3	2
Kandalaksha	7	8
Pechenga	2	5
All 1997	7	5
All 1992	9	4

This practice of having secondary employment does not seem to be very widespread and also seems to remain fairly stable at approximately 7-9 per cent of all employed men, and 4-5 per cent of employed women. These rates for secondary employment are approximately equal to those found in Kaliningrad in 1994, in a region which has many points of similarity with the Kola Peninsula in terms of both settlement and economy (Hansen 1996, p. 95). In comparison, 17 per cent of employed men, and 12 per cent of employed women in Norway had secondary jobs in 1995 (SSB 1996, p. 68-69).

7.8 Underemployment

Within the labour force framework, any person who worked for any number of hours during the reference week is to be considered as employed, as outlined above. Similarly, unemployment is defined as a situation of a total lack of work. However, there may be some less extreme situations involving a partial lack of work, where the currently available work is considered to be inadequate; in the labour force framework, these situations are referred to as *visible underemployment*. According to the recommendations of the ILO, a person is considered visibly underemployed if: a) he or she works less than the normal duration; b) is doing so on an involuntary basis; and c) is seeking or is available for additional employment. The simultaneous fulfilment of these three criteria constitutes a very stringent definition of under-

employment. The normal duration of work has for this purpose been set at 40 hours for men and 36 hours for women. Seeking behaviour constituted a separate questionnaire item, and involuntariness with respect to the present work schedule was assumed equal to active seeking behaviour.

On the basis of this stringent definition, less than one per cent of the employed population in the survey areas can be identified as underemployed in the strict sense, and it seems safe to conclude that this does not present a significant problem for the local labour market.

Further investigation shows that both having and seeking additional employment is most common among men who work short part-time, as well as men who work full-time or more in their main jobs. Among women, both having and seeking additional work is equally common over all work schedules. Thus, additional employment is used as a compensation for insufficient amounts of work for a small group of men, for other groups the effect is cumulative, adding working hours (and presumably income) to the hours already worked in a full-time position.

There may be many reasons why secondary employment is not used more widely as a strategy to generate additional incomes. One possibility is that the local labour market does not provide such job opportunities, and among the surveyed areas only Murmansk city is likely to have a sufficiently varied labour market to do so to any extent. Further, people may prefer to turn to informal sector activities for added income, as the industrial wage level in general is low, and a second job for some hours per week thus provides little marginal gain for the effort. Also, there is a possibility that additional employment is not part of the traditional pattern of adaptation to the labour market, as working hours tend to be long enough as they are.

7.9 Wage arrears

In terms of household economic welfare, the problem of wage arrears, which has plagued Russian industry over the last years, will be a very crucial factor. The delays in the payment of wages has been the source of enormous amounts of understandable discontent and has also been the cause of a great number of rallies and marches, particularly during the last year. People have been forced to wait several months for their wages, and payments have at times been erratic and incomplete.

In the 1997 survey, an attempt was made to investigate the prevalence of delayed wage payments by asking respondents to report how long ago they received their last full pay. Responses are displayed in figure 7.2.

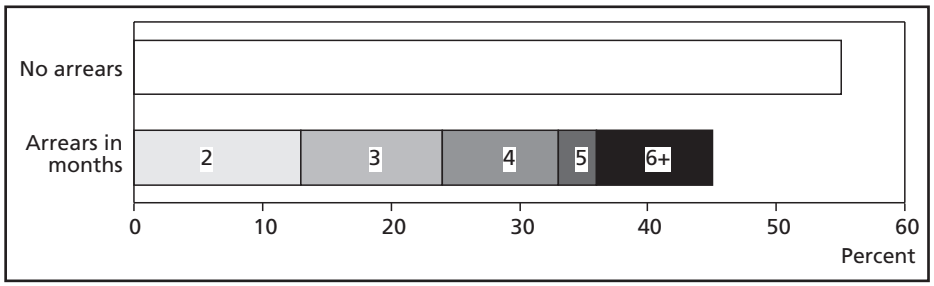
It emerges that nearly half the employed respondents had at least some wages owed to them by their employers at the time of the survey, and one third were running arrears of three months or more. As many as nine per cent of the respondents reported that they were owed more than six months in pay.

The survey data also allowed for an analysis of how wage arrears were distributed by industry. The highest average figures for arrears were found in the construction industry, where they amounted to 12 weeks of outstanding pay, followed by power, gas and water supply with 11.5 weeks, light industry with 10.9 weeks, agriculture and fisheries with 9.4 weeks, armed forces and police with 9.2 weeks, education and health care with 9.1 weeks and transport with 7.8 weeks. In heavy industry, trades and services, finance and insurance, as well as culture and art, wage payments seemed to be largely made on time, with less than four weeks on average since the last pay. However, there are considerable variations within industries with respect to the regularity of wage payments.

One would also expect that the cash-starved state sector would have more difficulties in making wage payments on time, but this is not supported by the data. Average delays in wage payments were approximately equal in both the state, the private and the semi-private sector at close to eight weeks in all.

The reasons for the delays in wage payments may be many, though all related to the transitory stage the Russian economy is in. Firstly, enterprises may lack available cash in their accounts. This has mainly been due to the inability of enterprises to pay their bills, and hence they have continued to accumulate credit with each other. State enterprises and institutions have had to take large cuts in the transfers from central authorities, and have on occasion been without funds to meet wages. There is also a strong possibility that some enterprises have withheld wage payments for strategic reasons, as a method of improving their credit-base and financial solidity at times. The temptation to use available liquid cash for speculation in volatile stock markets, where the possibility of windfall gains was seen as good, may have been higher than paying out wages. A further simple answer to how enterprises can withhold wages for several months may also just be that nobody is able

Figure 7.2 Employed persons with different amounts of wage arrears, percentages



to stop them from doing it. The lack of legal foundations and workable union-employer agreements containing enforceable punitive sanctions means that employers have a wide latitude for action with respect to wage payments. However, the drop in inflation rates has contributed to reduce the gravity of the problem, and the growth in inter-enterprise credits seems to have slowed down over the last year.

Another question is how people can stay on in the enterprise without receiving any wages for months on end. In some enterprises this is likely to be influenced by the provision of non-cash benefits without which the employees would find it hard to cope. Housing, kindergartens, schools, or the suchlike that employees find themselves dependent on, fall in this category.

7.10 Unemployment

As opposed to 1992, the 1997 survey documented a considerable number of unemployed persons on the Kola Peninsula. In common with other parts of Russia, unemployment has become visible and has affected all age groups and both genders, though to a somewhat unequal extent, as shown by table 7.7.

At the general level, it seems as if unemployment has hit the male population harder than the female. Among the population aged 18 and over, every sixth man, but less than every tenth woman is an unemployed job-seeker. This difference is likely to be an effect of the gender-segregated labour market, with typically male and female industries as described above. The male-dominated industries, such as mining and metallurgy are likely to have been those most affected by rationalisation and the shedding of excess labour, whereas the female-dominated occupations

Table 7.7 Unemployment by age group and gender. Per cent within each age group who are unemployed job-seekers*

Age group	Men	Women
18–19	26	15
20–29	19	14
30–39	15	12
40–49	17	10
50–59	10	3
60–69	-	-
70 and above	6	-
All	15	9

* These figures should not be confused with the unemployment rate, which is calculated as a percentage of the labour force, i.e. excluding the not economically active.

in health care and education are more likely to have been sheltered from layoffs. Trade and services, which are traditionally female-dominated, are likely to have grown in absolute volume, as indicated by table 7.5 (Employment by industries). More women than men also seem to have left the labour force and become economically inactive.

Table 7.8 Employment by educational status 1997

	Men			Women		
Education	Employed	Unemployed	Non-active	Employed	Unemployed	Non-active
Primary	35	4	61	27	-	72
Incomplete secondary	46	21	33	36	5	33
Common secondary	66	20	14	57	12	14
Vocational	77	12	11	66	10	11
Unfinished high	68	16	16	51	8	16
Higher	86	8	6	77	5	6

There is a strong tendency for the higher educated to do better in the labour market than their lesser educated counterparts. Employment rates increase systematically with each increase in the level of education in the same manner as in other industrialised societies. It should be noted that the group with only primary education is very small and is mainly found in the older generation who received their education in the first years of Soviet power and in the inter-war period. The average level of education is negatively correlated with age, i.e. the younger generations tend to have higher educational scores than the older. This is described in a separate chapter of the report. The data do not suggest that the older generations are systematically discriminated against in the labour market; on the contrary, the young seem to face higher barriers to labour market entry than do the old in their search for new jobs.

7.11 Hidden unemployment

Particularly during the first of the reform years, there was a widespread fear that administrative practices in the bloated industrial giants in Russia had created a high rate of hidden unemployment among persons who had been put on long-term administrative leave instead of being made redundant, and hence were de facto unemployed, even if they maintained a formal attachment to an enterprise. In none

of the surveys carried out by Fafo in Russia since 1994 has this phenomenon been documented as being as widespread as it is sometimes claimed. This item was also included in the 1997 survey in a specific question to respondents on the occurrence of temporary lay-offs and leave without pay. It will be recalled from the above that persons who are not job-seekers and have a formal attachment to a job, even if they are absent from that job in the reference period, are counted as being employed. Respondents who stated that they were on administrative leave during the reference period constituted approximately one per cent of the employed population. This is equal to figures for this type of hidden unemployment found in St. Petersburg and Kaliningrad in 1994 (Hansen 1996, p. 101). If anything, the practice thus seems to form a stable, though minor, feature of the situation in the Russian labour market.

Another type of hidden unemployment can be found among the so-called "discouraged workers". These are jobless persons who either have given up their search for a job, do not know how or where to find one, or believe that they do not possess the right qualifications in the local labour market. Because they do not engage actively in job seeking, they are counted as non-actives, not as unemployed. They make up approximately 5 per cent of the non-active category, a somewhat higher rate than was found in, for example, St. Petersburg and Kaliningrad in 1994, an indication that this group is growing. However, in a situation where privatisation has changed many of the rules of the labour market, and local industries have faced several new challenges, a certain disorientation with respect to the labour market would only be expected. In spite of this, adaptation to the labour market seems to have been relatively organised as far as the majority is concerned.

7.12 Mobility in the labour market

With respect to unemployment, an important indicator of turnover and mobility in the labour market is the length of time people spend as unemployed before they are able to return to a paid job. Simultaneously, this is an important welfare indicator, as a lengthy spell of unemployment will tend to be a major strain on the household economy as well as a source of other social problems for those affected.

On average, an unemployed male in Murmansk has sought work for 10.6 months, and an unemployed female for 12 months. The median job search time for men was 8 months, and 6 months for women. These averages conceal major variations, and some respondents even reported having been unemployed for as long as five years, whereas close to 30 percent had been looking for a job for four months or less. It should be borne in mind that an unknown number of these job-seekers may have had short-term employment during their job-search period, as the

unemployed status was assigned solely on the basis of their activities within the reference period.

The observed gender difference means that among women there is a more pronounced spread in job-search time patterns. Approximately 75 per cent of unemployed women have been looking for a job for one year or less. However, at the other end of the scale 12 per cent of the group of female job-seekers report having spent more than two years searching for a job. Among men, the spread of job search time is somewhat more even, though nearly 80 per cent of unemployed men report less than one year of job search. Only 6 per cent of the male job-seekers report having spent more than two years looking for employment.

As a general conclusion, it seems as if turnover in the labour market in the surveyed areas tends to be slow. The gender-segregated character of the labour market on the peninsula also appears to cause slightly different unemployment patterns for men and women. It will be remembered from the above that two thirds of the total number of unemployed job-seekers are men.

In comparison, the median time in unemployment was 5.4 months for a male, and 5.7 months for a female job-seeker in Kaliningrad in 1994. (Hansen 1996, p. 103).

7.13 Economic inactivity

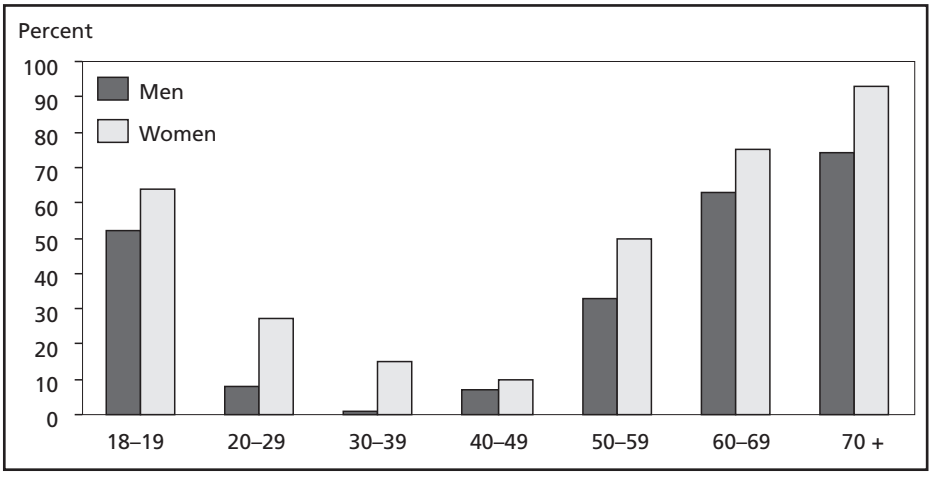
In addition to the employed and the job-seekers, a certain part of the adult population will be economically inactive, i.e. non-participants in the labour force.. They form a residual category in the labour force measurement framework made up of persons without any paid work during the reference period, and who either have not sought work or are not available for work at the time of the survey. This status can be voluntary or involuntary, temporary or permanent.

The age composition of this group is shown in figure 7.3. The distribution is clearly U-shaped, with the heaviest concentration at both ends of the age scale. Closer scrutiny reveals that 65 per cent of this group consists of retirees, i.e. persons over retirement age who did not have any paid employment during the reference period. Persons of working age, but with a disability pension, and women on maternity leave accounted for another 8 per cent of the inactives. Students and others engaged in full-time educational activities accounted for 10 per cent of the economically inactive respondents, and the final major group among the inactives consisted of women who reported as housewives, 6 per cent of the total. Together with the discouraged workers described above, equal to 5 per cent of the total, these groups accounted for 94 per cent of the economically inactive population.

As described above, economic inactivity without a valid reason was not allowed according to the USSR labour code. The only valid reasons for not working were permanent disability, of which there were three classes according to the gravity of the disablement. Class I and II disabled were exempt from the obligation to work, but class III, with the lightest forms of disability were required to undertake some form of suitable employment. Women with responsibility for children up to the age of five were also exempt from the duty to work and still kept a significant part of their previous pay during maternity leave. These rather generous benefits formed part of the pro-natalist policy of the Soviet government.

However, the abolition of the coercive Soviet labour regime in 1991 seems not to have entailed a major increase in economic inactivity in the studied population during the ensuing period. The overall increase in voluntary or involuntary forms of inactivity seems to remain within a few percentage points. The overwhelming share of the reduction in employment rates has come as an effect of unemployment, which almost by definition is involuntary on the part of those affected. Even if economic inactivity has become perfectly legal, this option is not more widely used by the population than earlier. One may hypothesise that what earlier was an obligation by law now has become a virtue of necessity, as many households struggle to generate enough income to make ends meet. Furthermore, the high rates of economic activity have become an ingrained pattern in the Russian context, and economic inactivity thereby does not belong to the repertoire of alternatives.

Figure 7.3 Economically inactives by age group and gender, all regions 1997. Percentage within each age group who are economically inactive



Chapter 8 Poverty and Wealth

Anyone who has visited the Kola Peninsula regularly over the period since the beginning of reform in Russia cannot have failed to notice how the very face of Kola society has changed in these short years. Though maybe highly unscientific as a method of investigation, taking a stroll through the commercial and residential areas of Murmansk reveals many sides of the recent changes in daily life on the peninsula to even a casual observer. In terms of dress, people in the streets are hardly distinguishable from those across the nearby Norwegian and Finnish borders. Shops are well-stocked and crowded, an unthinkable fact only five or six years ago. Traffic has increased markedly, and Japanese and German cars have become almost as usual as the domestic makes. Houses covered in scaffolding and numerous construction sites testify to investment. Along the central thoroughfare the young and upwardly mobile fill the many new cafes and restaurants, though the ostentatious display of wealth seen in Moscow and St. Petersburg is absent. However, on the sidewalks ragged beggars rummaging in the dustbins have appeared. These are all very observable signs that a process of social change has been set in motion.

Put in more economic terms, the introduction of nascent market mechanisms has affected both the amount of resources available, as well as the manner in which these resources are generated and distributed. This notwithstanding, the Russian economy remains in a fundamental disequilibrium, with deep-seated system-level dysfunctions. Russia remains far from the ideal state of a liberal market economy, and the economic manifestations should therefore not necessarily be interpreted as if a functioning, democratic economy were already in place. The causes for both poverty and wealth may therefore not be entirely the same as in contexts which are more familiar to a Western observer.

The remainder of this chapter will contain an attempt to investigate the characteristics of this evident process of change in terms of its effect on economic welfare, poverty and social distribution of income. In the introduction to this report, the restructuring of Russian society has been described as taking the form of adaptation on the part of the population to politically generated change in the framework of social and economic action. This gradual adaptation is a fundamentally much slower process than the reformation of the framework itself. The aim of this chapter is therefore to penetrate below the surface observed on the streets of Murmansk, investigate how structural change has affected the social organism on the

Kola Peninsula and to see what consequences these changes have had for households and individuals in terms of their economic position.

There are several possible perspectives to the study of the economic and welfare position of households. One possibility is to investigate income and income distribution; however, if there is little systematic connection between average incomes and average living conditions in the sense of being neither very poor nor very rich, focusing on income alone will be insufficient. A complementary perspective is to focus on what people own, in the form of durable consumer commodities. The underlying assumption here is that the purchase of such items requires a minor investment, and hence can be regarded as an indication of a surplus of spending power in the household, providing a proxy variable for income. Put simply, households convert their monetary income into material welfare through expenditure decisions. The aggregate result of these decisions thereby represents the actually realised welfare level for the household. However, the combined household income represents the upper limit of welfare potential, meaning that some spending opportunities will have to be foregone. As only the luckiest of us can buy everything we want, it is revealing to study what people say they cannot afford, as these foregone expenditure decisions reveal a great deal about their economic position. In the following, all these three indicators – income, ownership of durable commodities, as well as the perceived affordability of various necessities – will be given a closer scrutiny. In combination, these indicators will form the basis for an estimate of the prevailing poverty levels on the Kola Peninsula.

8.1 Income levels and income distribution

It is an open question whether comparison of incomes in nominal or even real terms between the two survey points makes any sense at all from a social welfare point of view. According to official wage statistics, the nominal average monthly income over all sectors of the local economy grew from 800 roubles in 1991, to 10,600 in 1992, to 112,000 in 1993, and was up to 850,500 roubles in 1995 (Goskomstat (1) 1996, p. 46). These wage figures reflect the double-digit monthly inflation rates experienced during the first reform years.This inflation was partly the result of profound macroeconomic instability, coupled with persistent scarcities of consumer goods. In other words, during the period 1992 – 1993 it was difficult to convert income into consumer goods, as the shops simply had next to nothing on their shelves. The scarcities gradually disappeared as the borders were opened up for imports, which have accounted for a growing share of the market for consumer goods on the peninsula, as in other parts of Russia. The prices for imported goods tended to reflect

those in the exporting country, meaning that price levels also were imported. Former scarcities thus have turned into a cornucopia of consumer opportunities, the restriction now being found in household budgets.

Simultaneously, households face other new challenges related to the new economic realities. In Soviet times the entire infrastructure accessed by the households was held by the state; housing, including heating, telephone, electricity and gas were virtually free of charge. Vacations were paid for by the enterprise, and domestic travel was cheap. This made economic planning as known for example in Scandinavia hardly necessary, and wages were meant to be spent on daily necessities. A surplus could be saved to purchase a car, something which in most cases would involve several years on a waiting list, or put into a savings account. Today, an average household will in many cases not only struggle in order to survive on current income, but is also forced to plan and structure their finances in very new ways, as the access to infrastructure now sometimes requires substantial payment.

All this combined have changed the economic position of the households not only in terms of available resources and income-generating potential, but now the new economic environment has required households to adapt to the changing surroundings which affect both income and expenditure.

The overwhelming majority of the working population still comprises employees who derive their income in the form of wages. A short review of wage formation systems and incomes policy may therefore serve as a background to a further description of income distribution.

8.2 Wage formation systems in Russia

In the period since 1992, new, more market-based forms of wage formation have emerged in both the privatised and the state sector, and this is possibly the single change which has played the most prominent role in the population's adaptation to life in a market economy.

In the USSR, wage levels were administratively controlled through a nationwide tariff system, in which all jobs were graded according to the required skill level, output, hours of work, etc. In addition, the system provided for a great number of bonuses as well as regional and special incentives. In the northern regions, workers were granted a so-called "arctic coefficient", which could make wages up to 80 per cent higher than for the same job in central parts of the country. The entire wage system was based on the legally stipulated minimum wage, and all the other grades were calculated in coefficients relative to this sum. Whereas the minimum wage level remained virtually unchanged for several decades, wage adjustment mainly took

place in the form of ad hoc changes to the various coefficients, reflecting political priorities in terms of selected regions or industries. Though complicated and intransparent, this wage formation system was flexible and lent itself easily to adaptation to prevailing industrial polices.

In general, wage levels in the USSR were low, and the average wage remained at roughly 70 roubles from the beginning of the sixties to the mid-eighties. Wage differentiation was also moderate, and the ratio between the top and bottom deciles of the wage distribution was approximately 3:1. This wage formation system had several ideological underpinnings, one of which was the alleged attempt to "decommoditise" labour according to Marxian theory. An increasing share of labour remuneration in the form of state or enterprise-supplied social benefits or services would entail a shift away from the sale-and-purchase relationship with respect to work between the enterprise and the workers. Another ideology-based feature of the wage formation system was taken from the Marxian theorem that value is only created by labour. Because this was reflected in accounting systems, enterprises were in fact rewarded for overuse of labour, as labour cost was irrelevant to the enterprise. This incomes policy likewise prevented the emergence of openly wealthy population groups, which would have been ideologically unacceptable in a purportedly egalitarian society.

Even in the – in theory – tightly controlled planned economy of the USSR, such a wage formation system gradually yielded to the pressure from supply and demand forces in the labour market. Wages for low-skilled personnel, for which there was a constant shortage in Soviet industry, had to be continually adjusted upwards, mainly at the expense of highly skilled professions. As an example, a professor's nominal salary remained virtually unchanged from the 1960's until the 1980's, while the average wage increased by 250 per cent in the same period (OECD 1995, p. 8) By the mid-1980's, the wage structure had more or less ceased to reflect positively real differences in skill levels, and contained major disincentives for acquiring skills and education.

Today, wage formation follows different types of logic within the major sectors of the economy, as defined by ownership forms. In general, four such sectors can be identified. Firstly, those enterprises and institutions which are financed directly from the state budget (the so-called "budgetary sector"), comprising sectors such as health care, education, culture, public administration and defence. Secondly, the still state-owned enterprises, which have received a significant degree of financial autonomy, and no longer receive state subsidies. Thirdly, the privatised enterprises, which now mostly are organised as joint-stock companies, and fourthly, the newly established private enterprises.

In the "budgetary", or public sector proper, wage formation by and large still follows the same procedures as in the USSR. Wages are set according to the Uniform

Tariff Scale (UTS), introduced in December 1992. This tariff scale consists of 18 pay classes, and uses the minimum wage as a unit of calculation. The actual wage for each of the 18 classes are set by multiplying the minimum wage by a class-specific coefficient. In March 1995, the highest grade was reduced from about ten times to 7.54 times the minimum wage (OECD 1995, p. 9-10). The minimum wage amount used for calculation of the UTS may be set higher than the statutory minimum wage, though the difference has tended to be virtually negligible. The minimum wage was increased twice in 1992, four times in 1993, and only once in 1994 and 1995. The revisions of the minimum wage seem only partly to have been able to compensate for increases in the consumer price index (ibid.).

In the non-budgetary sector, comprising both state-owned enterprises with financial autonomy as well as privatised and private enterprises proper, market forces are making themselves felt with respect to wage formation. There is extensive competition for the most valued labour power, and average wage levels seem mostly to reflect a kind of ongoing bidding process. The winners are naturally found in enterprises with the highest profitability, and hence the greatest wage-paying abilities; in most cases they are found among new entrants in the private sector, filling previously empty market niches (ibid.).

The state-owned enterprises in general are plagued by low productivity and high production costs, mostly due to their obsolete production equipment, marketing problems and remaining social welfare responsibilities. Many also have a large surplus of labour power, which was hired in a period when the distortions created by the planned economy gave enterprises incentives to overuse, and even hoard labour power. Trade unions have tended to use their influence to prevent shedding excess workers. A large number of the state-owned enterprises also suffer from the effects of the growth in inter-enterprise credit, resulting in large payment arrears. Such enterprises have little opportunity to recover production costs, let alone make any profits, and are hence incapable of paying competitive wages. However, part of the effect of the lower wage level is offset by their ability to offer access to the social infrastructure which they still control (ibid.).

Nevertheless in certain sectors of the economy profitability, and hence wage growth opportunities, derives from market power. Some large enterprises, e.g. the automobile industry, are in the position of monopolists who, despite low productivity, are capable of controlling the domestic market. They thereby can easily increase prices and profit margins, and pay higher wages even if their actual output volume is falling (ibid.).

Newly emerging small-scale private businesses, on the other hand, tend to be more competitive, both through being more technologically updated, as well as through exercising more flexibility in terms of both wages and prices. Commodity prices seem to have risen even faster than inflation particularly in retail trade, which

is dominated by private enterprises. The difference in average wages between the state and the private sector grew from around 60 percent in 1992 to around 80 per cent in 1993 (Carlin et al. 1994, p. 64). It should be added that these averages conceal very wide inter- as well as intra-industry variations.

In addition to the market adjustment of wages, a certain role is played by collective bargaining through the trade unions which have redefined their role as a consequence of reform. In the Soviet period, the local trade union cells were more or less part of the enterprise management, often with a particular responsibility for the administration of the social infrastructure assets held by the enterprise. The emergence of independent labour market institutions began in 1989, following the slow democratisation of labour relations. The existing trade unions have undergone a thorough transformation, and new labour unions and movements without ties to the former system are emerging, partly in competition with the "old" unions.

Relations in the labour market are today governed by the Law on Collective Bargaining and Agreement, enacted in 1992. This law foresees a tripartite bargaining mechanism, including representatives of the trade unions, employers' organisations and the government. Tripartite agreements concluded at central, regional and industry level cover minimum wage levels and their adjustment to the rate of inflation, as well as several other issues. Additional earnings negotiations usually take place at enterprise level. On the whole, the impact of collective bargaining on wage levels varies considerably between different industries and enterprises, depending on the bargaining strength of the particular trade union.The overall influence of collective agreements on wage setting is still limited mainly due to two factors. Firstly, such agreements apply only to those employers who actually have signed them, and even then they regulate only minimum wage rates, leaving out higher earnings. Secondly, even this minimum wage cannot be guaranteed due to the lack of an enforcement mechanism, and employers are able to break collective agreements by using administrative leave, reduced working hours or simply by running wage payments arrears (OECD 1995, p. 11-12).

8.3 Measurement of income

The measurement of income using the methodology from a survey of the kind described in this report is very difficult, due to the characteristics of the interview situation itself as well as of the phenomenon one attempts to measure. Firstly, given the media focus on increasing crime rates in Russia, many respondents will be reluctant to reveal their level of wealth to a stranger who knocks on the door, as an interviewer in most cases will be perceived. Moreover, this reluctance will be

unevenly distributed in the population, as the more well-off will be more likely to refuse to state income figures, resulting in a downward bias of the income estimate. Some underreporting of income may also not be deliberate, as many households engage in various sources of informal economic activities, spending income as it is earned, without any account being made. Furthermore, it may be difficult to accurately assess the value of income earned in kind, or the value of access to services or infrastructure. In order to overcome these measurement problems, it is necessary to follow a sample of households which actually keep accurate records of their income and expenditure over a longer period of time, allowing for both a relationship of confidence to be built up, as well as gaining an overview of various types of income. Because of these measurement problems, questions about income were left out of the present survey, as they would be unlikely to result in a usable estimate. However, such income and expenditure surveys are routinely carried out by the local statistical authorities on the Kola Peninsula, and in the following their figures will be used. The disadvantage lies in that income levels cannot be systematically related to other living conditions parameters, though this is partly compensated for by a gain in the accuracy of the income estimate.

8.4 Development of real wages

The "shock therapy" measures initiated by the Yeltsin-Gaidar administration in January 1992 sent inflation skyrocketing, and available data indicate that by December 1992 prices had increased by more than 2,200 per cent compared to twelve months earlier. Wage increases during 1992 lagged greatly behind inflation, and real wages were reduced to one third of the 1991 level by December 1992. In the following years, inflation has gradually decreased, and the Kola population has had real wage growth in all the consecutive years. By 1995, real wage levels had grown to approximately 74 per cent of pre-reform levels.[1] However, these averages conceal very wide variations in both wage and price levels within as well as between regions.

The intra-regional variations in wage levels within the Kola Peninsula are displayed in table 8.1. As has been described elsewhere in this report, this is an effect of the industrial structure, where the welfare of the citizens is dependent on the success of the local plant and its wage-paying abilities.

Among the regions comprised by the present survey, Pechenga municipality has an average wage level considerably higher than the rest of the survey area.

[1] Author's calculations, based on information in Goskomstat (1) 1996, p. 44-48, 116.

This is an almost exact repetition of the position of the municipality in 1992, when Pechenga inhabitants reported approximately twice the regionally average wage level (cf. Hansen 1993, p. 85). Even if the relative position of the Pechenga miners has been reduced somewhat, they still receive the highest wages on the Peninsula. It should be added that these figures concern wages and not income from business activities or self-employment.

Even if real wage growth over the inter-survey period has nearly regained its pre-reform level, there have been major changes in the expenditure structure of the households. These changes are reflected in the share of available income which is spent on food products. This so-called "food share" is an indication of the overall economic burden experienced by the households. Available data from household income and expenditure surveys indicate that the food share of the household budgets on the Kola Peninsula increased from a pre-reform level of 28 per cent in 1991 to 40 per cent of available income in 1995 (Goskomstat (4) 1996, p. 15). In comparison, a Norwegian household spent on average 14 per cent of its total income on foodstuffs in 1993 – 1995 (SSB 1997, p. 175). On the other hand, whereas a Norwegian household spends close to one fourth of its income on housing, this item including rent, electricity, gas, heating and municipal services represents only approximately 5 per cent of the total expenditure of a household on the Kola Peninsula (ibid.; Goskomstat (4) 1996, p. 21).

Table 8.1 Income distribution. Average monthly wages for employees by region. (in thousands of roubles) The Kola Peninsula 1995

Murmansk	910
Apatity	730
Kandalaksha	896
Kirovsk	767
Monchegorsk	970
Olenegorsk	785
Polyarnye Zori	1417
Severomorsk	700
Kovdor raion	670
Kola raion	832
Lovozero raion	659
Pechenga raion	1414
Terskiy raion	591
Average, All	851

Source: Goskomstat (1) 1996, p. 46

However, these averages may be more or less evenly distributed in the population, and the rising economic inequality between groups in the population has been a source of much discontent and political unrest in Russia in the reform period. On the Kola Peninsula it is not so easy to observe any ostentatious public display of wealth as in the larger cities of Moscow and St. Petersburg, though the growth in private enterprise would indicate that there at least would be pockets of considerable private wealth to be found also here. Table 8.2 shows the distribution of nominal per capita income levels for 1995.

The distribution curve displays the double-humped shape which has become typical in Russia since the reform, with the majority of the population clustered at the bottom and a small high-income group at the top. The degree of clustering at a fairly low level can be further illustrated by comparison with the officially stipulated subsistence minimum. In 1995, the sum deemed necessary for bare survival amounted to approximately 416,000 roubles per capita per month, with some variations for different age groups. As can be seen from the figure, the modal value of the distribution is just above this minimum. According to official statistics, 22 per cent of the Kola Population had incomes of less than the subsistence minimum in 1995, increasing from 19 per cent in 1994 (Goskomstat (1) 1996, p. 50). Accordingly, one million roubles per month – the top income category in table 8.2 – represents only two and a half times the subsistence minimum, equal to approximately USD 250, or close to 1,500 Norwegian kroner, and is hence not a large sum, even by Russian standards. A further analysis of the prevalence of poverty will be given later in this chapter.

Table 8.2 Income distribution. Percentage of the population with a monthly per capita income within each interval. The Kola Peninsula 1995. Thousands of (current) roubles

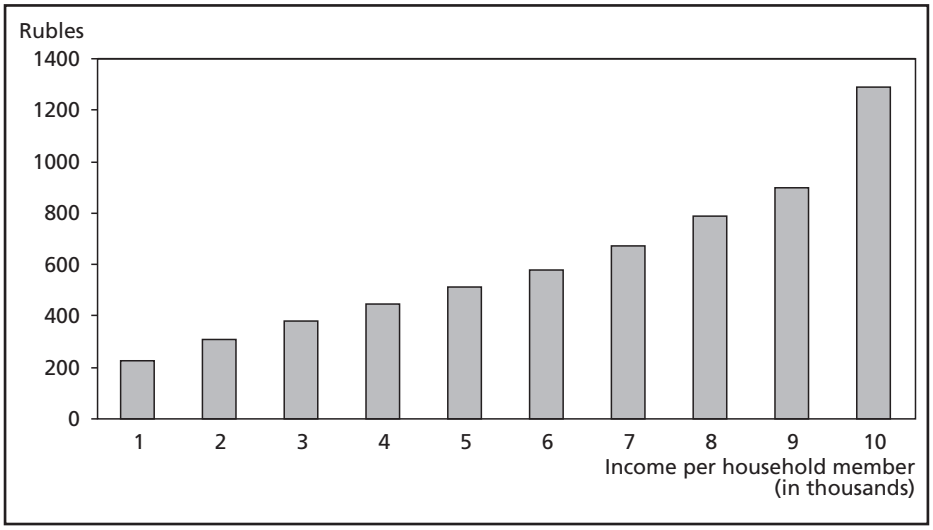
0–200	0.1
200.1–300.0	2.5
300.1–400.0	9.5
400.1–500.0	15.6
500.1–600.0	17.3
600.1–700.0	15.3
700.1–800.0	12.0
800.1–900.0	8.8
900.1–1000.0	6.2
over 1000.0	12.7

Source: Goskomstat (1) 1996, p. 45

The income distribution can also be seen from another perspective. If the population is split into ten groups of equal size and ranked according to their income level, the picture illustrated in figure 8.1 emerges.

This figure shows the amount of inequality in the income distribution, where the top earners stand markedly out from the rest of the population. As a measure

Figure 8.1 Income distribution. Income per household member in thousands of roubles, by deciles. The Kola Peninsula 1995



Source: Goskomstat (4) 1996, p. 18

Table 8.3 Average monthly wage level by industries (in thousands of roubles). The Kola Peninsula 1995

Manufacturing	1046
Agriculture	661
Construction	878
Transport	1246
Telecommunications	1081
Trade	516
Health care	596
Education	540
Culture, art	496
Science and research	616
Credit, finance and insurance	1082
Public administration	685

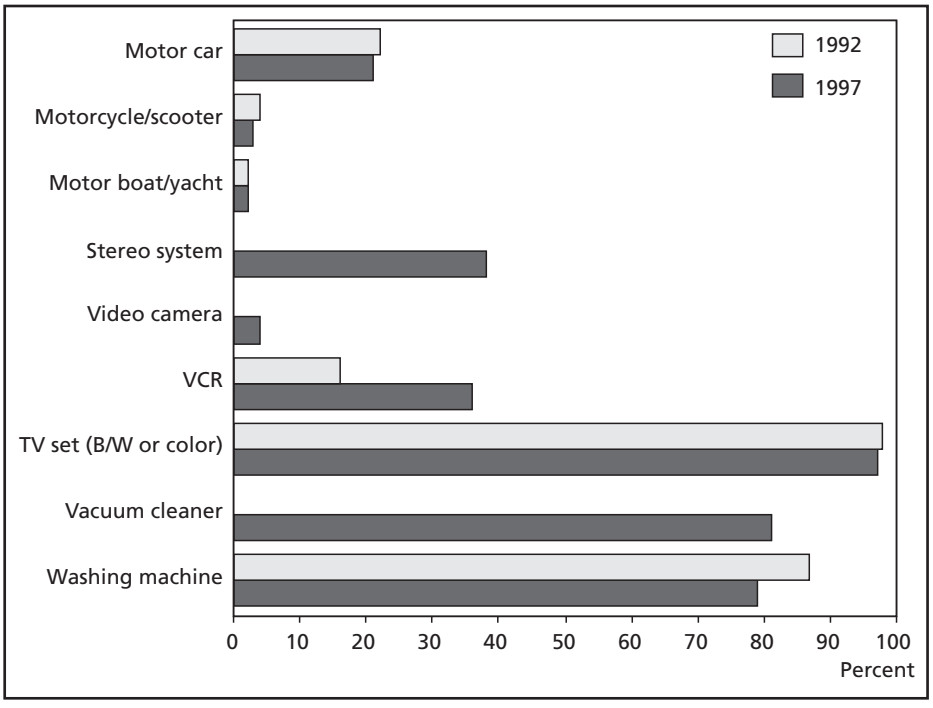
Source: Goskomstat (1) 1996, p. 478.6 Household income: Ownership of durable commodities

of income inequality, official statistics report a Gini index of 0.272 for 1995, down from 0.304 in 1994, indicating that income inequality actually is decreasing on the Kola Peninsula despite consistent reports to the opposite (Goskomstat (1) 1996, p. 50).

The composition of this income naturally varies over the various income groups. In the lowest decile of income distribution, 65 per cent of the total income came from wages or self-employment, whereas 25 per cent consisted of various social transfers, in the form of pensions and other benefits. The remaining 10 per cent consisted of "other" income, including informal economic activity (Source: Goskomstat (4) 1996, p. 7). In the highest-earning decile, 85 per cent of the income came from wages or self-employment, but as much as 11 per cent came from social transfers, and only 4 per cent from other activities (ibid.). Thus, even in the highest income groups, social transfers play a significant role in the income structure of the households.

In order to obtain an impression of how households cope with their economic challenges, it is often revealing to investigate how much they own in terms of durable consumer durables. As described above, the idea is that such a purchase naturally

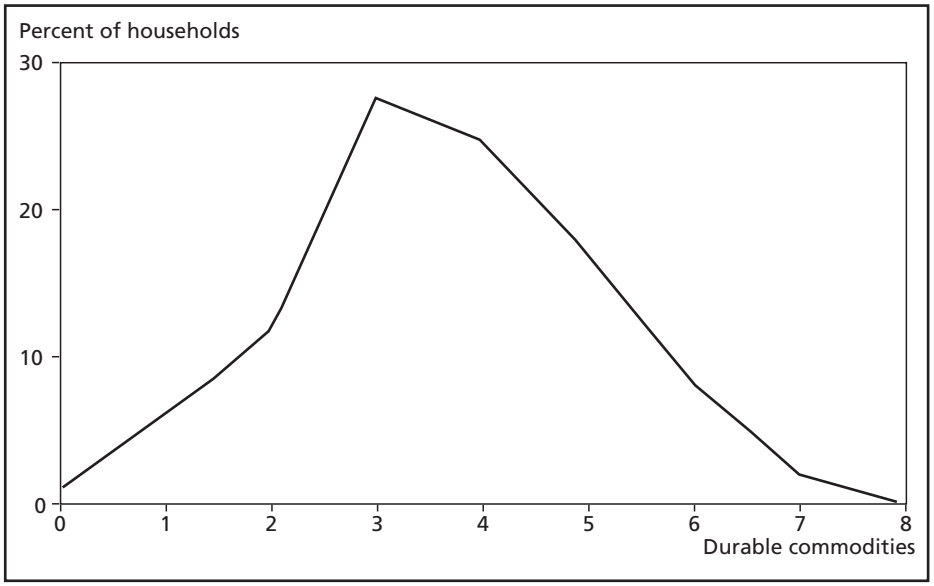
Figure 8.2 Ownership of consumer durables. Percentage of households reporting ownership the given item



requires a minor investment on the part of the household, and the presence of such an item in the household is thereby prima facie evidence of a purchasing power surplus. In addition, it is much easier to register the ownership of these items in the interview situation than to record consumption of e.g. groceries, and the interviewer may even check visually during the interview for the presence of the listed items. The total sum of such items present in the household will therefore rank the households with respect to economic resourcefulness. Figure 8.2 shows the percentage of households which own the given item.

As can be seen, the prevalence of ownership for the listed items is virtually unchanged, with the exception of video recorders which have become much more widespread. On the other scores, differences be within normal margins of error. However, the 1997 figures are particularly prone to underreporting, as particularly the more well-off households would be more reluctant to disclose items of wealth than the less well-off. It would seem car ownership in particular has been underreported, as there can be no doubt that car density has increased, especially in Murmansk city. It should be borne in mind that this method of assessing household wealth has some limitations. Firstly, the presence of durable commodities may be an indication of previous wealth, and the situation of the household may have changed since the given item was purchased. Secondly, this index does not take into account differences in the quality and durability of the items, but only registers their presence in the household.

Figure 8.3 Ownership of durable commodities: Index scores. Percentage of households with each score



Based on the information of ownership of various items, a simple additive index can be constructed, merely by adding the number of reported items for each household together. The index score thereby varied from 0 (owns none of the items) to 9 (owns all the items). The distribution of scores over the surveyed population is displayed in figure 8.3.

As can be seen, distribution of the score is slightly left-biased, indicating that the majority of the population is found at the lower end of the distribution and testifying to a relatively limited reserve of surplus purchasing power. Consequently, it accords fairly well with the shape of the income distribution. This serves to validate the index further, meaning that it can be used as a fairly good proxy variable for income level in the household.

8.6 Poverty and hardship

Contrary to common belief, it is not easy to assess with any degree of precision the share of the population which rightly should be considered as 'poor'. One school of poverty research identifies poverty in absolute terms, counting those who lack monetary or other resources to cover basic needs, most often defined relative to daily nutritional intake. Generally, this approach is operationalised in the form of a poverty line, defining a level of income sufficient to purchase a selection of foodstuffs deemed necessary to cover basic caloriy intake, though without particular attention to the needs of a varied and healthy diet. On the other hand, poverty can also be defined in relative terms, taking into account that the needs which must be met by a household are often socially, more than biologically, determined by the context in which the household lives. Poverty studies using this approach tend to include the social actors' own perceptions and experience of hardship. This approach often operationalises poverty in terms of a percentage of average income; e.g. in the EU, this criterion is set at 50 per cent of the average or median income in the member state (Room 1990, p. 39). This approach further presupposes that income is relatively normally distributed, and that there is a balance between wages and prices. Applied to the Kola Peninsula, half an average or median income would give a poverty line well below the sum officially recognised as the subsistence minimum.

To account for this, a combination approach has to be used. In the survey, an attempt was made to investigate the degree of economic hardship felt by the households, and the trouble they have in "making ends meet". In order to investigate

these hardships, respondents were given a series of questions measuring how often during the previous 12 months the household:

- had been forced to resort to outside help in order to pay current expenses (e.g. rent) on time;
- could not afford to heat the dwelling to an acceptable temperature in the winter time;
- had been involuntarily forced to refrain from having fish or meat for dinner more than 1 or 2 times per week;
- had been forced to refrain from the immediate purchase of necessary clothing for adults or children in the household;
- had been forced to refrain from participation in cultural activities, such as cinema, theatre, etc.

Response distributions are shown in table 8.4.

In this table, it is reasonable to identify as poor those in the outer right column, i.e. those who report having encountered payment problems more or less constantly over the preceding 12-month period. Accordingly, approximately one in ten households have constantly recurring problems in paying for such basic necessities as food and shelter, and must be said to belong to a group of "the poor" in the absolute sense. (It will be remembered from the above that housing and heating are still relatively minor expenditure items for an average household). Simultaneously, a substantial proportion of the households lack resources to cover needs of a "higher" order, related to participation in social and cultural activities, and to periodic renewal of clothing. Both these latter needs must be said to form part of the accepted cultural pattern of life in the local context. Official data report that cinema attendance went down from more than one million visits in 1991, to less than 300,000 in 1995 (Goskomstat (1) 1996, p. 73). Still, the survey findings testify to the fact that at the time of the survey one could not speak of mass impoverishment

Table 8.4 Experience of hardship, the Kola Peninsula 1997. Percentage of households reporting not being able to afford the stated item during the previous 12 months

Number of times	Never	1-2	3-12	More than 12
Rent	57	12	18	12
Heating	69	7	11	7
Meat/fish	52	15	20	12
Clothing	14	13	32	39
Cultural act.	15	5	17	57

on the Kola Peninsula in terms of a widespread lack of means to fulfil basic physical needs.

It should be added that the price levels for consumer products are higher in Murmansk Oblast than both the Russian average and that for the other parts of the Northern Economic Region. On average, the cost of a "basket" of 25 basic food products was 25 per cent higher in Murmansk Oblast than the national average in December 1996 (Goskomstat (5) 1996, p. 24). This higher price level seems to be both related to the increased transport costs induced by the remote location of the region, as well as to a relatively higher purchasing power in the population.

At this point, it ought to be borne in mind that the official subsistence minimum to a certain degree is a political, more than purely economic concept. As mentioned above, the proportion of the population with below-subsistence incomes rose from 19 to 22 per cent from 1994 to 1995, i.e. significantly more than the share reporting hardship with respect to purchase of food and clothing in the 1997 survey. Average monthly wages over all sectors of the economy was equal to 257 per cent of the subsistence minimum in 1994, sinking to 198 per cent in 1995, in spite of the growth in real wages (Goskomstat (1) 1996, p. 48). However, the official subsistence minimum was increased by 273 per cent from 1994 to 1995, whereas the consumer price index in the same period rose by only 230 per cent, and the price index for foodstuffs, which serves as the basis for the calculation of the subsistence minimum, rose by 210 per cent. (ibid., p. 50, 116) This relative upward adjustment of the subsistence minimum will in itself account for most of the increase in the share of the population with below-subsistence incomes.

However, some authors have suggested that in Russia, a more dynamic approach to the study of poverty ought to be taken. Analyses made on the basis of nationwide data suggest that a permanent classification of the population into poor and non-poor households fails to take into account the dynamic aspects of the adaptive strategies of households during the transitional period. When the prevalence of poverty is measured against a set poverty line using long time-series data it emerges that poverty in fact is highly dynamic. Accordingly, poverty is rarely a permanent state for the affected households, but rather temporary and transient, and poverty is mostly experienced intermittently (Lokshin & Popkin, 1997, p. 2ff).

In certain respects this means that the poverty phenomenon in Russia manifests itself somewhat differently than in the Scandinavian countries for example. Nordic approaches to the study of poverty usually attempt to identify poor segments of the population in terms of social characteristics, such as exclusion from the labour market, unstable family relations in adolescence, abuse of alcohol or drugs, poor educational record and cognitive skills, etc. In Russia, poor families and individuals are economically active just as often as not, and found within all educational categories. In addition, as the poverty status of households may vary over time, this

means that it is difficult to identify a particular group of households or individuals through the use of permanent, socially defined characteristics. In other words, those defined as poor at any given point in time may not be behaviourally very different from the rest of the population.

In order to be able to compare different types of households with respect to their degree of hardship, the answers to these questions were combined into a unified index by assigning each individual or household a point score according to their answers. If the respondent reported never having experienced this problem, the household was given a score of zero points. If the listed problem had been encountered 1-2 times, it scored 1 point, if 3-12 times it scored 2, and if 12 or more times it scored 3. The scores were then added up, giving a minimum score of 0 and a maximum score of 15 points. The combined scores could then be combined with other individual or household characteristics to investigate how households perceive daily hardships.

The measurable effects on perceived levels of hardship from the most common background variables were small an observation which further corroborates the observed heterogeneity of the poor households, and that these are difficult to identify by using common social characteristics, as outlined above. It should also be borne in mind that this indicator of hardship is strongly subjective. However, the reported levels of hardship are strongly negatively correlated with the reported number of consumer durables, and this will serve to corroborate the assumption that these two indicators are valid as measures of the economic position of the households. However, in this particular analysis, the focus is on how the population actually perceives their level of daily hardship. In most cases this hardship will be an attribute of the household, rather than the individual. However, the subjective nature of this indicator is demonstrated by the fact that women report higher levels of hardship than men in a consistent manner over all age groups and household types. If anything, this is indicative of the role of women as those responsible for the economic "management" of the household.

However, as in a number of other contexts described in this report, the highly educated report significantly lower levels of hardship than those with less education. Having a higher level of education thus seems to protect against both exclusion from the labour market, as well as against the highest levels of hardship experienced, even when the heterogeneity of the highly educated group is taken into account. At the other end of the scale, the least educated (with only a primary school education) mostly consist of persons of retirement age, who report consistently higher hardship scores than the younger generations.

Not very unexpectedly, the unemployed also report significantly raised hardship scores, irrespective of age and gender. Also not very surprisingly, household size is positively correlated with perceived hardship, since large households tend to have

a higher ratio of dependents to breadwinners than smaller households. Furthermore, among the surveyed regions, Pechenga Municipality has the absolutely lowest hardship scores, consistent with the position of this region in terms of wage level, described above.

8.7 Concluding comments

The description given above of the economic development and situation on the Kola Peninsula from 1992 until today forms the basis of a number of conclusions with respect to the economic position of households and the prevalence and character of poverty in the region.

With respect to income and wages, the "Big Bang" which initiated market reform in 1992 reduced on average the value of real incomes to one third of pre-reform levels. In the ensuing years, wages and income have been able to keep up with so as to secure real income growth in the whole reform period. Real income in purely monetary terms had by 1995 reached approximately 75 per cent of the pre-reform level. However, there are two major qualifications to this seemingly positive development.

Firstly, the absolute level of income relative to the cost of living is still fairly low. The median point in the income distribution was only 23 per cent higher in 1995 than the officially stipulated subsistence minimum. Accordingly, in the same year, 22 per cent of the population had a per capita household income equal to or below this minimum. Average costs of living seem also to be higher in Murmansk Oblast than in Russia as a whole, and even higher than in comparable regions in the Northern Economic Region. Survey figures indicate that experiencing hardship has increased among the population, and reported hardship levels are approximately twice those found in Kaliningrad and St. Petersburg in 1994 (cf. Hansen 1996, p. 127).

Secondly, the distribution of income is somewhat uneven, though probably less than in central areas of Russia, for exampleMoscow and St. Petersburg. This conclusion is supported by both survey findings and official statistics. In addition, the ostentatious display of wealth seen in the central cities is largely absent in provincial Murmansk.

To assess the prevalence of poverty is not easy in any context, and even less easy in a transitional society like contemporary Russia. However, it seems fair to conclude that poverty in an absolute sense, meaning a constant lack of resources to purchase daily necessities and pay for housing, comprises approximately one in ten households in the surveyed area. This level of poverty has remained more or less

constant since 1994 (cf. Gordon 1995, p. 119). Other studies indicate that poverty tends to be a temporary state for most households, and that many households experience intermittent spells of poverty, though of a relatively short duration.

This dynamic character of poverty in Russia necessitates a more complex approach to the study of poverty than the usual division of the population into a poor/non-poor dichotomy, where the poor share a number of behavioural traits which set them apart from the rest of the population. Whereas poverty in most market economies is associated with long-term exclusion from the labour market and low education levels, the poor in Russia are just as often economically active as the rest, and are not drastically different from the remaining population with respect to most identifiable social characteristics.

There can be little doubt, however, that the greatest proportion of the mass of households experience considerable difficulties in covering needs of a "higher" order, e.g. related to participation in social and cultural activities, and periodic renewal of clothing. It would seem as if it is this lack of a purchasing power surplus beyond the most basic needs for nutrition and housing which gives Kola society its somewhat drab appearance. Put in somewhat more popular terms, the most outstanding feature of society on the Kola Peninsula in the transitional period is not dire poverty, but rather the gritty, threadbare greyness of everyday life, just barely getting by.

Part II
Environmental concern on the Kola Peninsula

Introduction and background

The current report will document the main results from Part II of the Kola Environment and Living Conditions Survey, principally in the form of elementary descriptive statistics. The questionnaire frequency distributions resulting from the final controlled weighting of the respondents on the Kola Peninsula will be compared to distributions in reference material from Europe, Norway and Northern Norway. The intention is to enhance the possibility of comparing concerns, risk perception, environmental attitudes and nuclear emergency issues across different settings.

This part of the project Environment and Living Conditions on the Kola Peninsula has been performed within the Radiation Risk Project" (RRP) study group, which is an interdisciplinary research group formed in collaboration between the University of Oslo and The Norwegian Radiation Protection Authority (NRPA). The group consists of scientists from various disciplines, ranging from biological effects of ionising radiation to mass media and communication, as well as an expert in traumatic stress. The group consists of the Director of the Environmental Department of NRPA, Per Strand PhD, the Director of the Radiation Medicine department of NRPA, Jon B. Reitan MD PhD, Professor Ragnar Waldahl PhD at the Department of Media and Communication, and Professor Lars Weisæth MD PhD at the Division of Disaster Psychiatry (KKP) of the University of Oslo. The latter three experts function as a scientific steering group for the project described in this report.

The point of departure for the RRP project group was a survey of reactions in the Norwegian population to the Chernobyl disaster, performed by Professor Weisæth in May / June 1986 during the Chernobyl crisis. This study documented the informational problems of the situation very thoroughly (cf. Weisæth 1991). In an official parliamentary hearing, based in part on material from this survey, the situation in Norway at the time was termed an information crisis (Hærnes 1986). In view of the information problems encountered in 1986, a follow-up survey conducted in 1993 enhanced the focus on information preferences, confidence in sources of information, etc. (cf. Tønnessen et al. 1995). Among the main findings of the 1993 study was that the general public in Norway evaluated the issue of nuclear accidents as highly important, and that six out of ten thought it very likely that another Chernobyl accident would occur within the next ten years. The Norwegian public in 1993 also expressed a preference for concrete information regarding

measures they themselves could take in order to protect themselves in case of an accident. The study also documented the considerable challenges faced by the authorities related to the improvement of accident preparedness measures, and to their familiarisation among the general public.

The RRP group also participates in a European research project on risk perception termed RISKPERCOM[1]. Within the RISKPERCOM project, a broad risk perception survey with a three-wave design was performed in 1996. The wave design aimed at measuring possible effects on public risk perception from the media attention surrounding the tenth anniversary of the Chernobyl accident. Among the outputs of the three-wave survey in Norway was a documentation of the Norwegian public's concern over the current nuclear threat situation on the Kola Peninsula. (Tønnessen et al. forthcoming). As a natural extension of these findings, the current project attempts to document the concerns over such issues held by the population on the Kola Peninsula. This task was operationalised by including in the questionnaire many of the same risk perception items as were used in the 1996 RISKPERCOM survey of the Norwegian population. In addition, major parts of the nuclear accident preparedness section of the 1993 survey are employed. It is our fervent hope that none of the accident preparedness information thus gathered ever will serve any "real-world needs", but they may perhaps serve as input for those working with accident preparedness in the area. Current financial limitations have made it impossible to perform an in-depth statistical analysis on the Kola Peninsula data set, and this has dictated a fairly simple, descriptive presentation of the results. It is our hope that more detailed analyses may be made of the data in the future.

A description of the questionnaire items employed will be alternated with a presentation of the results obtained for each item in lieu of a distinct chapter on methods and instruments. The items considered in this report were administered in the second part of the Kola questionnaire, including the respondents' general environmental concerns, risk scale evaluations, personal evaluation of the environmental situation and more specific questions regarding radiation threats.

Nearly all of these questions used in the second part were chosen because reference materials were available for comparison. The reference material came from various sources, mainly from studies carried out by the RRP research group in Norway in 1986 and 1993 (Weisæth 1991, Tønnessen et al. 1995). The materials

[1] RISKPERCOM is a European Commission sponsored project (contract no. F14P-T95-0016, DG12-WSMW) involving France, Norway, Spain, Sweden and UK, and co-ordinated by L. Sjöberg, Sweden. The RISKPERCOM national project leaders and involved institutions in the various countries are: France: Dr Jean Brenot, Institut De Protection et de Surete Nucleaire (IPSN), Spain: Dr. Ana Parades Lopez, Centro de Investigaciones Energeticas, Medioambientales y Tecnologicas (CIMEAT), Sweden: Professor Lennart Sjöberg, Center for Risk Research (CRR), UK: Dr. Lynn Frewer, Institute of Food Research (IFR)

that mainly will be used for comparisons are: 1) Norway 1993 (RRP-replication of 1986), 2) Northern Norway 1996 (Joint SI[2]/NRPA-project), 3) Norway 1996 (RISKPERCOM-project), 4) various EUROBAROMETRE[3] data sets.

A short description of the various data sets is given below, for further details regarding the various comparative materials please refer to Appendix 2.

Reference materials

1 Norway 1993 (1986-replication): The RRP group conducted a follow-up survey of Weisæth's 1986 survey with the aim of enhancing the focus on information preferences, confidence in sources of information, etc. (cf. Tønnessen et al. 1995).

2 Northern Norway 1996 (Joint SI/NRPA-project): Some of the questions originally used by the RRP group in Norway in 1993 were replicated in a joint project between the Norwegian Central Information Service (= SI) and NRPA in Northern Norway in 1996 (Haast 1996). The SI/NRPA project was an evaluation of information about nuclear safety in the northern regions. As the joint SI/NRPA project used the RRP 1993 material for reference purposes an agreement was made that the RRP group would have free access to the SI/NRPA data set after publication of the SI report. For the purpose of the current report an adapted and re-weighted version of the SI/NRPA data has been generated and applied.

3 Norway 1996 (RISKPERCOM Project): Another part of the reference material comes from the above-mentioned ongoing 'RISKPERCOM' project, where partners from five European countries (France, Spain, Sweden, UK, Norway) study amplification and attenuation processes regarding the perception of radiation risks.

4 Various EUROBAROMETER surveys: Finally some questions regarding risk from industrial installations were derived from EUROBAROMETER studies. Some of the EUROBAROMETRE material will be presented separately for Norway or Northern Norway.

For details regarding the sampling procedure and implementation of the fieldwork procedures see Appendix 1 of the report. As also described in Appendix 1,

[2] SI = Central Information Unit of the Norwegian Government (in Norwegian = Statens Informasjonstjeneste

[3] For more information regarding the use of EUROBAROMETER data see Appendix 2

respondents were selected in a three-stage process. A self-extracting weighting parameter was constructed based on a probability estimate for each stage for each respondent. After weighting the data file with this parameter, checks were performed on distributions regarding sex, age and geographical area. For the purposes of this part of the present report, control weighting is applied above and beyond the self-extracting parameter in order to achieve sex, age and geographical distributions that are comparable to population figures. The Murmansk Regional Committee of State Statistics kindly made detailed population figures available.

Before turning to the results of the current study, three chapters will be used for presenting background information regarding environmental issues and radiological emergencies. Firstly, the more conventional environmental issues in Murmansk Oblast will be described; secondly, a rather detailed presentation of sources of possible radiological emergencies in the Oblast, and thirdly, the impact on health and the interventions required in the case of the radiological emergencies described in Chapter 10 will be given.

As described above the major research focus of the RRP group is public perception of nuclear threats and possible coping and reaction patterns in a situation of radiological emergency. Therefore Chapter 10 and 11 will be devoted to describing various nuclear installations that *may* become involved in possible nuclear threat scenarios, and the impact of such emergencies. The major emphasis in Chapter 10 and Chapter 11 is thus best explained by the research focus of the RRP group, and is not necessarily an evaluation of how seriously the different environmental issues should be judged.

Chapter 9 Environmental Issues in Murmansk Oblast

The environmental issues in Murmansk Oblast[1] may be divided into the more "conventional" environmental concerns such as air pollution, emissions into waterways, disruption of land, etc. that will be the focus of this first chapter, and the more conspicuous issue of radioactive pollution and radiological emergencies that will be described in chapter two. In order to give an overall picture of the more conventional environmental issues, we will first describe the local industrial context.

9.1 The environmental issues in a heavy industry context

Starting with the glasnost period, there have been numerous revelations of environmental disasters in the former Soviet Union as a heritage from the many gigantic industrial projects undertaken during the various five-year plans. Many environmental problems in the former Soviet Union indeed have large dimensions but as a general impression, many revelations have been in reports of a sensationalistic and scandal-mongering character. Often the reports of problems have been without nuances and with little effort to place the issues into a broader national or international context. As in other parts of the former Soviet Union, many of the environmental problems on the Kola Peninsula can be better understood as unfortunate by-products of the various enormous industrial enterprises.

Furthermore, the evaluation of the impact of environmental problems on the lives of the population is complicated by a set of factors related to this massive industrial context. Firstly, as the current grave economic situation makes unemployment and delayed wages important worries for the population, maintaining even environmentally harmful production may be seen as more acceptable than an alternative of reduced activity. Secondly, as also documented in previous chapters of the current report, this region has historically been seen by a large proportion of

[1] Oblast, an administrative unit comparable to a county.

the population as a place of temporary residence, to which many arrived in order to work for some years, enjoying the higher wages and other compensations (the so-called "arctic coefficient"), with plans for later return to their place of origin. Consequently, for a large proportion of the population, their main attachment to the region, as well as their source of livelihood, is their job in one of the gigantic industrial complexes, and this may understandably influence their personal evaluation of the possible harmful effects of the same industrial activity.

The combination of very rich natural resources when it comes to mining, a well developed infrastructure, and relative early and extensive geological surveys (around 1930) are important background factors for the gigantic mining and metallurgical complexes on the Peninsula. The science centre at Apatity has played a major role in the extensive geological survey of the region. As an illustration of ongoing geological competence and activity, it can be mentioned that the research borehole at Kolsky in Pechengsky District is currently operating at a depth of approximately 12-km.

Currently among the largest industrial enterprises on the Peninsula, we find producers of nickel, iron-ore and apatite. Two giant nickel industrial complexes produce about 40% of the nickel in Russia and these complexes belong to the Norilsky Nickel Russian Joint-Stock Company. They are the Severonikel Industrial Complex in Montchegorsk and the Pechenganikel Industrial Complex situated in Zapolyarny.

The two large iron-ore enterprises are the Kovdor Mining and Ore-Separating Industrial Complex (AO "Kovdorsky GOK") situated in Kovdor and the Olenegorsk Ore-Dressing Industrial complex, (AO "Olkon") in Olenegorsk. The region is important for Russia's production of phosphate based fertiliser as the region produces 100 % of the apatite concentrate in Russia. Important here is the Apatit Joint-Stock Company(AO "Apatit") situated in Kirovsk. As an indication of the gigantic proportion of the mining activity the total ore extraction in 1988 was around 375 million tons (Castberg 1992). Proximity to the railroad is a decisive localisation factor for the various industrial complexes, as will be realised from a glance at a map of the area.

The selected survey areas include the cities of Kandalaksha, Apatity, Murmansk and Nikel. There is a clear difference between Murmansk, the region's administrative centre, and the other "company towns", more industrially dominated. For the cities of Kandalaksha, Apatity, and Nikel, clearly the context is one of resource dependency, with an aluminium plant (Kandalaksha), ore separator (in Kirovsk near Apatity), and in Nikel a smelter dominating the employment of their respective communities. This fact is also illustrated by the place names, viz. Apatity (Apathite) and Nikel. Reading about the history of these places one is struck by the extremely rapid establishment and expansion of industry; for instance the town

of Apatity was established in 1966 with the opening of the local apatite-nepheline ore-separating factory, and now has a population of more than seventy thousand. In contrast to Apatity's 32 years of existence, Kandalaksha has a much longer history, but the industrial developments there are more recent and mainly linked to the aluminium plant that started operation in 1951. The industrial activity was started quite early in Nikel where Canadian/Finnish interests opened the nikel smelter in 1933 based on local ore.

This may appear to be a strange and unique history of rapid and one-sided industrial growth, largely based on natural resources, in very remote areas of scattered population. On further examination, however, this is not so "unfamiliar". Looking for instance just over the border from Murmansk to Norway, the iron ore mines of Sør-Varanger started production in 1906, and an industrial centre was established. Other well known examples from Norway are the rapid establishment of an industrial centre at Rjukan (Norsk Hydro), or pyrite mining at Løkken Verk (Orkla). More recently, in Norway in 1970 the vast majority of 21 places extremely dominated by industry (defined by more than 65% of working population in industry) had developed around a local raw material source or energy resource (Hansen 1997). Studies of such one-sided industrial development in Norway show that these communities may easily develop an industrial culture in which innovation and capability for creating new activity is weakened (see for instance Vatne 1996). Often the work force in these industries have as their main task monitoring only limited parts of the production process, as in electrochemical and electrometallurgical production systems. Hence, there is no fertile setting for the establishment of alternative activity and the "pulse" of the "company town" will "rise and fall" with the developments of that company. Aside from Murmansk itself, the other survey areas are in the position where one dominant industrial enterprise has a major impact on the local economy.

Of the industrially dominated survey areas, Apatity is clearly an exception, with its quite large research/academic activity. The second largest employer in Apatity after the AK Apatit (approximately 5500 employed) is the Kola Science Centre (Russian Academy of Science), with some 2160 employees.

9.2 Conventional pollution issues

As mentioned above, the major environmental problems in the region are related to the large industrial complexes, and hence the impact on the environment also to a large extent has a very specific and local character. Even a casual visitor driving

through Nikel or Monchegorsk gets a vivid illustration of the major impact of, for instance, the nickel smelters on the local vegetation.

The more "conventional" environmental problems may be further subdivided into the issues of: emissions into the air and water, and the pollution and destruction of land areas.

Air pollution

In terms of air pollution, the main problem is the emission of sulphur dioxide, accounting for about 80 % of the release of harmful substances into the atmosphere in the *Oblast*. The emissions mainly come from stationary sources in the municipalities of Monchegorsk and Pechenga, and are a result of the activities of the Pechenganickel and Severonickel smelters and the nickel ore roasting plant in Zapolyarnij (Sulphur 1994). To understand the levels of sulphur dioxide emissions from the nickel smelters it is important to note the change of practice that occurred around 1975, when the plant started using ore of a much higher sulphur content from Norilsk[2]. A more positive change was the opening of a sulphur acid factory in 1981 using some of the sulphur dioxide release in its production. To illustrate the dimensions of sulphur dioxide emissions, the release only from Pechenganickel in 1995 was more than six times the total for Norway. The nickel smelter situated in Nikel, even if smaller than the smelter in Monchegorsk, has larger SO_2 emissions but lower metal emissions than at Severonickel. When it comes to ecosystem damage around these enormous point source polluters the damage areas started to grow even further with the use of ore of a higher sulphur content, and by the mid 1980s a severe damage zone with a radius of some 10 km could be observed around Monchegorsk and Nikel (Kruchkov 1991). By using retrospective satellite imagery the total area affected by air pollution around Nickel can be shown to have increased from some 400 km^2 in the early 1970s to an area some ten times larger in the late 1980s thereafter remaining relatively stable. (Høgda et al. 1995). The areas around Monchegorsk with partially damaged vegetation due to industrial pollution have increased from some 400 km^2 to an area some 3 times larger in 1994 (Solheim et al. 1995). The local damage zones around these sites have gradually merged together giving the ecological damage a more regional character even though the technogen deserts still are limited to an area less than 20 km from the emission sources.

In contrast to the usual grim reports in Norway of the transborder impact of emissions from Kola, the Geological Survey of Norway (NGU) has quite recently,

[2] Before 1975 they used local ores with 3–8% S, and this was replaced by the Norilsk ore containing up to 30% S.

as a part of a larger ecogeochemical mapping project, demonstrated that in some areas overgrazing by reindeer herds is a bigger threat to the vegetation in polar areas than are the discharges of heavy metal pollutants from the Pechenganikel plant, and an alarming 71 % of the Finnmark plateau is harmed by reindeer overgrazing (Kashulina et al. 1997). In the above mentioned ecogeochemical mapping project that covered some 188 000 km^2, it was documented that the nickel industry of Monchegorsk and Nickel/Poliarnij are responsible for some 60% of the observed damage at the Russian sample locations (Kashuline et al 1997).

In Murmansk city, mobile sources account for a much larger proportion (nearly 50 %) of the emissions of harmful substances into the air, and much of the stationary release is the result of the some 50 different heating stations that use coal or heavy oil (mazut) as their energy source.

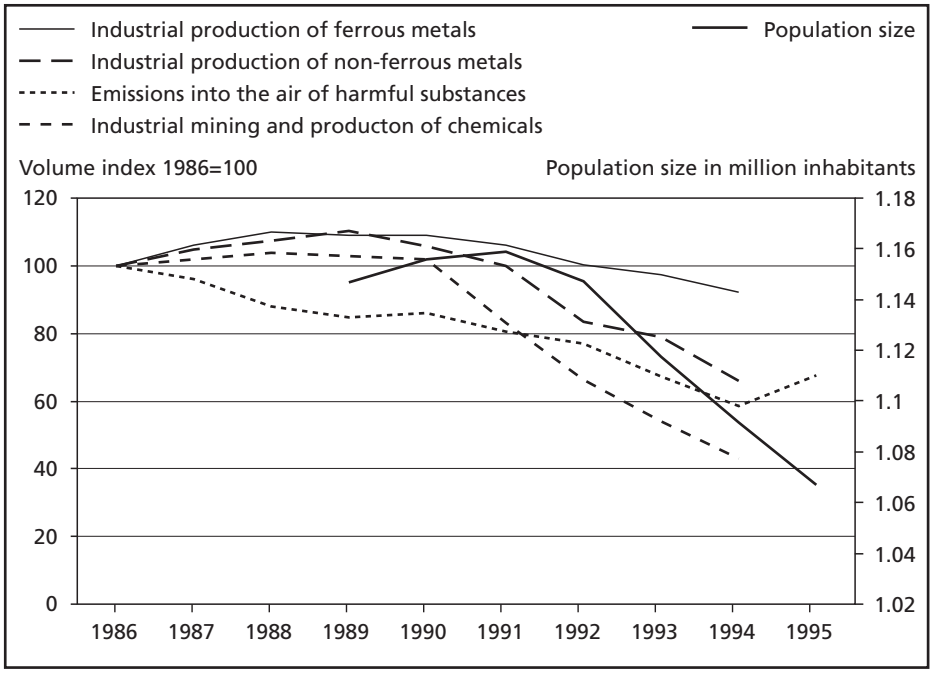
Motor vehicle numbers are increasing rapidly in most Central and Eastern European countries (OECD 1996). This is related to the increase in both numbers of privately owned cars and volumes of road freight transport. A similar increase in motor vehicle use is suggested by OECD also to have taken place in the Russian Federation, perhaps explaining why the NO_x releases in the Russian Federation are nearly the "only" releases that remain unchanged while CO_2 releases have declined by some 38% from 1985 to 1994, and the emissions of SO_x from stationary sources within the Russian Federation in the same time period have gone down some 40 %. In the Murmansk Oblast the number of privately owned cars has also increased quite markedly in recent years, nearly doubling from 1989 to 1994. Consequently the NO_x releases probably have become relatively more important as an air pollution problem.

Much of the variation in the release of pollution into the environment on the Peninsula in recent years is best understood as a result of a variation (mainly reduction) in the activity levels of those gigantic Combinates and not as a result of any applied environmental protection effort, as illustrated by figure 9.1 about air pollution emissions. The Figure also indicates an exception to this, as a reduction in the release of harmful substances (mainly SO_x) before the general industrial output slowed down can be noted. This reduction could probably be related to the before mentioned new practices of Pechenganikel and Severonikel, which started to extract sulphuric acid from emissions.

Russian and Norwegian authorities at high levels have suffered several "defeats" and "backlashes" when it comes to the issue of different emission control projects in North-western Russia, for instance the much publicised project at the Pechenganikel plant. As of August 1997 Oneximbank obtained permission to buy the Russian State's share of 38 % of Norilsky Nickel Company and hence carry on the negotiations now as the new owners of the Pechenganikel plant.

At the time of writing, the Kyoto Agreement with its tradable emission quotas may open new avenues for the different environmental projects, presently at a standstill, aimed at the heavy industry in the region. In the best of cases, Kyoto and the forthcoming follow-up meeting in Argentina will put the emissions of the region in a new perspective and provide new incentives for possible solutions. According to the media, this perspective has recently been a part of the discussion between the environmental ministers of Norway and Russia, as both countries are so-called Appendix One countries, meaning that Russia and Norway may exchange quotas in accordance with the Kyoto Agreement.

Figure 9.1 Variation in total emissions of harmful substances to the air related to industrial output indexes and population size



Note: Production and emission figures , volume index with 1986 = 100. Population size, figures in millions of inhabitants.

Source: Murmansk Regional Committee of State Statistics, 1995

Pollution of the waterways

In terms of emissions into water, the mining combinate PO Apatite is the most important source. In 1988, this company alone accounted for about 50 % of the emission of untreated wastewater in the Oblast. Especially vulnerable in this context is the largest lake in the region, Lake Imandra. Imandra receives all the wastewater from PO Apatite, and in addition also the sewage from Monchegorsk and Kovdor, as well as the spillwater from Kolskaya nuclear power plant (AES). As far as drinking water sources are concerned, a recent report suggest that particular attention should be directed at the risk of contamination affecting the catchment area of the water source (Fossum 1998). One problem area specifically mentioned in the report, is the water supply to Murmansk City and the emissions from the large poultry farms in the Kolsky district.

Pollution and destruction of land areas

As previously mentioned the mining and metallurgical complexes on the Peninsula are of vast dimensions, and hence there are large deposits and large areas with enormous "wounds" in the landscape. These wounds are especially pregnant at the open cast Ni-Cu mine at Zapoljarnij, the open cast iron ore mine at Olenegorsk, or at the open cast apatite mine near Kirovsk. There are also areas where environmental damage can be directly observed, with dead vegetation, etc. as seen in the proximity of the nickel smelter at Nikel, the Ni-Cu ore roasting plant at Zapoljarnij, or at the Severonickel smelter at Monchegorsk.

Health consequences of the more "ordinary" pollution issues:

There are clearly different opinions about the present impact of the pollution level on the health of the population. According to some sources, the population in Monchegorsk for instance is suffering from deficiencies of the immune system as a result of the large emissions from heavy industry (Krutsjkov in Castberg 1992). Even if Soviet and present Russian health statistics are not directly comparable to Western ones, a certain higher rate of occurrence of dermatological diseases as well as of afflictions of the respiratory tract can be observed among children in Monchegorsk.

The local commitment in Northern Norway has been strong related to the feared health consequences of the pollution from Kola; for instance, a protest movement was established with the vivid name of "Stop the Death-Clouds". In the early 1990s, nearly every household in Sør-Varanger municipality had one member in this movement. Many studies document the environmental impact of the pollution, but only a few have addressed the issue of the possible health consequences of the pollution. Tone Smith-Sivertsen and co-workers have recently conducted a large

survey of possible health impacts of the nickel and sulphur dioxide pollution from the nickel industry in Nikel and Zapolyarny (Smith-Sivertsen et al. 1997) and as this study is rather unique we would like to describe it and the findings in some detail. The study was a collaborative project between the Institute for Community Medicine at the University of Tromsø and The Kola Research Laboratory for Occupational Health in Kirovsk. The method applied was a population based cross-sectional study with its main focus on allergy, obstructive airway disease and individual nickel exposure in Nikel, Zapolyarny and Sør-Varanger with comparison study areas in Apatity, Kirovsk, Umba and Tromsø. The study started in Sør-Varanger in 1994 where the whole population between 18–69 years of age was invited to participate; a final response rate of about 60 % (n=3671) was achieved. On the Russian side a sample was created based on residency, a certain number of pre-existing city zones were chosen, and all inhabitants of the zones living in five and nine storey buildings were contacted. Of the 8026 invited a total of 3731 participated from Nikel/Zapolyarny. All participants replied to a questionnaire, delivered a urine sample for nickel content measurements, and a blood sample tested for, among other things, heavy metal content. In addition, tests of lung functions were done by spirometry and fluorography. The analysis of nickel content in urine was done on a randomly selected subsample (N=2333). On a much smaller subsample, extra blood samples were drawn and concentrations of lead in whole blood were estimated. In addition, testing for nickel allergy was performed on another subsample. Some 55 participants in Nikel and 43 in Sør-Varanger carried portable SO_2 measurement equipment in order to estimate individual SO_2 exposure.

The overall conclusion of the study was that, with the health indicators employed, no relationships between the pollution and serious health problems could be established. Although the Russian participants reported more respiratory symptoms and lung diseases, the overall result from the tests performed was that of generally good lung function compared to European standards. Furthermore, Nikel/Zapolyarny, the area with highest pollution levels, had the best health results. No correlation was found between the daily concentration of sulphur dioxide and measured lung function. When it comes to nickel levels in urine, the overall finding was that these were higher among all the Russian participants than Norwegian ones, including those in the control areas; there must therefore be additional sources of nickel exposure on the Russian side other than the nickel refining industry. As expected, urine samples from residents of Nikel, as the most nickel polluted area, had the highest concentrations. Current workers in the nickel industry had as anticipated, a higher nickel content in their urine samples than other participants. Nickel allergy showed a much higher prevalence among women in Sør-Varanger than on the Russian side, whereas the prevalence among men was quite similar on

either side of the border. An interesting finding was that subjective symptoms of nickel allergy were reported much more often on the Norwegian side than they were diagnosed, while the opposite picture emerged on the Russian side. Atopic dermatitis and hay fever as well were more frequently named by Norwegian respondents, whereas measurements of serum total IgE and Phadiatop showed higher levels on the Russian side. (These findings suggest that Norwegians had been more educated about typical allergic responses to the types of pollution present.) Smith-Sivertsen et al. indicate that the Russian participants in general more frequently reported vague complaints (those not adding up to a recognisable diagnostic syndrome), and less often reported identified diseases as did their Norwegian counterparts (Smith-Sivertsen et al. 1997, p. 48).

Chapter 10 Sources of Possible Radiological Emergencies

The emphasis in this chapter will be on possible scenarios with radiological emergencies at the nuclear installations on the Kola Peninsula, and not so much on the more slowly evolving pollution aspects of the same installations. As well documented there are rather large amounts of radioactive waste on the Peninsula that are stored under clearly unsatisfactory safety standards (Engelmann et al. 1995). Thus, the various nuclear installations may have been described in terms of their current environmental impact, and make no mistake there are even today minor releases and leakage causing radioactive pollution in areas adjacent to radioactive waste sites. A recent example of radioactive pollution, due to local waste facilities, are the measurements that indicate increases in radioactivity levels of sediment samples from areas surrounding the submarine bases of the Northern Fleet[1]. However, when it comes to the environmental impact, for instance on the Kara Sea from radioactive pollution, it is important to note that currently the levels both in sea samples and fish are very low compared to other oceans, for instance the Baltic Sea. In addition, currently the fallout from atmospheric nuclear bomb testing and the U.K. Sellafield reprocessing facility is the major sources of impact currently measured. A more recent example, of this far field impact, is the fact that Technetium from Sellafield has been measured along the Norwegian coast as far up as Tromsø, and carried by the Gulf stream this release in due course will also be measurable in the Barents Sea (Brown et al. 1998).

As mentioned above the various nuclear installations may have been described in terms of their current environmental impact. But as explained in some detail already, our research focuses more on coping and possible reactions in radiological emergencies, hence the various installations will be mainly described in the context of their possible emergency situation impact.

The radiological emergency scenarios on the Kola Peninsula may be divided into three categories: nuclear installations related to military activity (i.e. mainly the

[1] The Murmansk Marinebiological Institute collected the sediment samples, and the V.G. Khlopin Radium Institute and the Kusnetsov Laboratory carried out the analyses. The higher levels of those observed originated from samples taken close to the Andreeva Bay, where Northern Fleet's main storage facility for spent nuclear fuel is found.

Northern Fleet), the nuclear powered ice breaker fleet, and the Kola Nuclear Power Plant (Kolskaya AES).

The threat from the different categories may be viewed from many perspectives. On the one hand, one may argue that the Peninsula has the largest density of nuclear reactors on earth: almost one fifth of the world's reactors are located in this area. In addition, one may also argue that the arctic areas have a special vulnerability. From quite another perspective one may argue that as the many nuclear submarines with their reactors and fuel assemblies typically are in a very small size range compared to that of a nuclear power plant, the very high frequencies do not necessarily add up to a total volume of fissionable material exceeding that of one large nuclear power plant. Independently of the level of seriousness attached to this situation, it clearly ought to be viewed also as a legacy of the Cold War. On the other side of the Cold War line of divide, for example looking at the Hanford site, the United States also face large challenges when it comes to the decommissioning and disposal of nuclear subs. One major difference between the Russian and US situations is the fact that US have established a program[2] with substantial although perhaps not sufficient funding (U.S. Department of Energy 1995, MacKINNIN III and Burrit 1996).

General overviews of the inventory of radioactive waste and spent nuclear fuel in the Northwest region of Russia have been accomplished during the last few years due to joint international and Russian efforts (e.g. Engelmann et al. 1995). The Norwegian authorities established a Norwegian Plan of Action in 1995, and a revised plan for the forthcoming years has been drawn up, aimed at an improvement of nuclear safety and the prevention of radioactive contamination, mainly in Northwest Russia (Utenriksdepartementet 1997).

A grave example of how current economic restructuring also causes problems in connection with these issues is a serious incident that occurred in September 1995. The Kola energy distribution network *Kolenergo* cut off power to the nuclear submarine base of the Russian Northern Fleet because the base had not paid its electricity bills. Power was restored to the base only after the base commander sent armed soldiers to the power plant. The loss of electricity reportedly left several decommissioned nuclear-powered submarines with no means of powering the reactors' cooling systems. Because of this and similar incidents, the Prime Minister signed an order prohibiting regional power systems from cutting off electricity to military installations. One may question how dangerous the incident really was, but it illustrates how the transition in the economy is making many aspects of society unstable. Another indication of the ongoing dramatic changes was President Boris Yeltsin's announcement in Stockholm of a 30% to 40 % reduction in the military

[2] The US Nuclear-Powered Ship and Submarine Recycling Program

and naval units in the Northwest. In addition, during Norway's King Harald V Moscow visit in May 1998 Yeltsin stated that Russia's North-Western region was "saturated with nuclear objects" and thus acknowledged Norwegian concerns[3].

10.1 Military Nuclear installations

"Russia is never as strong as it looks; Russia is never as weak as it looks"

This old cliché may be important to remember. Looking back on the overestimation of former Soviet Fleets capabilities during the depths of the Cold War, it has recently become just as apparent that the risks posed by the current Russian Navy are in danger of being badly underestimated.

Related to military activity on the Peninsula we find storage places for nuclear weapons, nuclear waste facilities, three nuclear-powered naval surface vessels, and many nuclear submarines of different operational status. When it comes to the recently much discussed issue of decommissioned nuclear submarines (see for instance Nilsen and Bøhmer 1994, Nilsen, Bøhmer and Nikitin 1996) there are indeed large unsolved problems, but before going into details regarding this situation on the Kola Peninsula we will try to place it in a more global perspective. The problems related to spent nuclear fuel cells and decommissioned nuclear subs awaiting a "final" solution clearly are better understood in a cold war legacy perspective, where different countries participating in this part of the arms race compete much less vigorously in the design of safe disposal of the different weapon carriers developed. We will briefly describe below the US, UK, and French situation, before returning to the Russian context.

There is no set lifespan for nuclear submarines but a fair estimate is an operational life of about 20-30 years, and it is common to expect that the reactors will need refuelling every seven to ten years (Bukharin and Potter 1995). Today it is only 44 years since the first nuclear submarine, US Nautilus, became operational and some 39 years since the first Soviet nuclear submarine, Leninsky Komsomol, some

[3] This statement is taken from a Reuter's bulletin from Tuesday May 26th. On the same occasion Yeltsin stated that «We don't need these submarines", a statement that was later clarified also by the (at that time) Foreign Minister Yevgeny Primakov to be directed at old submarines that were in any case destined to be decommissioned.

35 years since UK Dreadnought and about 27 years since the French Le Redoutable[4] became operational. Nowhere in the world, has there been a long-established tradition of decommissioning nuclear submarines. All in all, Former Soviet Union/Russia have built about 245 subs, US 179, UK some 24, France 12, and China 5 or 6. Currently three main classes differentiate nuclear powered submarines: SSBN (Ballistic missile submarine, nuclear-powered), SSGN (Guided missile submarine nuclear powered), and SSN (Attack submarine nuclear powered) (Sharpe 1995).

Taking a look at the **US situation** we find that after an environmental impact study performed in 1982 the US Navy preferred dumping the entire defueled sub in deep water. When the London Dumping Convention and sea disposal agreements barred this option, it was decided instead to use land disposal, and in 1984 it was decided that reactor compartments should be cut out and buried in a shallow land disposal at the Hanford site in the state of Washington, the rest of each hull being scrapped. The process starts at the Puget Sound Naval ship yard in Bremerton, Washington, which is the main shipyard in the US Nuclear-Powered Ship and Submarine Recycling Program. Some of the subs ready for decommissioning are defuelled at other naval bases, or taken directly to Puget Sound. The reactor compartments are cut out and both ends are sealed with bulkheads, whereafter the compartments are transported on a barge on the Columbia River to the burial trench at the Hanford site, where they are buried at a depth of about 5 meters. According to Ølgaard (1996), about 5 compartments have been shipped yearly since 1986. On a 1994 US Dep't of Energy photograph of the site one can count 36 reactor compartments in the Hanford trench. Given an estimate that about 70 US nuclear subs had been taken out of service by mid 1996, the backlog of subs awaiting disposal would be in the range of 20 to 25.[5]

To decommission about 100 US nuclear subs the recycling program has been provided with funding of about 2.7 billion US dollars (Handler 1993a), and, according to MacKinnon III and Burrit (1996), the estimated cost for inactivation and scrapping of a SSBN is about 40 million US $, and a SSN decommissioning is some 2 million US $ cheaper. Hence using simple arithmetic the funding is nearly sufficient to provide for the inactivation costs (about US$ 29.6 million) of the 100 submarines, but not for funding the total scrapping process.

The **British** government is considering a method of deep land burial. The UK Navy also considered sealing the submarine hulls and sinking them in deep

[4] France started the first- ever ballistic missile submarine program with ballistic missile submarines in 1959.

[5] Actually a submarine enthusiast Don Shelton fmr ET1(SS) gives an indication on a web site (http://www.cyberramp.net/~mshelton/djs-srp1.htm) where, when flying above the Puget Sound facilities, he counted some 19 submarines waiting for decommissioning.

waters to be by far the safest means of long-term disposal, but again the London dumping convention forbade this solution. Deep land burial will imply a need for breaking up the reactor compartments into smaller pieces and hence imply higher dose burdens. The British Navy has 11 defuelled nuclear submarines moored at the Naval dockyards at Devonport and Rosyth where they are awaiting final disposal[6]. There were plans for including the submarines in the Nirex deep repository being prepared at Sellafield. This deep repository was planned to be available around 2012, at which time the number of subs awaiting disposal probably will have doubled. Due to recent developments within the Labour Government and resistance from local authorities no deep land burial option would appear likely to become available in Britain in the short term. In any case that option would increase significantly the temporary storage time needed to allow as much decay as possible to occur before starting to divide the reactor compartments into smaller, more manageable pieces.

The **French** Navy to date has decommissioned two subs, one more will probably be decommissioned in 1998, and three more by 2007. The companies Technicatome and DNC Cherbourg are performing the dismantling, and the long term storage of all radioactive waste (also civilian) is handled by the National Radioactive Waste Agency (ANDRA). The French situation is comparable to the British in as much as that no long-term storage site is capable of handling large units such as the reactor compartment, and hence it has to be temporarily stored. After interim storage for some 15–20 years at Cherbourg the circuits and components of the reactor may be dismantled (Masurel 1996).

Going back to the **Russian context** it can certainly be said that while the Soviet Union developed the world's largest nuclear-powered submarine fleet, it did not make adequate plans for the disposal of the fleet's radioactive waste nor for the final disposal of these vessels. At the end of 1995, Russia had an estimated backlog of about 140 subs awaiting final disposal, the main problem being related to insufficient funding. Indeed the Navy has had to choose between operational activities maintaining combat readiness and the gigantic decommissioning task within the same greatly reduced budget. By the end of the decade it is estimated by some sources that the Russian Navy will have to decommission and dispose of some 180–200 nuclear submarines, while others put the figures at around 125 by the year 2010. When considering the cost of the decommissioning process it is necessary to remember the unique design feature of Russian/former Soviet Union subs, namely that the majority have two reactors. On the other hand, the job is rather labour intensive

[6] Four of the eleven subs have been scrapped at Devonport, their nuclear fuel have been removed but with the rest of the sub stored afloat. A quarter of Plymouth's 250 000 residents live within 2 km of the Devonport Dockyard, and in 1993 this dockyard was awarded the contract to refit the newer Vanguard class of SSBN equipped with Trident missiles.

and wage levels are very much lower than in the US. After the Yablokov Commission's report in 1993 revealed the secret dumping practices of the Russian Navy, these practices were halted. The Russian interim solution after defueling is to have the reactor compartment cut out with its two neighbouring compartments to provide buoyancy; the "three-compartment units" are then stored afloat.

In the Pacific Fleet context there are mainly two shipyards involved in scrapping, the Zvezda plant with full scrapping capabilities (120 km east of Vladivostok) and the Gornyak shipyard more adapted to simple stripdown. The decommissioning process in the Pacific fleet started in 1987. It is estimated that about 60 submarines will be decommissioned by the end of the decade. At the current rate of about 1–2 a year, an estimated 30–40 years are needed for the disposal of those 60 subs. The decommissioning operations for the Pacific Fleet almost ground to halt in 1994, not only due to lack of finance, but also because of the lack of storage space for off-loaded spent nuclear fuel.

The Northern Fleet headquartered in Severomorsk is the most important in the context of this report. Currently, more than 80 Russian nuclear submarines, most of them with 2 reactors have been taken out of service and are at present laid up in the Kola/Severodvinsk area. Inactive subs are laid up at naval bases at Severodvinsk (Arkhangelsk Oblast), Zapadnaya Litsa, Vidyayevo, Gremikha, Polyarny, Sevmorput and Gadzhievo. The missiles have been removed but there is still fuel on board about 50 of these vessels. The subs with fuel still aboard[7] need permanent cooling, requiring electricity for the circulation pump of the primary coolant, and also to produce compressed air for the ballast tanks to keep the sub afloat. Filipov estimated in 1995 the annual cost of keeping one submarine in port to be about 2 billion roubles; for comparison the cost of dismantling a Yankee-class submarine is estimated to about 22 billion roubles (Nilsen, Kudrik and Nikitin 1996).

The main partners in the scrapping program of the Northern Fleet are the shipyards of Nerpa, Pala Guba, and Rosta on the Kola Peninsula, and the Sevmash and Zvezdocha yards of Severodvinsk[8]. As a result of disarmament and the scrapping of nuclear submarines, large quantities of plutonium and uranium, both weapons-grade and less highly enriched, will be stored ashore. The Northern Fleet's major storage facility for spent fuel is located at Andreeva Bay in the Zapadnaya Litsa fjord, and here spent fuel assemblies amounting to something like 70 reactor cores are stored in stainless steel containers in two large concrete tanks (Kvaerner 1996). The storage facility at Zapadnaya Litsa must also be seen as an interim storage facility used to achieve some decay before eventual transport for reprocessing. Having run

[7] It is also reported that non-defuelled submarine according to regulations have certain minimal manning demands.

[8] Severodvinsk is situated close to the city of Archangels in the Archangels Oblast.

out of space in land based storage sites; the Navy has had to switch over to service ships as interim storage places for spent fuel. This is a problem, as the service ships become nonoperational when their storage space is used. The treatment, transport and storage of this material represent both an environmental and a safety problem.

According to Russian Federation Government Decree No. 614 of July 24th 1992, nuclear submarine recycling was planned to use self-support principles by selling off scrap metals. Experience has shown that such an approach underestimated the costs involved, and thus both the NERPA ship repair plant in Murmansk Oblast, and the ZVEZDA[9] far eastern plant have endured significant losses from their involvement in nuclear submarine recycling. One major issue for NERPA when it comes to scrapping earnings is the issue of tax relief on exports. The ZVEZDA plant has created a special joint venture company, -Stella, just to facilitate the sale of scrap metal. Using such an approach ZVEZDA has achieved metal prices 3-4 times higher than those offered by the Russian VTORCHERMET organisation; the Stella joint venture company is also duty free (Maslakov 1996). Clearly, the very large operations involved vividly illustrate all the difficulties with the economic operations of large dimensions in the current enterprise framework conditions of the Russian Federation.

Various experts give quite different estimates for the costs involved, but there is general agreement that the funding of a recycling program could not be based on scrap metal earnings. Zinovenko from the NERPA plant estimate, for instance, that the earnings scrap are about equal to the wages of the workers involved in the process, and in 1995 the total net loss was about 10 billion roubles per submarine. NERPA estimated in 1995 a total cost around 15–16 billion roubles for recycling a nuclear submarine. However, after having carried out the preparatory work NERPA passes the defuelling operation on to a special defence plant operation (probably a Northern Fleet service ship). In contrast to the 15-16 billion estimate, Vice Admiral Victor Topilin (at that time chief of the Navy's main Technical Directorate, now Deputy Commander-in-Chief for Technical Readiness and New Construction) stated in 1994 that the cost was more than 5 billion roubles for breaking up one submarine. Independent of which estimates are the most correct, clearly with such a huge volume, the total resources demanded by the decommissioning process are enormous. As stated by Alexander Lebed when he still was a national security adviser, "Today we cannot find tens of billions of roubles, tomorrow we will be looking for tens of trillions of roubles to liquidate the consequences […]. Will we explain to our children that we couldn't find the finances?" (quoted in Handler 1997). All the major participators involved put stress on the financial problems when explaining why the

[9] The Zvezdocha yard suffered a loss of 311 million roubles when cutting up their first submarine in 1993 (Filipov 1995)

recycling programme currently is nearly at a standstill. Recently the Governor of Murmansk Oblast confirmed that in 1998 no submarines of the Northern Fleet will be recycled due to economic problems.

Seen from the perspective of the Russian Navy, giving priority to the decommissioning process may very well interfere with or drain the resources needed for operational activity, given the dimensions of the effort needed. Seen from the perspective of other countries considering contributions to the decommissioning process in Russia, one dilemma may be whether providing external resources may interfere with a needed internal process of giving higher priority to these issues.

Transport of radioactive waste through the region

The Soviet/Russian system for nuclear fuel management assumes a closed fuel cycle. Spent nuclear fuel from the numerous existing nuclear reactors is transported to a reprocessing facility at Mayak in the Urals where uranium and plutonium are extracted and later reused. One major aspect of the radioactivity problem for the regions is the treatment of spent nuclear fuel and the waste products from the refuelling cycles of the numerous nuclear reactors. The refuelling process mainly involves Polyarny and adjacent areas (at the western side of the outlet of the Kola fjord), and the Severodovinsk yard on the White Sea in Archangels Oblast. The high level waste has mainly been transported to a storage facility at the Litsa fjord.

There are many problems related to the transportation to the reprocessing facility at Mayak. For instance, the rail link from Severodvinsk was in such a bad condition that between 1973 and 1992, spent fuel was sent by service ships to Murmansk for loading on to a special train at the Rosta shipyard (near Murmansk City). For safety reasons the regional authorities withdrew permission to continue in 1992 (Castberg 1992). In addition, in 1993 Gosatomnadzor (The Russian Nuclear Regulatory Agency) banned the use of old containers used for transportation of spent fuel by railway, and demanded the use of new transport containers that met IAEA[10] standards. However, these new containers were too heavy for the existing rail system and there were also problems regarding the availability of these railcars. Currently there is said to be only one four-car train with the new railcars capable of transporting the spent fuel from one submarine (i.e. two reactors). These railcars also have to be divided between the Pacific and the Northern Fleet. The round trip from the Northern Fleet to Mayak may take up to 45 days. More importantly there are also controversies between the Mayak Chemical Combine and the Northern fleet regarding their ways of handling financial transactions. The Mayak Combine now wants to receive spent fuel only after receipt of advance payment (transport

[10] IAEA = International Atomic Energy Agency

and reprocessing of one trainload in 1995 was about 7 billion roubles). According to Handler (1997), the train circulates on average three times a year – and Yerofeyev (in Handler 1997) estimates that some 55 trainloads of spent fuel await transportation.

Dumping of nuclear waste at sea

Like other countries the former Soviet Union used the method of dumping radioactive waste into the sea, in their case the Northern Sea, mostly along the east coast of Novaya Zemlya and in a dedicated area of the open Kara Sea within the Novaya Zemlya Through (Yablokov 1993). As the former Soviet Union adapted to the voluntary moratorium of 1983 in accordance with the London Convention the dumping stopped. The total amount of radioactivity dumped by the former Soviet Union into the Kara Sea is comparable to the amount dumped by Great Britain's reprocessing plant at Sellafield. In order to investigate the possible environmental impact of the dumping problem a Russian-Norwegian bilateral expert group has performed a comprehensive investigation of the radioactivity levels of sediment, water and fish from the area around Novaya Zemlya (JNRC 1994). Currently the most traceable impact of radioactivity in samples from the Kara Sea is the fallout from atmospheric nuclear bomb tests, and the dumping related to the UK Sellafield reprocessing plant and the quite extensive releases related to this during the 1970's (JNRC 1994). The overall conclusion from the extensive investigations around the dumping sites and the sunken Komsomlets submarine is that, for instance, fish from this area currently pose little concern from a radiation protection viewpoint.

Operational activity of the Northern Fleet

In recent years, the operational capabilities and activities of the Northern Fleet's submarines have increased somewhat again after a period of little operational activity. Russian subs have been observed for the "first time in many years" at different locations; for instance in April-July 1995 an Akula class sub operated in international waters off the US east coast, marking what seems to be the first Russian deployment in the western Atlantic since 1987. Reading both ONI[11] reports and Jane's *Fighting Ships*, (Sharpe 1996) one gets the distinct impression that tough decisions have been made by the Russian Navy, and that a strategy in which quality replaces quantity has been implemented. The Navy seemingly has decided that older designs of nuclear subs will be laid off and instead, focus is put on particular segments of the flotilla. The current number of the operational nuclear submarines

[11] ONI= US Office of Naval Intelligence

in the Northern Fleet varies somewhat among different sources, but amounts to something like 24 subs of the SSBN[12] type, 12 of the SSGN[13] type, and 32 subs of the SSN[14] type, all in all about 68 nuclear-powered subs; some of the subs of the older designs have been included in these figures but are "in reserve" or ready to be designated as such or may already have been laid off. The figure of approx. 68 subs is by no means an estimate of the number of combatant operational nuclear subs, but then combat readiness is not a primary concern for our overview purposes. When looking at radiological emergency scenarios it is important to note that one clearly is discussing low probability events but radiological emergencies possibly affecting the population are more readily foreseen related to operational activity. These may take the form of a refuelling incident (e.g. the Chazma bay incident[15]), or perhaps an incident while on mission e.g. the collision in 1992 between an US and Russian nuclear submarine just off the Murmansk coast. In addition, the recent incidents as of January and May 1998 gives vivid indications of the risk imbedded in nuclear submarine operational activity. On January 26th 1998, a nuclear submarine incident took place in Zapadnaya Litsa with an ammoniac and nitrogen gas leak as one of the pipes in the cooling system broke during reactor start up. The incident resulted in five crewmembers being wounded and one of the crewmembers died from his injuries. On May 5th 1998 what seems[16] to be an explosion took place in the rocket shaft of one of the missiles of Delta IV submarine while on patrol outside the Rybachiy Peninsula.

On a political level there clearly may be many important dilemmas related to the current increase in operational activity. For instance the Norwegian government is using quite large resources for radiation protection purposes on the Peninsula, directed in part at waste problems related to the military installations; mean-

[12] SSBN=Balllistic missile submarine, nuclear-powered

[13] SSGN=Guided missile submarine nuclear powered

[14] SSN= Attack submarine nuclear powered

[15] The accident at Chazma bay will be described in further details in section 10.4

[16] The exact circumstances of this incident are so far somewhat unclear. According to a Norwegian military High Command spokesperson a Delta IV submarines was spotted on May 5th outside the Rybachiy Peninsula returning to base in surface position with a strange opening at one of the rocket shaft covers. The so far only Russian media report of this incident heavily reported in the Norwegian media was an item in the Moscow based newspaper Ruskij Telegraf. According to the Ruskij Telegraf, the explosion reportedly happened as two parts of the rocket fuel came in contact with each other. This incidence is also reported in Jane's Defence Weekly. According to the 20 May Jane's Defence Weekly, U.S. military and intelligence officials said that intercepted Russian communications and other information indicated that on 5 May a "Delta"-class SSBN had an emergency involving one of its nuclear missiles.

while some segments of Russian society still have the resources for developing, for example, fourth generation nuclear subs such as the SSBN of the new Boris class or the SSN/SSGN of Severodvinsk class. (In November 1996, there was a keel-laying ceremony in Severodvinsk for the first of a new class of SSBNs). The evaluation of Russia's finding resources for developing new submarine classes must not overlook the fact that the US are spending more than 3 billion US$ for each of the new Seawolf class submarines.

Independently of one's views of the solutions to these dilemmas, one must beer in mind the enormous strategic importance of this region. Norwegian as well as other nation's authorities must come to terms with the fact that this region in the foreseeable future will be very strategically important also for the Russian nuclear deterrent capability (Norwegian Ministry of Defense 1997). According to Rear Admiral Michael W. Cramer, head of ONI, something like half of Russia's strategic weapons will, if ratified under START II, reside aboard SSBNs; nearly 2/3 of Russia's SSBNs are based on the Kola Peninsula. Thus, about 1/3 of Russia's strategic weapons capabilities will be dependent upon the Northern Fleet operations in this area. The reportedly increasing level of submarine operational activity and resources for new building compared to the decommissioning efforts may appear striking, but may be understandable as the only means for a superpower to maintain its nuclear deterrent capability in the future in a black economic situation. For another kind of insight into the region's strategical importance one can look back in history to the importance of infrastructure capabilities: Murmansk was a supply entry route during both World War I and World War II.

One major aspect of the radiological emergency scenario on the Peninsula is thus related to the nuclear submarine fleet, with various operational activities, with used fuel elements stored ashore or on service ships and the nuclear submarines awaiting decommissioning and defuelling. As far as an eventual storage solution for the reactor section of the hull is concerned, different suggestions have been made. Among the ideas mentioned was one suggestion to blast a shallow channel at Novaja Zemlja, floating the compartments there and then filling over the channel. Another suggestion was to use the enormous underground submarine hangars that originally were made in order to make it possible to hide tactical submarines. It must also be stressed that as far as the process of finding more suitable storage solutions are concerned, the mere process of moving the various waste objects may pose a risk as there is a potential for creating criticality situations in the used fuel (Mærlie et. al 1998)

Nuclear weapons related issues

When it comes to nuclear weapon technologies and facilities Murmansk Oblast has one major nuclear weapon storage facility for ballistic missiles at Revdna in the central parts of the Peninsula; in addition the Northern Fleet has one major storage facility at Sevromorsk and one near Poliarnij.

The only nuclear weapon test site in Russia is at Novaja Zemlya where the last detonation occurred in 1990. Related to the recent US subcritical[17] experiments at the Nevada test site, it is anticipated that similar sub-critical tests are performed at Novaja Zemlya. In a historical context, from 1960 until 1988 the former Soviet Union carried out 115 "peaceful" civilian nuclear bomb detonations whose purpose ranged from seismic exploration, to mining activities, etc. Once in 1972 and once in 1984 such "civilian" nuclear bomb detonations took place in the Kulpor Mine near the city of Kirovsk in the Khibny mountains. The purpose of these detonations was to achieve better production of apatite, but the explosions did not succeed and the mine is now closed. The civilian use of nuclear bombs further adds to the impression that in earlier periods nuclear bombs and energy were perceived as some kind of "brand new technology" with unlimited applications and capacities. Reminiscent of such an image are today's serious suggestions for the final solution to radioactive waste problems by detonating underground nuclear explosions in order to melt and vitrify the various waste materials (Klimenko et al. 1996).

10.2 The Icebreaker fleet – Murmansk Shipping Company (MSCo)

The Murmansk shipping company is the operator for a fleet of eight nuclear powered icebreakers. In addition, MSCo also operates ore-freight ships, other cargo liners, passenger ships, trawlers and three diesel-powered icebreakers. The nuclear powered fleet consists of five large icebreakers of the Arctica class, two shallow-draught smaller icebreakers, and one barge ship with ice breaking capability. MSCo uses five different service ships for refuelling and temporary storage of nuclear waste

[17] The so-called subcritical "experiments" are performed to test the reliability of existing nuclear weapons without a nuclear explosion. One primary objective is to study the effect of ageing on nuclear materials. The US have planned six sub-critical tests on the Nevada dessert test site's facility (LYNER). These US tests are conducted some 300-meter below ground level, using 50 to 500 pounds of conventional explosives to detonate explosions involving nuclear material as plutonium or uranium. The final text of the CTBT (Comprehensive Test Ban Treaty) leaves open the right to conduct sub-critical and other non-nuclear explosive testing. Because these tests entail chemical and not nuclear explosions, they are not against the letter of the CTBT, but still are seen as many as violating the spirit of the CTBT treaty.

and used fuel. The more well known of these, at least in Norway due to heavy media reporting, is the former cargo ship "Lepse" which contains some damaged spent fuel elements that Mayak will not accept for reprocessing. Currently a project is well underway for a more permanent storage solution to "Lepse", because of the damaged fuel component partially poured in concrete, the vessel must be treated as a "nuclear waste" item[18]. The world's first civilian nuclear powered vessel "Lenin" is currently laid up at a mooring buoy at "Atomoflot", the maintenance base for MSCo, where we find quays, several building workshops, an administration building finished in 1992, and storage and processing facilities for both liquid and solid nuclear waste. The use of the five storage facilities for solid radioactive waste at Atomoflot was started in 1986 after the dumping of solid waste into the Kara Sea had stopped. The capacity for processing liquid waste is greater than needed by MSCo activity, so MSCo will also process some liquid waste for the Northern Fleet. There are many indications of the close relationships between MSCo and the Northern Fleet, although MSCo was converted in 1993 to a limited company partially own by the employees, the state and other investors. For instance, MSCo and the Northern Fleet cooperate in the use of the service ship "Lotta". "Lotta" is used to change the capsule of the fuel elements before transport to Mayak. Another indication of the close relationship is the claim by some sources that the Soviet exception to the London conventions for the Navy implied that for several years civilian liquid waste was transferred to the Northern Fleet and then dumped by them (Castberg and Stokke 1992, p. 41). Another indication is the fact that the spent fuel from both MSCo and the Northern fleet is reloaded on special railcars at the Atomoflot service base. The reloading of spent fuel on to special railcars was moved from Sevmorput to Atomflot when the new TUK-18 transport container was introduced.

Under normal operating circumstances, the nuclear icebreakers are refuelled every three to four years, and these refuelling operations are carried out at the Atomflot service base. One major reason for concern regarding MSCo is the fact that their base and maintenance yard Atomoflot is located only 2 km north of Murmansk City; i.e. given a critical situation a large population is potentially exposed.

[18] The damaged fuel dates from an accident in 1966 involving the world's first civilian nuclear powered vessel "Lenin" launched in 1957, operational from 1959. Lenin had several cooling problems, and during maintenance and refuelling in 1966 it was discovered that the fuel elements had enlarged so that it was not possible to remove them from the reactor using standard procedures; about 40 % was removed and transferred to Lepse. Because of this and new cooling problems with "Lenin" in 1967, including an accident involving radioactive contamination of the reactor compartment, it was decided that the total reactor section with three reactors should be replaced and the old section was dumped east of Novaja Zemlja in 1967.

10.3 The Kolskaya Nuclear Power Plant

The Kolskaya nuclear power plant situated in Poliarny Zory produces about 60 % of the electricity for the Peninsula. The 15-hydropower stations supply about 34 % whereas thermal stations produce about 6 %. The nuclear power plant has four reactors of the Light Water Reactor type, without complete security enclosure. More technically the Kola nuclear power plant has two reactors of the older VVER 440/230 type and two of the newer design VVER 440/213. The design of all four reactors is *not* the same as the "Chernobyl" type where graphite is the moderator and light water is the coolant. The reactor type used at Kola NPP has light water both as coolant and moderator, and this design is believed by expert opinion (for instance IAEA) to be more stable in a critical situation; the design makes the reactor more self-regulating under critical conditions. Of greater concern is the fact that the two older reactors at Kola NPP were designed with a lifetime of 30 years and the current shutdown plans now have been postponed. Over a 10-year period, the Russians plan to build three new VVER 640 reactors, i.e. the same type as is also planned at St Petersburg. Similarly in the civilian nuclear threat context there will be political dilemmas concerning foreign aid for security measures, because at the same time as other countries are assisting with security, Russia is planning and using resources for an enlargement of the Kolskaya power plant. One may also argue that aiding security measures may contribute to a continuation of the operation of the older reactors. Recently there have been discussions whether the plans for new VVER640 at Kolskaya AES will be delayed as Rosenergatom gives priority to partly completed reactor installations at Rostov, Kallinin and Kursk nuclear power plants. The engineers at Kolskaya are now planning to prolong the use of the two older reactors beyond the year of 2003 and 2004 when they supposedly should be closed down. According to the chief engineer Vasily Omelchuk (in Kudrik 1997), the equipment provided as aid by the Norwegian authorities enhances security at Kolskaya AES and also contributes to prolonged operational life. The Norwegian government decided in 1992 to spend 20 million NOK on security measures at Kolskaya AES, and for the years 1995/96 a sum of 44 millions was included in the budget. According to Omelchuk (in Kudrik 1997), Kolskaya AES in November 1997 invited for tenders for a USD$ 84 million project two outfit the two oldest reactors with new equipment. The European Bank of Reconstruction and Development has allocated 21 million USD for this project. There are no "simple solutions" to these dilemmas where aid to enhance security indirectly or directly contribute to prolonged operational life, but it would seem the dilemmas should be a more explicit part of aid decisions taken by different countries.

One interesting part of the Norwegian projects regarding safety at Kolskaya AES is the work done on consequence scenarios given an accident. In this context,

we would especially like to mention the analysis performed by The Norwegian Meteorological Institute (DNMI), (Saltbones, Bartnicki and Foss 1997; Bartnicki and Saltbones 1997). Comparative analysis of fallout from atmospheric nuclear bomb testing and the Chernobyl accident has shown that the patterns of far field fallout will be very much dependent upon the wind & weather conditions. The analysis of atmospheric transport and the deposition of radioactive material released during a potential accident at Kolskaya AES was based on eleven years of meteorological data and trajectory analysis. The analysis used a source term specification from Institute for Energy Technology - IFE and episode studies using DNMI's SNAP[19] a picture emerges of a very circular dispersion, with a spread to the north and east, both concerning the probability of being hit by fallout from the radioactive cloud and the "shortest travel time" (Bartnicki and Saltbones 1997, p.18). Such dispersion models may of course also be of some value when considering releases from other installations in the region.

10.4 Comparing different radiological emergency scenarios

In order to compare the magnitudes of the different radiological emergency scenarios on the Kola Peninsula, several indicators may be used. Firstly, the activity level of the various types of installations may be judged by the amounts of nuclear waste that are generated. According to Perovsky (in Castberg and Stokke 1992), the Kolskaya NPP produces approximately 50% of the solid, and 20% of the liquid nuclear waste in Murmansk and Archangels Oblast combined. The remaining waste volume, i.e. 50% of the solids, and 80% of the liquid waste in the two Oblasts is produced by various maritime installations. According to Perovsky, the Murmansk Shipping Company produces 7-8% of the total, with the remainder represented by the Northern Fleet.

Secondly, the relative activity levels may be compared according to the total thermic effect produced by the different institutions and their nuclear reactors. Evidently, average deployment percentages, load percentages applied and even the effects on the individual maritime reactors are difficult to estimate, let alone document, but given the fact that the Kolskaya NPP obviously is not running at full capacity, an attempt at a rough estimate can be made. The figures in the table below are adapted from *Jane's Fighting Ships* (Sharpe 1996), and data from Nilsen, Kudrik and Nikitin (1996) are used for comparison. The figures in these two sources

[19] SNAP = Severe Nuclear Accident Program

differed considerably in several parameters, and the data given by *Jane's* (Sharpe 1996) have been regarded as the most authoritative.

From the table it is interesting to note the good fit between the dimension estimate of 7–8 % generated waste generated by MSCo given by Perovskij and the 7 % share of "total thermal power capacity at the Peninsula".

Although the Kolskaya AES generates approximately 50 % of the solid nuclear waste in the region, our general judgement of the relative importance of the different radiological emergency scenarios is that the maritime context related to the various military installations represents the most considerable problems. This is in particular concerning nuclear waste and the problems of decommissioning the vessels. Of course if there is an accident at a Kolskaya AES reactor it will involve a core inventory of some 10–20 times more radioactivity than the various maritime reactors, but it is our general judgement that also the great number of objects related to the maritime nuclear installations renders a radiological emergency scenario involving such installations an important consideration. A detailed description of why we view the military maritime nuclear installations as the most considerable problem will be given below.

Nuclear accidents are often classified as either loss of control accidents (criticality accidents) in which an uncontrolled chain reaction may occur or as a Loss Of Coolant Accident (technically referred to as a LOCA). In the former Soviet Union there seems to have been a total of about ten nuclear accidents involving nuclear submarines of which five have been criticality accidents, and the five remaining

Table 10.1 Comparison of total thermic effect of the various nuclear reactor installations on the Kola Peninsula[20]

	Units	Reactors	Thermal Effect MWt	Percent of total thermal effect
Sum of SSBN	24	48	5160	20
Sum of SSGN	12	17	3165	13
Sum of SSN	32	63	9795	39
Sum nuclear submarines	68	128	18120	72
M.S.Co.	8	13	1790	7
[Sum maritime installations]	76	141	19910	(79)
Kolskaya NPP	1	4	5200	21
Sum nuclear installations	77	145	25110	100

[20] Numbers of nuclear submarines in active duty are overestimated, for instance it is known that two of the Typhoon class SSBN currently have been taken out of service, but all six are included in the table for illustration purposes. The purpose is to compare different installations on the basis of their thermal effect, and not to bring the currently most up to date figures for the Northern fleet, for more updated figures see for instance Jane's Fighting Ships.

perhaps better described as LOCA accidents. All five criticality accidents have taken place while the submarines were in port at a base and with the reactors shut down. Of these, two accidents[21] happened during work on the control rod system, one happened during a hydraulic test[22], and two accidents[23] have happened during refuelling. Under more normal operational circumstances, there have been some seven fires/ explosions that have resulted in loss of human life. The majority of crewmembers killed in nuclear submarine accidents was involved in the three fires/explosions that have resulted in a lost vessel.

One major aspect of the safety assessment is related to the process of defuelling the nuclear submarines, since in a pressurised water reactor[24] a criticality accident is more likely to occur when changes in the core configuration, for instance withdrawal of the control rods, are performed. When considering reactor accidents in submarines one must also remember that during more normal operational activities the great strength of the submarine hull serves as an extra safety containment layer. In addition, Russian nuclear submarine design is almost exclusively a double hull design, making the containment layer stronger than in their Western counterparts with their single hull design. Thus, for instance, in the case of a collision like the one that happened in February 1992 just off the Kola fjord the double hull Russian design is an advantage. This is meant to say that for the crew, reactor problems, and in the worst case a criticality event, are of course disastrous but during normal operational activity the hull itself acts as a safety shield against massive radioactive release. However, during refuelling or defuelling the hull is cut open in order to service the reactor and thus one important shield is disabled. It is from this perspective of interest to note that in the three criticality accidents where the hull was intact (i.e. not the defuelling incidents), there was only a minor release of radioactivity outside the submarine hull. Thus, it seems like the hull in these three cases acted as a rather effective security barrier, whereas in all three cases the reactor compartments involved had to be replaced.

One may also imagine the practical challenges involved in the precision lifting of a reactor lid and spent fuel by a crane on a service ship, with both the crane

[21] These two accidents happened in Severodvinsk, in 1968 and 1980, both involving a Yankee class submarine.

[22] This accident happened in Gorki in 1970 involving a Charlie II class submarine.

[23] The first refuelling accident happened in Severodvinsk in 1965 involving a November class submarine, while the other one happened in Chazma bay involving an Echo II class submarine.

[24] Pressurised Water Reactor (PWR) the type of reactor almost exclusively used in nuclear sub marines

and the sub bobbing slightly because of sea movements. Of course inside a Nuclear Power plant all cranes and mechanical equipment for servicing the reactors will be of a much more permanent and, mechanically speaking, fixed character and operations are carried out without having to take wind and wave effects into consideration. Thus from a common sense perspective, reactor servicing, refuelling or just defuelling a nuclear submarine must involve much more complex tasks than the same procedures undertaken within the midst of the giant reactor halls of an NPP.

The accident at Chazma Bay in 1985 can serve very well as a case in point for the kind of risks refuelling implies. The Chazma Bay accident occurred after refuelling and when trying to fix a leak; the reactor compartment lid was lifted, some control rods where not properly secured and followed up with the lid and a criticality accident occurred (Soyfer et al. 1995). The accident most probably was a two-step process, firstly the lifting of the lid with the control rods still attached because of a human error, this prompted a chain reaction in the reactor with a rapid peak of the power level. The rapid heat increase of the fuel made the water flash, the result being an excursion of steam, water and fuel particles. This excursion in turn may have lifted the reactor vessel lid (and the still attached control rods) thereby creating the second step excursion. However, as this was an accident involving new fuel, much less radioactivity was spread than would have been the case if the accident had involved fuel used for an extended period. The accident lead to severe local contamination and about ten of the personnel involved in the refuelling process were killed, and in addition 10 of the personnel suffered radiation sickness.

An analysis made by the Russian Federation for AMAP[25] shows that the form of accidents included in the design of the defuelling process will not lead to contamination beyond the safety zones included in the design. According to this analysis an accident involving core melt down will lead to severe harm to personnel participating in the defuelling process with deterministic health effects, and probably also the death of some from immediate high exposure, but for the public outside the containment zones the Russian estimate is that they will probably not be at great risk. However the analysis describes how the accident may imply iodine tablet distribution, and also, under unfavourable wind directions, evacuation of nearby towns (AMAP 1997, p. 125).

The facts of the Chazma Bay accident involving fresh fuel offer clear evidence that contamination beyond the safety zones must probably be expected in the case of radioactive release after a criticality accident involving spent fuel during refuelling/defuelling. When considering a criticality accident during refuelling/defuelling one may categorise the potential release in two parts, one related to release caused

[25] AMAP = Arctic Monitoring and Assessment Programme

by the energy involved in the fission of the criticality event itself[26], and further more the release due to radioactivity accumulated in the spent fuel. Again, broadly speaking a criticality accident involving spent fuel is much more serious, especially considering the more long-lived isotopes such as $^{137}Cs/^{90}Sr$. According to calculations made by Professor Povl L. Ølgaard (1997), using release fractions from the Chernobyl accident[27], a radioactive release after a criticality accident involving spent fuel may yield a factor 10 to the sixth power higher release[28] of for instance the more long-lived isotopes of ^{137}CS and ^{90}Sr than an accident with the same release fraction of core inventory involving "fresh fuel". Thus in a criticality accident involving spent fuel the accumulated component of the release will be totally dominant for the more long lived isotopes. One important distinction between defuelling a decommissioned nuclear submarine and refuelling a still operative one should be noted concerning the time frame from reactor shut down until the operations are started. The decommissioned submarines are typically laid up at different bases for an extended period before any defuelling operations start. Hence, for the radionuclides with a shorter half-life like many of the iodine isotopes, substantial decay[29] will have occurred in the accumulated activity before defuelling occurs. As discussed above the accumulated radionuclides would dominate the release if there was an accident involving spent fuel, but if the reactors have been shut down for an extended period before defuelling, only the long-lived accumulated radionuclides will be more important. On the other hand during the defueling of a still operational

[26] The energy produced in a defuelling criticality accident is estimated by Professor Ølgaard to be some 1700 MW or $4{,}6*10^{19}$ fissions (Ølgaard 1997, p. 5)

[27] One of the special features of the Chernobyl accident was the prolonged duration of release due to the fire in graphite moderator, which would not be the case in the nuclear submarine PWR design. It is not easy to estimate a «reasonable" release fraction, but maybe for instance the first day release fraction of Chernobyl is a more relevant parameter. More relevant in this discussion is the fact that the same release fraction is used both in the proportion related to the criticality event itself and to the accumulated proportion of release. Thus, the proportion between the amount of fission products resulting from the criticality event itself and the accumulated amount of fission products in the spent fuel is not dependent upon the release fraction.

[28] Based on a total burn-up of 10 000 effective full power hours, with release proportion of equal value Professor Ølgaard estimates for instance an activity release of 0.0017 Ci of ^{137}CS for fresh fuel and 26 000 Ci of ^{137}CS for spent fuel. This yields a release of $1.53*10^5$ more ^{137}CS with spent fuel, i.e. a ten to the sixth power higher release because of the accumulated activity in the spent fuel (Ølgaard 1997, p. 5 and p. 6)

[29] For instance for ^{131}I with a half life of 8.02 days, there will be some 8 % of core inventory at reactor shut down left after one month of decay and a fraction of some 1.99E-14 left after one year of decay. Except for ^{129}I the other iodine isotopes are typically much more short lived than ^{131}I

submarine there will be time pressure to get the submarine operational again, and hence the reactors will have been shut down for a much shorter time before defuelling operations are started. One reason for stressing radiological emergency scenarios involving defueling is based on the previous history of two serious radiological emergencies during such operations. Professor Ølgaard has calculated that based on the previous history of these operations one may estimate a $2*10^{-3}$ risk of such an event (Ølgaard 1997, p.7), and if for instance the number of decommissioned non-defuelled submarines is set at 100, then the number of emergencies expected based on past experience is something in the range of 0,2, which of course is unacceptable high. This has also been recognised, and a number of measures have been introduced to improve safety (Lystsov 1997).

Although less likely than a defuelling incident, a criticality accident may also occur related to the servicing and maintenance of the laid up nuclear submarines, that needs constant circulation of the coolant in their primary coolant circuit[30]. Furthermore, nuclear fuel freshly unloaded from submarines will need cooling for some years after reactor shut down, and thus they are often temporarily stored in wet basins; and if for some reasons these basins should loose their coolant this could cause a severe LOCA incident. In addition a loss of coolant in such a storage pool is critical as not only the cooling but also the shielding is lost, and hence the radiation level will be drastically increased in the area close to the facility. This is in fact what nearly occurred at Building Number Five at the Northern Fleet's storage facility for nuclear waste in Andreva Bay in 1982, when it was discovered that the water levels of the pools had fallen (Yablokov 1993). There was a serious leak of highly radioactive water from the pools, and even today, the brook going the 350 meters from this building to the sea is contaminated.

When considering the probabilities of a radiological emergency scenario the human error aspect must be stressed, as many of those working in these areas experience a severe decline in financial compensation received for the work done. Indications of instability have been in evidence in recent years; for example, several protests by personnel mainly because of delayed wages. Eleven workers at Sevmash[31] went on hunger strike in January 1995; and a one-day general strike affecting some 29,000 workers at the shipyard Sevmash occurred in September 1996. At the "10 SRZ" ship repair plant of RF Navy (="Skhval" Naval Yard), close to Polyarny there have been several protest episodes. On February 10th 1997 the workers blockaded a repaired nuclear submarine scheduled for patrol and demanded their salaries for

[30] Even if the reactors are shut down, heat will still be produced in the fuel due to the radioactive decay of the fission products produced during reactor operations. (For more on decay heat, see Elatomtsev et al. 1997).

[31] Sevmash is a main naval yard in Archangels Oblast

the last 8 months. In fact, they succeeded in getting some money transferred from the Navy. However, the crisis for the personnel continues and it was reported that in June 1998 some 21 workers went on hunger strike, and there are plans for the blockade of yet another submarine. Furthermore, the workers at the "82 SRZ" ship-repair plant of RF Navy located in Roslyakovo[32] gave expression to their protest by setting up road blocks both in October 1997and in May 1998. One may pessimistically conclude that there are reasons to believe that the motivation of the personnel to fulfil their working duty in all aspects is not enhanced by the circumstances endured. One should of course not forget than in many of foreseeable radiological emergencies it is precisely the personnel at the Naval Yards, or their families in the nearby towns, who will have to take the hardest impact. This vulnerability does to a certain extent motivate workers to adopt a safety - minded work approach; however, harsh working conditions, badly serviced machinery and missing pay are among the factors that may contribute to less safe operations.

Among military personnel, there have also been several episodes indicative of an unstable situation. For instance in August 1995, members of the crew on a newly commissioned SSBN went on strike, refusing to take the submarine out for sea-trials. The most dramatic one occurred recently at a naval base at the western side of the Kola fjord[33], involving a 19-year-old submarine-draftee and a hostage situation at a nuclear submarine[34]. One aspect of this incident is the speculations regarding the possibility for the hijacker to detonate a torpedo, and what the consequences of such an explosion would have been. Another aspect, is the incidence as a confirmation of a pattern where harsh conditions for the personnel increase the risk of a radiological emergency. This latter aspect has been a prime concern for instance for the local branch of the Security Police (FSB). In a newspaper interview

[32] Roslyakovo (Safonovo / Naval Yard no. 82) is situated a few kilometres southwest of Severomorsk, and the blockades were on the main road between Murmansk City and Severomorsk. Both the Skhval yard (near Poliarny) and Yard no. 82 are run by the Russian Navy, and thus subject to the Ministry of Defence, whereas for instance the Nerpa Yard (a few kilometres to the north-west of Skhval), and the much larger Yards situated near Severodvinsk in Archangels Oblast (The Sevmash and Zvezdochka) are subordinated to the Ministry of Finance.

[33] Skalisty/Gadzhiyevo

[34] Early in the morning Friday September 11th 1998, while under military arrest, the draftee with one year of submarine service, Alexandr Kuzminykh, manage to outmanoeuvre his guards taking their Kalachnikov. Kuzminykh killed 6 of his fellow crewmembers, and took two of them as hostage. Kuzminykh locked himself into on of the torpedo compartments of the Akula class submarine, and threatened to detonate a torpedo. Both member of his family and the Chief of the Russian Nay came to try to solve the hostage situation. Some 23 hours later the episode ended as Kuzminykh committed suicide.

after the incident the deputy chief of the Murmansk FSB branch expressed his concern for the situation.

When laying stress on the different nuclear threat scenarios distance from the various population centres should clearly also be an important parameter for consideration (as is well known to any physicist, ionising radiation from a radioactive source is reduced by the square of the distance to the source). Of course both fallout from atmospheric nuclear bomb testing and the Chernobyl accident made us all aware how a large explosion involving radioactive substances will lead to a radioactive cloud of larger/smaller radioactive particles which will follow wind and weather conditions. For the consequences of this fallout far afield, distance alone from a potential hazardous nuclear installation is a too simplistic measure. As mentioned before in the context of Kolskaya AES, DNMI produced a research report about possible fallout patterns after an accident at the NPP. This research using eleven years of meteorological data indicated that there is a small tendency for wind and weather conditions to indicate north east of Kolskaya as a slightly more likely fallout area. Looking at the fallout patterns in Ukraine, Belarus and Russia from Chernobyl one also sees that areas north of Chernobyl were more exposed to fallout. Taking the northeast direction, as a more likely perspective, may give an impression that several of the naval bases are less critical to important population centres as the bases are mainly situated to the north. Lying also in the same NE perspective, Murmansk City[35] is somewhat more often down wind given a release situation at Kolskaya AES. However, the main meteorological observation seems to be that of a circular spread, and thus mere distance alone, not dependent upon direction, is probably the more important parameter. More importantly, one must also keep in mind that the radiological emergencies here considered are rare events with a low probability, so even if the wind typically is blowing in for instance a N/NE direction four out of ten days during the summer season, there is no way to predict if an emergency will happen on one of the six out of ten days with the wind coming from other directions[36]. However, the extreme observations extracted from such a very large meteorological data set are very important in specifying worst possible case scenarios.

Looking only at distances one may ask at what kind of distances should been seen as critical. From a short distance perspective, one may claim that the activities taking place only a few kilometres north of Murmansk City should be reconsidered because of the major population centre in such a close-vicinity. In fact refuelling at

[35] Murmansk City covers quite an extensive area in a narrow strip along the Kola fjord and is situated some 165 km north – north east of Kolskaya AES.

[36] If the meteorological data were utilised for daily releases etc. or other kind of frequent events, the utility of probability calculations would have been more valuable.

the Sevmorput base was stopped as a consequence of the short distance from the facility to Murmansk City. It was the regional authorities of Murmansk Oblast represented by its governor, at that time Jevgenij Komarov, who issued a decree that banned the Northern Fleet and the MSCo from defuelling decommissioned vessels (Castberg 1992). The Atomflot base of Murmansk Shipping Company (MSCo) is situated only a few kilometres further north from the Sevmorput base. A sign of the quite open public discussion regarding these issues is the fact that the newspaper of the regional authorities, the Sovjetskij Murman, in February 1992 printed the answer from the Northern Fleet Commander admiral Gromov[37] regarding the decree. A sign of not so open communication from the Northern Fleet was the fact that Admiral Gromorov in his letter stated that there had been no radiological emergencies during defuelling. Even more interestingly the Sovjetskij Murman commented on this, the newspaper explicitly referring to the Chazma Bay accident in 1985 and the near accident at Sevmorput in 1986, and expressed the hope that the Admiral would be more clear about this in his future letters. It was also discussed publicly in the same newspaper whether a new method of completely draining the reactors of coolant[38] before defuelling could even further minimise the risk of criticality incidents. This newspaper discussion gives an unique insight to the fact that already in 1992, the regional authorities, or the journalist employed in their newspaper, have firstly an extensive knowledge of the different nuclear submarine accident and secondly have a clear distrust in information from the Northern Fleet, and even instruct the Northern Fleet Admiral to be more open.

To summarise one has obtained the following broad picture: The two older reactors of The Kolskaya AES are a reason for concern, but it is our evaluation largely based on the much larger number of objects that defuelling/refuelling operations at the various maritime reactors is of even greater concern. A radiological emergency scenario involving Kolskaya AES would of course be of larger proportions due to the fact that each of the four reactors there is 10–20 times larger in thermal effect than each of the maritime reactors. Given a *worst* case scenario of a nuclear accident at Kolskaya AES one could estimate a total release in the range of one tenth of the Chernobyl accident. A radiological emergency situation involving such amounts of radioactivity of course easily may effect people several hundred kilometres away by far field fall-out. At risk of near field impact one finds the nearby town of Polyarniye Zori with some 18,000 inhabitants established to accommodate the power engineering specialist of Kolskaya AES and their families. Kandalaksha

[37] Admiral Feliks N. Gromov was in 1996 Commander-in-Chief and Deputy Minister of Defence (Sharpe 1996)

[38] One important problem with complete draining is related to a higher dose burden on the personnel if the method is not combined with a longer shut down period before defuelling.

is the second closest major population centre within the 30-kilometre zone, followed by Apatity.

A maritime nuclear reactor involved in a radiological emergency is more thinkable related to defuelling/refuelling operations. Even though such an emergency probably will yield a more locally focused impact than a Kolskaya AES emergency it is our current evaluation based on available information that a worst case scenario involving spent fuel and with unfavourable weather conditions may affect the population outside the containment zones with far field fall out. For instance a radiological worst case refuelling emergency involving spent fuel at the Shkval Naval Yard may affect the some 25 thousand inhabitants in the nearby city of Poliarny[39], the some 16 thousand inhabitants of Snezhnogorsk[40], the some 17 thousand inhabitants of Skalisty[41], the Severomorsk area with about 80,000 inhabitants and even Murmansk city some 30 kilometres away. Even though MSCo handles less maritime reactors than the Northern Fleet it is also our evaluation that the Atomoflot base with its activity is situated all too close to a major population centre. It is further our evaluation that in foreseeable radiological emergencies the short term countermeasures of staying indoors, taking iodine potassium tablets, being careful with food and water and also, for those living nearby, evacuation are very relevant both to plan and to prepare for by giving information and conducting exercises in preparedness measures. In the section to follow, different countermeasures will be discussed in some detail.

[39] Polyarny was established in 1899 as Alexandrovsk named after the Tsar, and was the region's administrative centre until 1920. During WW II, the headquarters of the Northern Fleet were located there, and in addition, a detachment of the British Royal Navy headed by The Duke of York was based there in Yekaterininskaya Harbour.

[40] The town of Snezhnogorsk also known as Vyuzhny (M40), located inland from Olenya Guba some 4-km as the crow flies from Shkval Naval Yard.

[41] The town of Skalisty also known as Gadzhiyevo (M140), located near Yagelnaya Guba some 5-km as the crow flies from the Shkval Naval Yard.

Chapter 11 Health Impact and Intervention in the Case of a Radiological Emergency

In planning different responses to a radiological emergency, it is useful to consider temporal aspects to distinguish the more immediate and subsequent concerns. In many of the possible scenarios one can think of, including extended release, dose from external exposure to and inhalation of the radioactive plume is the more immediate concern, while subsequent external exposure to deposited radionuclides and ingestion of contaminated food and water may be of more substantial concern.

This latter perspective is illustrative of how different ecosystems take up and redistribute radionuclides (their scientific study is termed radioecology). One oft-cited and important example in the Polar region is the lichen reindeer pathway. As much radiocesium is absorbed by lichen, the reindeer who feed on this vegetation will build up a higher radiocesium content in the winter season (Westerlund et al. 1987). After the Chernobyl accident the South Sami population of Norway was severely affected by fallout through the lichen-reindeer-human food chain, when the grazing areas for their reindeer received high levels of fallout. One prevention measure in the first season after Chernobyl was to destroy large quantities of reindeer meat. In the years to come, other responses were found: e.g. to use fodder gathered elsewhere in Norway with lower levels of fallout in the period before the slaughter, or to change slaughter date. Even though these measures did reduce the dose burden for the South Samiis, these measures also implied a serious blow to their way of living and even their culture as reindeers play such an important role for them (Stephens 1995).

Another example illustrating the great many facets of countermeasure implementation, is that when the decision was made that the population of quite large areas adjacent to Chernobyl power plant should be evacuated, appropriate plans were not made for their domestic animals, and hence some people refused to participate in the evacuation as no one could help them in rescuing their livestock. All this illustrates the point that countermeasures and interventions produce effects at many levels and that there is an important lesson to be learned: intervention plans that hold together on paper may not be applicable in real life situations. Moreover, it is still questionable whether the achieved averted dose after evacuation or relocation can justify the psychosocial suffering caused by the countermeasure.

11.1 Health effects of radiological emergencies

Turning to the health effects of a radiological emergency the more purely biological effects are often categorised into two groups: *deterministic* effects of higher doses and the *stochastic* health effects associated with lower doses / dose rates. Stochastic effects are chance effects, with a probability of occurrence in proportion to the dose, but the effect itself is of an all or non-nature. The best known effect is cancer evolving from a cell transformed by chance. One does not get more or less cancer according to the dose, but the probability of the occurrence of this all or non effect, increases with increasing dose. On the contrary, deterministic effects are more severe the higher the dose is, and is generally in biologic terms the result of cell killing. Cell killing requires a dose above a certain threshold, and killing of more cells even higher doses. Organ and tissue failures with clinical effects require the killing of a large number of cells. The severity of the lesions depends on the level of cell depletion, increasing with increasing dose.

Deterministic effects[1] such as the acute radiation syndrome are not a likely scenario (except perhaps for workers at the nuclear installation involved), and therefore will not be described here (see for instance UNESCEAR 1988 for more). Thus, except for the people situated very close to the "epicentre" of a radiological emergency, stochastic health effects represent the more probable scenario. Among the better-known stochastic effects are cancer induction and hereditary effects. Concerning cancer induction it is possible that ionising radiation acts at one or several stages in a multi-stage carcinogenesis, but it is mainly believed to act in the initial conversion of normal stem cells. Furthermore, it is believed that most cancers originate from damage to single cells. One of the implications or corollaries of the theory of the "single cell" origin of cancer is that no low-dose threshold it to be expected[2].

Some of the anxiety-provoking features of the stochastic health effects centre round their stochastic (unpredictable) nature, their long "incubation" period before the effects occur, and the uncertainties in scientific knowledge about the issue.

[1] As briefly mentioned in Chapter 10, deterministic health effects are not likely to occur at absorbed doses less than 0,5 gray.

[2] One aspect further complicating the issue of the health effects of ionising radiation is the numerous concepts and quantities involved in describing this field; there are, for instance, the concepts of: acquired dose, equivalent dose, effective dose and committed effective dose. To estimate the effective dose one starts by calculating the equivalent dose. The equivalent dose is the absorbed dose in an affected tissue or organ weighted with a tissue-weighting factor, and is measured in Sieverts (Sv). The effective dose then is the sum of all equivalent doses. To calculate the committed effective dose the duration of the exposure is taken into account i.e. the committed effective dose is the time integral of the effective dose rate. When doses approach or exceed the thresholds for deterministic health effects, the effective dose is not a good measure of the risk of stochastic effects.

The scientific debate around stochastic effects concerns issues about the extrapolation from higher, more acute doses to low doses and dose rates. The shape of the dose-response curves is not well known, especially for lower doses. Often, in the absence of reliable data, it is assumed that extrapolation to low doses should be linear and without a threshold, a point of view that however is controversial (BEIR VII 1998). Some investigators believe that a threshold dose exists below which radiation has no deleterious effect. Others cite data indicating that the shape of a dose-response curve close to a zero dose has a slope much greater than that of the straight-line that represents interpolation between a zero dose and high doses.

Furthermore, the RRP group considers it an important research issue that established scientific knowledge about stochastic health effects is of very little value in a face to face meeting between an affected individual and a radiation protection expert. Although the expert may be extremely knowledgeable about all of the more recent dose effect risk estimates, these have more meaning at the general societal level. In a face-to-face meeting with an individual affected with some elevated dose (say in the range of ten times natural background level), the expert may be asked, is this safe, will anything occur to my family or me? How may an expert possibly answer for that specific individual? One can only respond with generalisations: for a large population exposed at a given level there may be an effect in a certain range, subject to identified uncertainties, e.g. in Norway in the 50 years following Chernobyl some 50 to 500 additional cancer cases, or none at all, will occur because of the Chernobyl fallout (Strand 1994, p. 48). There is no way of telling who these victims are, even not after an eventual effect has occurred: even with today's enormous knowledge of cancer and its causes there is no test to show if a specific cancer is caused by exposure to manmade radionuclides). In an interview performed within the RRP project group with a Norwegian South Sami individual, affected heavily in his way of life by Chernobyl and with cancers occurring in his closest family in the post-accident years, it became all too clear to us that state of the art scientific knowledge about radiation and health effects was of no help to this man in his quest to find the reasons behind his family illness hardships.

Going beyond the deterministic and stochastic health effects to the psychological impact of a radiological emergency, it is a sad fact that such impact is often undervalued in intervention planning, despite the fact that studies after the Chernobyl accident clearly have established the vital importance of psychosocial health effects (WHO 1995). It is also very often found that various experts have strong opinions about the various psychosocial impacts, betrayed in e.g. the ill-used "radiophobia" term, opinions backed by very little thorough research.

Without being too bold we will state that it is our working hypothesis that each intervention's capability to influence an individual's positive outcome expectancy, is a key factor in that intervention's influence on the psychological impact.

Each protective action that an individual has in their own repertoire and whose application they consider possible and meaningful is of vital importance. Thus given a radiological emergency it is an essential concept to optimise how different population segments cope and their *perceived* ability to influence the health impact of the accident on their family and themselves. Some segments of the population will doubtlessly need reassurance, e.g. a strong authority spokesperson taking care of the emergency "for them", while some may very well need to be more frightened before being motivated to take protective action. Others will want specific details and opposing arguments so as to prepare themselves for taking decisions regarding protective action. In fact, when the Norwegian population was asked about this in 1993 the opinions were evenly split: half of the population wanted to have conflicting information quickly distributed, whereas the other half preferred the information to be withheld until a more consensual picture could be reported. Given the before mentioned uncertainties involved in stochastic health effects, it is a very certain prediction that in radiological emergency situation various "experts" will have extremely conflicting "truths" to impart about the health impact of the situation. It is our current evaluation that public education *before* emergency occurs is possibly the only means for familiarising the public with the type of conflicting information that will certainly circulate in an accident situation. Perhaps knowledge about ionising radiation and its health effects, spread beforehand like popular science information, could later play a valuable role in helping the public to recognise, if not fully grasp, the difficult issues of radiation protection. To conclude, in addition to the dose-averting function of a protective measure, the measure's ability to optimise the psychological coping of affected individuals should be evaluated in order to reduce the overall health impact of radiological emergencies.

11.2 Source term and exposure pathways

The sources of a possible radiological emergency were mentioned in the previous chapter. They should be evaluated in terms of how a release situation may, or may not, affect the population of the region: that is, in terms of exposure pathways. Some possible countermeasures to apply in order to reduce the impact will be described.

When considering possible means of intervention in a radiological emergency situation, it is important to identify possible exposure pathways and to evaluate their relative importance. It is common practice to distinguish between external and internal exposure (ICRP 1993, p. 9). The major external exposure pathways are radiation from: the source/facility of the incident, the plume from the incident, radionuclide contamination on surfaces, and radionuclide contamination of skin and

clothing. Principal internal exposure pathways are: inhalation of radionuclides in the plume, inhalation of resuspended radionuclides, ingestion of contaminated food and water, ingestion of radionuclides from contaminated materials and finally absorption through skin and wounds.

To give priority to the various pathways and optimise measures to block the more important pathways, rather detailed knowledge about the various parameters of radioactive releases is needed. The concept "source term" is used to describe the release of radioactive materials from a source to the environment. Some of the important parameters of the source term are: radionuclide composition and the amount of each isotope released, physical-chemical form (aerosols, gas, compounds etc.), time development of the release, and the energy content of the release related to the plume height.

Estimating the radionuclide composition of the radiological emergency scenarios (as mentioned in the previous chapter) is extremely difficult; thus, a simplified approach will be applied here. Generally, a fission process results in an enormous number of radioactive isotopes that may be divided in three groups: fission products, transuranium and activation products. To give an indication of the number of radioactive isotopes involved it can be mentioned that more than 200 fission products are known of from the sole element Uranium, and some 7% of the total energy released in the fission process is released from the radioactive fission products. Among the better-known fission products are ^{131}I, ^{137}Cs and ^{90}Sr. The transuranium are elements with an atom number higher than Uranium (92), for instance ^{239}Pu. Activation products are radioactive isotopes created when a stable atom is hit by a neutron, for instance as observed with the Chazma Bay accident described in Chapter 10: an activation product ^{60}Co[3], was an important part of the radioactive release. This report will not take into account transurans and activation products, in that fission products are considered to be the most important radioactive release in the emergency scenarios seen as most likely among those described in Chapter 10.

Using data from Slaper et al. (1994) and their evaluation of possible accidents at nuclear power plants with pressurised water reactors, one would in a longer time perspective (70 yrs) estimate that the major dose contributors would be five radionuclides, namely: ^{131}I , ^{137}Cs, ^{134}Cs ^{133}I and ^{132}Te. Although these calculations were not based on the most recent input parameters[4], Slaper et al.'s work illustrates the importance of e.g. ^{131}I for the total dose acquired. It is estimated by Slaper that for a one year old child, some 70% percent of the first year total dose could be attributed to ^{131}I. Another indication of the importance of radioiodine are the

[3] ^{60}Co is created when ^{59}Co captures a neutron.

[4] For instance if the ICRP-60 dose conversion rather than ICRP-48 had been used, this would have changed the weighting factor for the thyroid from 0,03 to 0,05.

calculations made by Baverstock (1995). The doses to the thyroid from Iodine isotopes were compared to the whole body dose from the isotopes of Cs and Sr through external exposure and ingestion. The comparisons were made for the population close to the Chernobyl accident and the ratios found for children in the four year period 1986-1989 was in the 20 to 50 range, i.e. for these children thyroid doses were the absolutely dominating problem. Below follows a short description of what are judged to be the more important isotopes to consider namely: radioiodine (^{131}I), radiocesium (^{137}Cs, ^{134}Cs), and strontium (^{90}Sr).

In a nuclear reactor a variety of iodine radioisotopes are formed as fission fragments in radioactive chains from corresponding tellurium isotopes. Of the iodine radioisotopes with mass number from 124 to 141 that are formed in a reactor, the Chernobyl accident release composition has pointed to ^{131}I, ^{132}I, ^{133}I, ^{134}I and ^{135}I as the more important ones[5]. Of these ^{131}I has a significantly longer half-life, thus taking half-lives into acount, 20 hours after the release and beyond, ^{131}I is the main contributor to human exposure. Looking broader than share decay and half-lives, the radioiodine isotope ^{132}I should be noticed, as it is the "daughter" product of ^{132} Te with a half-life of 78,2 hours. ^{132}Te were estimated by OECD-NEA (1996) to constitute some 10% of the total activity of the Chernobyl release. Looking again at the Chernobyl accident, by the first of May 1986, five days after the accident, only the iodine radioisotopes ^{131}I and ^{133}I could make any substantial contribution to human exposure (Baliff and Stepanenko 1996). In accordance with a simplified approach here chosen ^{131}I will mainly be considered, even though it has been suggested that the other more short-lived radioiodines could play an important role in the increase in thyroid cancer seen in the former Soviet Union (Hall & Holm 1998).

^{131}I, with its short half-life of 8,05 days and other radioiodine isotopes with even shorter half-lives, will make up an important part of radionuclide composition after the radiological emergencies as portrayed in Chapter 10, especially in the acute phase after the emergency. ^{131}I is more easily spread as an aerosol but it is reasonable to assume that another major part will be in particle format. ^{131}I will readily be taken up by for instance cows grazing and transferred to the milk, the gravity

[5] Importance of various Iodine radioisotopes relative to ^{131}I in the Chernobyl accident release. Data adapted from Orlov, Snykov, Khvalensky and Volokitin (1996)

Activity level relative to ^{131}I Relative activity after decay time given in hours

Isotope:	T 1/2 in hours	at t=0	t = 1 hour	t = 2 hours	t = 4 hours	t = 6 hours
^{131}I	192.96	1	0.996	0.993	0.986	0.979
^{132}I	2.28	1.42	1.048	0.773	0.421	0.229
^{133}I	20.8	1.97	1.905	1.843	1.724	1.613
^{134}I	0.88	2.14	0.971	0.440	0.091	0.019
^{135}I	6.61	1.84	1.657	1.492	1.210	0.981

being somewhat dependent upon the lactation cycle of the cow (higher transfer taking place at the end of the cycle). Thus, the milk content of ^{131}I should be monitored by the use of simple gamma monitors. For instance in Norway after the Chernobyl fallout it was found that the milk produced in the districts of Oppland county more heavily affected had a ^{131}I content in June/July that made it unfit for human consumption. Generally, radioiodine is well known for the harmful effect it has on the thyroid, an effect however that is quite easily prevented if adequate intake of stable iodine is achieved before the fallout occurs (more about Iodine tablets as an intervention makes up a separate section below).

Strontium is another fission product that is well known from the fallout from atmospheric nuclear bomb tests. Strontium did not play such an important role in the Chernobyl fallout as compared to radiocaesium[6], apparently because the temperature of the fire was not high enough. In addition, the Strontium fallout was closer to the reactor than was observed for radiocesium. Expert sources disagree considerably as to the role of Strontium in the fallout from the radiological emergencies of Chapter 10: Slaper et al. find ^{90}Sr to be of low importance, while Stokke (1997) estimates ^{90}Sr as more important in the proposed source term for a reactor at Kolskaya AES. On the biological level Strontium[7] is described as "bone seeking " and is readily taken up by the intestinal canal. This is because Strontium is chemically very similar to calcium[8] and therefore "mimic" Ca in the food chain. As Strontium emits only beta particles it is harder to measure than radiocesium, emitting both alpha and beta particles. The main intake of ^{90}Sr after fallout from atmospheric nuclear bomb tests is due to foodstuffs such as milk, dairy products, fruit and vegetables, while meat and fish play a less important role in ^{90}Sr intake. It should be noted that Sr^{90} in bone structure has a biological half-life of about 50 years.

Radiocesium is quite near to potassium in the periodic table and is quite readily taken up by the intestinal canal, and incorporated to living cells, but only under specific conditions could ^{137}Cs replace potassium in chemical and biochemical compounds. ^{137}Cs on the organic level could be said to be "muscle seeking ". Even though the physical half-life of ^{137}Cs is quite similar to the physical half life of ^{90}Sr, the biological half life is much shorter, around 100 days in humans. In the human diet, the main contribution of ^{137}Cs will originate from meat, milk, fruit and vegetables, where milk and meat consumption will account for some 70% of

[6] For Chernobyl the release ratio ^{90}Sr to ^{137}Cs was 1:8.5, whereas for Nuclear weapon test the ratio ^{90}Sr to ^{137}Cs is something like 1:1.38.

[7] ^{89}Sr is more important in a short - term perspective with a half-life of 50. 5 days, whereas ^{90}Sr has a half-life of 29. 2 years

[8] In fact it has been common practice to refer to the ^{90}Strontium levels as the activity of ^{90}Sr per gram Ca

the intake (Strand et al. 1987). Not dependent upon the final verdict of ^{90}Sr importance in a radionuclide release composition, it was generally found in Norwegian milk production during the 1960 nuclear bomb test fallout that radiocesium was found in a nearly constant factor of 10:1 as compared to Strontium (Hvinden 1979)[9].

After arriving at a probable source term description, an estimation of the importance of pathways may be undertaken. To simplify one could state that noble gases and radioactive Iodine are the more important in the short time perspective, whereas radiocesium is more important in the longer time perspective. Using these various probabilistic source terms Slaper et al. found that at a 10-km distance from the accident epicentre the various exposure pathways contributed the following to the overall dose: ingestion pathway some 52%, external ground some 34%, inhalation some 12% and the external cloud some 2% (Slaper et al. 1994, p. 31)[10].

The International Commission on Radiological Protection (ICRP) has built up a conceptual framework to describe the different interventions and their effectiveness. The concept of projected dose (PD) equals the dose to the population at risk for each exposure pathway without taking into account any possible protective actions; whereas the concept of averted dose (AD) is the dose saved by implementing a protective action. Averted dose (AD) is calculated for each pathway. The duration of exposure is also an important consideration, as protraction of the dose influences the threshold dose at which deterministic effects may occur. The difference between projected dose and averted dose is called residual dose. In "real life" circumstances, these theoretical concepts must be translated into "operational intervention levels" in terms of the more easily assessed, say, quantities of ground deposition density or dose rates. In the ICRP framework both justification and optimisation are key concepts, i.e. before introducing a protective measure, is should be demonstrated a positive net benefit (justification) can be produced, as every protective action also entails some risk to the individual affected and some costs for society. Furthermore, the radiation detriment averted by each protective measure should be balanced against the costs and other detriments in such a way that the highest possible net benefits from the protective action is achieved (optimisation). Some of the available protective actions that should be evaluated for their net benefit

[9] As the ratio of release is somewhere in the range of 1:1. 38, clearly the transfer factor in milk is higher for radiocesium than strontium, but then the biological half - life for strontium in the bone structure is more than 100 times longer than the biological half - life for "soft tissue" radiocesium.

[10] Another source for weighting the pathways is Strand's estimate that the 70% of the dose released on the Norwegian population in a fifty years perspective after Chernobyl will be from external exposure (Strand 1994, p.46), i.e. more weight on external exposure; in the context of describing countermeasures the estimates of Slaper et all will be used here.

are: shielding, stable iodine administration, evacuation, control of access (to the more contaminated zones), relocation, protective clothing and decontamination of individuals and clothing, restrictions on foodstuffs and advice on food gathering and preparation, and decontamination of structures and land surfaces. The data from Slaper et al. as cited above indicate that immediate and longer-term countermeasures that reduce the ingestion and external ground pathways should be given priority.

11.3 Interventions and countermeasures

Going back to the more immediate concerns after a nuclear accident involving extensive radioactive release, and to the major exposure pathways, the important countermeasures of: distributing iodine tablets, sheltering, selecting safe food and water, and evacuation will be presented below in some detail; these measures are also among those included in the questionnaire of the current study.

Counter measures related to dietary practices in a regional context

Generally, for both food and water, the various countermeasures will be described in a context of radioactive far-field fallout after a radiological emergency, as this scenario is judged the more likely. For the benefit of the general public's education, it would be important to increase their awareness that the irradiation of water or food is not the problem, but rather that those particles containing radioactivity must be stopped from getting into the food/water supply. For far-field fallout scenarios and in a longer-term perspective, the ingestion pathway will be more important. The Chernobyl accident experience has proved that for such fallout, the countermeasure of changing food and drinking habits is rapidly applied or adapted to by the general population. For instance in Norway, Weisæth's 1986 survey showed that only a very short time after only some of the fallout pattern were known, some 6 percent of the population had changed or planned to change their food and drinking habits (Weisæth 1991). This percentage may not seem large, but the context of the official advice of not doing any changes must taking into account. Furthermore, the larger 1996 RISKPERCOM data set indicated that, retrospectively estimated, more than one out of five of the Norwegian population made changes to their fare because of Chernobyl. Of course, various experts may have different opinions regarding the necessity of such widespread use of this countermeasure given the moderate average fallout levels observed in Norway. Nonetheless these figures indicate that dietary changes will be dominant among the countermeasures adhered to by members of the public. In addition, an evaluation of the various

countermeasures applied in Norway has shown dietary advice to be the most cost effective method per man-sievert in reduced dose (Strand et al. 1990).

Water

Generally, one can say that after radioactive far-field fallout, consuming water sources from surface water, still water or smaller rainwater tanks should be avoided. As an example of the result of really far-field fallout (1500 km +) after the Chernobyl accident some cistern water in Norway was found to be contaminated at more than 7000 bq/l, and in the Oslo area there was an observation of 4000 Bq/l for I^{131}. Although Norwegian authorities first announced that no measures were needed, this was revised and warnings were issued against using small rainwater sources[11].

If there are any prior warnings about the fallout, water sources or water tanks should be covered and if possible be made airtight in order to protect against the fallout particles. If such prevention cannot be effected, and if no other water source than still water is available, it is possible to try to decontaminate the water by settling, filtration and distillation; the aim of such measures would be to filter away the radioactive particles[12]. The effectiveness of filtering will of course be dependent upon the particle size; i.e. only larger particles will be easily filtered. It is also possible to try to increase the effectiveness of the settling process by adding natural ion exchangers such as clay, permutite or black dirt to the watertank, carefully mixing them together and then allowing adequate time for settling. For a better result, filtering and settling may be combined. A filter may be made for instance as a vessel with a drain in the bottom and filled with layers of slag, coke, or anthracite with intermediate layers of sand or charcoal. Pit wells may be decontaminated by removing an earth layer of about 5 cm deep in a radius of some 15–20 meters, then the water of the well should be pumped out, the sand or silt from the bottom be removed and the outer and inner surface of the framework and covering of the well decontaminated by rinsing.

[11] On the morning of 30th April 1986, Swedish Radio announced that warnings might be issued against the use of rainwater as drinking water in those parts of Sweden with heavier radioactive fallout, whereas the Norwegian health authorities the same day held to their message that *no* countermeasures were necessary. However, in the afternoon of the next day, a warning was indeed issued from the same health authorities against using cistern water; the warning was directed at owners of holiday cabins in the area of Norway known as Østlandet. The warning was a bit ridiculous as regards the geographical area, as Østlandet overall was proven afterwards not to have been greatly affected compared to, for instance, areas in Trøndelag.

[12] Generally in still water the particle size of the fallout will be important, as larger particles implies less time need before the particles have settled, larger particles will for instance typically be expected after an nuclear bomb explosion close to the earth

Our specific knowledge regarding water supply in the Murmansk Oblast region is quite limited, but given the fact that more than 80% of the population live in towns, centrally decided solutions for drinking water in radiological emergency would have to be provided for the vast majority of the population. One centrally decided intervention should be to have a close monitoring programme. A monitoring programme that should both focuses one the very early and a very late phase. A very early monitoring phase is needed as contaminating radionuclides tend to disapear from water quickly, and a later phase as wash-out in the catcment area may lead contaminatin to reach drinking water supplies (Likhtarev 1989). It would appear that draws upon the water present in the enormous unspoiled wilderness might have to be regulated, and also consideration should be given to any population groups that may consume rainwater or other untreated surface water supplies. Given the very high level of urbanisation in this region it seem fair to assume that there will be present water supply also from non surface sources. In addition, the share dimensions needed for providing large population in the steady state situation will imply a considerable dilution effect of possible contamination after radiological emergencies. In conclusion, the water supply will not be a predominant concern, expect possible for critical groups with alternative water supply than the general population.

Foodstuff

Interventions to reduce the impact on internal exposure from the ingestion of contaminated foodstuffs may be considered from the point of view of production or consumption. In the consumption context, the consumers may change their dietary habits, whereas on the production side various measures or special decontamination procedures may be introduced for fodder, etc. The distinction is especially important in an arctic urban region[13] like Murmansk where the ordinary citizen does not produce foodstuffs; i.e. foodstuff interventions available to the public in the region will be changes in food habits and routines for food preparation. Below will be given a description of the local production system for foodstuffs, and some further details will be given for milk, meat, vegetables and fish.

The production region and level of self-subsistence for the foodstuff consumed is important, as we in this report consider radiological emergencies originating from nuclear installations of the region. Generally for the region, a very large proportion of the food supply has been imported. In fact, Murmansk Oblast is among the regions with the lowest share of self-subsistence in the Russian Federation. It has been suggested that the increase in the share of the labour force between

[13] As opposed to the more rurally dominated areas where the average inhabitant may apply more of a mixture of interventions both at production and consumption side.

1970 and 1991 (1,4% to 3%) working in the agricultural sector could be interpreted as a deliberate effort to increase the level of self-subsistence (Castberg 1992), but despite such an effort, it remained low. More than 90% of vegetables have been imported, whereas for meat, milk and dairy products the average imports share for the years 1992-94 was some 70%[14]. It is still too early to tell what changes the recent economic crises will imply for food production and supply, but there are ample evidence that some regions of the Russian Federation are considering to withhold their food deliveries to the central system. Furthermore, it is a sure prediction that such halts in delivery to the central authorities especially will affect regions like Murmansk with their high dependency upon such centrally governed supplies.

Looking at changes that did occur from 1992 it can bee seen that even compared to the significant reduction in the agricultural production in the Russian Federation that occurred from 1992 to 1994[15] the reductions in the Murmansk region was even more significant for important foodstuffs. For instance, according to FAO statistic (http://apps.fao.org), the total cow milk production in the Russian Federation from 1992 to 1994 fell some 11%, whereas a 42%[16] reduction where seen in the same period in Murmansk Oblast. The total meat production in the Russian Federation[17] in the same period fell with 18%, compared to a 23% reduction in the Murmansk Oblast. Thus, the experience from the days of big bang of economical reform may point to a tendency that the special agricultural practices of this region are more vulnerable to the current economical crises.

One clear exception to the pattern of downscaling is the local potato production. Both per capita production and consumption of potatoes in Murmansk Oblast have increased in recent years, and in 1994, some 50% of the potato consumption were produced locally.

[14] It must be kept in mind that the transitions in the last years, and in particular the dramatic changes recently in 1998, also imply that large changes in both consumption and production patterns quite rapidly will occur, thus the numbers given must be interpreted cautiously.

[15] Some of the most significant reductions occurred in Murmansk Oblast in the year of 1991. The period from 1992 and forward are used because no comparable statistics available for The Russian Federation for 1991.

[16] Corrected to per capita production, a reduction of 40%.

[17] Figures from FAO – web sever (http://apps.fao.org): Russian Federation: total meat production in 1992: 8 265 400 ton, down to 6 814 900 ton in 1994. Total fresh whole cow milk production 1992: 47 015 000 ton, down to 41 951 000 ton in 1994.

Historically in the Soviet era, agricultural production was organised in large state (*"solkhoz"*) or collective (*"kolkhoz"*) farms[18], and, as is perhaps not so well known, the large industrial enterprises combinates had their own support farms[19]. In 1988 in Murmansk Oblast, there were 24 state co-operative farms and some 65-support farms owned by various enterprises. There is a deviation in Murmansk Oblast from the normal organisation of agricultural production in the former Soviet Union in that there are no kolkhoz farmers, only kolkhoz fishermen. While the state farm had delivery obligations towards regional authorities, the support farms delivered directly to the enterprises. The larger state farms were located in the municipalities of Kola and Pechenga, and according to Castberg (1992) those two municipalities alone accounted for more than 70 percent of local agricultural production. On the large state farms located in the municipalities of Kola and Pechenga, the main products are meat, eggs[20] and milk. For the radiological emergency scenarios related to military installations referred to in Chapter 10, the local agricultural production could probably be affected, because of the relative proximity to those installations. By January 1st 1995, the number of state farms had been reduced to 13 with about 50% reduction in the number of people[21] employed. When it comes to private farmers their numbers are increasing but plays an insignificant role in the agricultural production. For instance, although the private farmer livestock of pigs have quadrupled from 1992 until end year 1994, it still only counted for some 3% of the total livestock of pigs in the Oblast. Furthermore, the arable land of the private farmers counted for some 1% of the total arable land in the Oblast. This reflects a general tendency in the Russian Federation, the reform of the agricultural sector have been much slower than what is found in the industry.

Another remnant from the Soviet era, is the tradition of stockpiling foodstuffs for later use. A tradition established as a mechanism of adaptation to the erratic pattern of availability of commodities in Soviet shops. More specifically in the region it was found in Hansen's 1992 survey that some 68% held stockpiles for

[18] The collective farm (=kolkhoz) were in fact quite similar to the state farm (=solkhoz), both were subject to regional plans for their products, which they must sell to the State at set prices. In theory however the Kolkhoz had more room for manoeuvre, as the farmers jointly owned their products, buildings and machinery. In addition to the farm system, the private plot of the rural farmers played a significant role, even though the private plot only had 9% of the productive fund, it was estimated to deliver some 28% of agricultural products in the former Soviet Union (Ryvkina in Humprey 1979).

[19] The Russian term for support farm = Podsobnyje khozajajsta.

[20] The Kolsky district has two large poultry factories: the Snezhnaya and the Murmanskaya.

[21] Down from a personnel size of 8.501 on 25 state farms as of January 1st 1992, too 4.242 employed at the 13 state farms left by January 1st 1995.

foodstuffs (Hansen 93, p.95). It is hard to estimate the current rate of occurrence of such practices, but a reasonable estimate under the current conditions would be that this practice prevails. Thus, advice to the general public for protecting their stockpiles of foodstuffs may be well advised.

As there is a long tradition of a major importing of foodstuffs to the region, it seems reasonable to estimate that the share could be increased in a situation of a radiological emergency affecting the local production system. Transport and distribution systems for large-scale food imports are already in place in this region, and to increase their capacity to replace the very low level of self-subsistence would be a minor problem for many foodstuffs. This solution may appear non-optimal in the public's perception of a radiological emergency related to Kolskaya AES, since foodstuffs would be transported through the more contaminated areas close to the reactor. In that case, it would be important to educate the public, as mentioned in the introduction to this section, that the share irradiation of foodstuffs is not a problem, but contamination may be. To avoid contamination the food will have to be transported in airtight containers in order to prevent any radioactive dust from settling on it. A radiological emergency related to the various military nuclear installations would not imply such a scenario of transporting food through the "epicentre", except perhaps for foodstuff supply for the population of the Pechenga district.

Milk

Milk is often found to be an important foodstuff to investigate for radioactive contamination. In the shorter time perspective milk must be monitored for ^{131}I contamination, whereas ^{137}Cs and ^{90}Sr may be a more dominant problem in the longer timer perspective. The OECD-NEA has estimated that ^{131}I was the main contributor to doses, mainly via ingestion of milk, for populations outside the former Soviet Union, during the first few weeks after Chernobyl. The importance of milk in radiocesisum intake is illustrated by the fact that for an "average" Norwegian with an "average" diet the radiocesium intake in milk was more than 1/3 of the total radiocesium intake during the first year after Chernobyl. In addition, since milk and dairy products often are an important Calcium provider in the human diet, the possibility of Strontium intake, and its much longer biological half-life, must be remembered.

The food consumption pattern of the region shows that milk and dairy products form an important part of the diet. Even though the average per capita consumption has been greatly reduced in recent years, probably because of economic hardship, the average consumption of milk and other dairy products in 1994 was 171 kg per capita, down from a staggering 401 kg/per capita in 1990. In the same period, the local per capita production of milk falls with some 52%. For obvious

climatic reasons, only during a very short period of the year will it be possible for the locally produced milk to be made from cows grazing outdoors. Appropriate measures therefore should be taken to provide uncontaminated fodder and straw. We estimate that the some ten thousand cows[22] of the region get their fodder mainly from other regions; however, given a local fallout pattern it could be advisable to keep the cattle in their stables.

Meat

As mentioned above some 30% of the meat intake of the region is produced locally, a proportion that seems to be fairly constant, even though the average meat consumption has been reduced drastically in accordance with the economic hardships endured by the population[23]. The composition of the livestock in the Oblast give indications that meat from pigs and poultry plays a more important role in contrast to a less significant contribution of cattle meat in the local meat production as compared to an average of the Russian Federation[24].

Among the countermeasures on the "production side" can be found: intervention in fodder production such as plowing off the top soil layer, introducing cesium binders into the fodder, or by direct administration to livestock, alteration of slaughter time. In Norway, it has been common practice to introduce a period of clean fodder before slaughtering.

In other more rural areas of the former Soviet Union, where smaller scale agricultural practices are to be found, the production side of interventions is the more important. For our study region, interventions performed by the general population themselves will occur on the consumption side. One may predict a post-emergency situation in which customers will demand that meat is stamped with the original area of production, or where foreign imports of meat products increase even

[22] The figure of 10 000 cows dates from 1994, calculations have been done on the live stock and milk production figures from various years, and it would appear that quite a stable production yield of some 10 litre of milk per day per cow has been maintained. In comparison with the 10 000 estimate, the two counties of Troms and Finnmark in Northern Norway in 1994 had a livestock of 11.800 cows, but with less than one quarter of the population size of Murmansk Oblast.

[23] From a peak per capita consumption of meat and meat products of around 69 kg yearly in 1990, the consumption was down some 40% to around 40kg annually per capita in 1994.

[24] By January 1st 1995 the Murmansk Oblast livestock of poultry per 1000 inhabitants was some 72% of the Russian Federation average, the livestock of pigs some 58% of the R.F. average, whereas the cattle livestock of the Oblast only was some 8% of the R.F. average.

beyond their current relatively high levels[25]. There are also measures available to the general population themselves on the consumption side in the form of special food preparation methods. To reduce cesium contamination one may for instance use extensive cooking of meat, throwing away the meat broth to reduce the cesium content by some 50%. To reduce the strontium content of meat, consideration could be given to cutting out the bones, as is indeed recommended in a Soviet Union Civil Defence handbook; in fact, both of these food preparation measures are listed in the book. Although the advisability of the following is unclear, the Swedish Army Research Unit (FOA) suggests in a handbook also providing cesium binders such as Prussian Blue for direct human consumption.

The role of poultry meat in the meat statistics is not clear to us, but given the staggering production of some 170 million eggs, about 80% of regional consumption, there clearly must also be significant poultry meat production in the region. As of January 1st 1995, the poultry livestock in the Murmansk Oblast was some 2,01 per inhabitant as compared to an average of 2,8 in the Russian Federation. Perhaps in relation to ratio of price increases in imported versus regionally produced food products, egg consumption has not decreased as dramatically as meat and milk consumption. The current level of egg consumption seems to be quite comparable to that of a Norwegian "average" diet.

Poultry is the most ionising-resistant species in the barnyard (with regard to LD 50/60), a fact well known to the former Soviet Union Civil Defence system, as they listed in their handbook the mortality rates for domestic fowl given different whole-body gamma irradiation levels, as well as the specific symptoms of radiation sickness for fowl. Both poultry and eggs can be said to be of minor importance as a radiocesium source; it was estimated that the average Norwegian's consumption of 12 kg eggs annually only contributed some 0,5% of the total dose received due to cesium intake during the first year after Chernobyl. To summarise, the extensive local production of eggs and poultry is not estimated to be significant as far as dose contributions are concerned.

[25] Relatively high is as compared to levels of foreign import of meat products in other regions of the Russian Federation. Both meat and butter have traditionally been a part of the special barter-based border trade, particularly common with Finland. An anecdotal incident is the fact that the first ever shipment of goods to pass on the Norwegian-Soviet border (Storskog border station) was a shipment of meat products (a shipment of slicing Salami sausage from the Norwegian company "*Stabburet*" sent in 1983 (Castberg 1992, p. 77). Furthermore, looking to the last years of the Soviet era, food products made up an important part of the imports and counted some 16% of the total import. As an example of this in the years of 1990 and 1991, more than 1 million tons of meat was imported.

Vegetables and fruits

Generally, root vegetables like the potato are less affected by radioactive fallout, especially in the shorter-term perspective, whereas green vegetables such as lettuce are far more vulnerable to fallout. The larger consumption and share of local potato production does not therefore seem likely to be a significant dose contributor, although the seed potato seems to be more sensitive. The green vegetables in this area are a special case as they are mainly grown in enormous green houses, where the vegetables probably can be protected more easily from direct deposition in case of fallout. The share of local produced vegetables however is nearly negligible, and given the increasingly higher prices for these products, further consumption decrease per capita may be expected. In a situation in which radionuclides may have been deposited directly, the simplest treatment is to remove the outer leaves from leafy vegetables and to wash or peel fruit.

Fish

With regard to fish one must distinguish clearly between freshwater versus saltwater fish from a radiological point of view. In various fresh water species, radiocesium accumulates in the ecosystem because of the low availability of potassium in comparison to seawater[26]. However, in shell and shellfish there is amplification even in seawater. Given the widespread practice of angling in the more than 110 000 lakes or 18 000 rivers of our study region, freshwater fish consumption may become an area requiring dietary advice, just as it did in Norway after the Chernobyl accident[27]. Even though the average yearly Norwegian diet in 1986 was composed of 39 kg of saltwater fish as compared to about 1 kg of freshwater fish, the dose contribution from radiocesium in freshwater fish was calculate to be 1,5 times higher than that of saltwater fish.

Traditionally, in the Soviet era, Murmansk was very well known for providing enormous amounts of saltwater fish, the catch and production of the Murmansk City-based fishing industry making up a staggering 16–20% of the Soviet total. Much of the catch was taken far out at sea, and to deliver the catch all the way "back" to Murmansk was not very efficient. At the time of writing the fishing industry has been effectively halted as the trawlers are delivering to places offering hard currency income; for instance the North Norwegian fishing industry is currently very much dependent upon the Russian trawler catch.

[26] As explained above related to radioactive nuclide composition, cesium "mimic" pottasium, and with the low concentration of potassium in fresh water one get a high transfer factor for cesium to freshwater fish.

[27] In Norway after the Chernobyl fallout the highest measured value of total cesium activity in fresh water fish peaked at a staggering 55 000 $Bq.kg^{-1}$

To summarise the foodstuff section, one can stress that the large share of imports will imply a modest impact in dose contribution from locally produced foodstuffs from radioactive fallout. The recent years have seen large changes both in per capita consumption and production of various foodstuffs. It is still to early to tell how the current crises will impact the local food demand and supply, but even with such uncertainties involved the main conclusion of the large import share seem sound. The large import share also implies that from an emergency perspective one may anticipate that there is a transport and distribution system in place with the capacity to provide imports from other areas. In Murmansk the food production from poultry and saltwater fish is a special case, because of the very large local production capacity and the fact that both poultry and salt water fish will not be greatly affected by radioactive fallout, and thus will not significantly contribute to the dose received by the population. In a radiological emergency, both poultry and seawater fish may thus be important protein reserves for the population.

The Codex Alimentarus Commission has adopted guideline values for radionuclide contamination in food in international trade (FAO/WHO 1996). These guidelines may not be seen as intervention levels, but nonetheless may be used as an indicator; for instance, one may present the public with the argument that this level is the same as what might be expected from foreign foodstuff imports. This said, because one sure prediction will be that the publics trust in safe and non-contaminated food will be a matter of vital concern for the involved authorities.

On a general level one can say that for any single foodstuff, an intervention that gives an averted effective dose of 10 mSv /year is justified, but this level must also be seen in the context of alternative food supplies. For radionuclides with low values of dose per unit intake (e.g. most beta and gamma emitters) the optimised levels for various foods would be expected to lie in the range from 1-10 kBq/kg[28].

Iodine tablets

Iodine tablet administration is performed to protect the population from the exposure route of inhalation of radioiodine from the radioactive plume, or ingestion of radioiodine in foodstuffs (for instance milk) after an accident. Iodine tablets taken in the form of stable iodine/ potassium iodide block the radioactive iodine isotopes from reaching the thyroid gland. Iodine prophylaxis will always be justified provided that an average individual thyroid dose of 0,5 Sv can be averted. In addition, the optimised intervention level may be lower but not by more than a factor of 10. Hence if it is possible to avert an average individual thyroid dose in the range of

[28] For radionuclides with high values of dose per unit intake, e.g. alpha emitters the levels would be in the range 10-100 Bq/kg.

0,05 Sv to 0,5 Sv then this intervention is recommended (ICRP 1993). The intervention level for children may be even lower, as the dose of 0.05 Sv can be reached by lower air contamination than for adults.

It is possible to detect a change in iodine countermeasure policies after the evidence of thyroid disorders following the Chernobyl accident. The increase in thyroid pathology in children started some four years after the accident. The increase is predominant in regions most affected by fallout, which strongly suggests that exposure to radioactive iodine was the primary cause, even though there are some difficulties in estimating radiation doses to the thyroid, especially the components of the dose due to short-lived iodine isotopes (WHO 1995). According to WHO the former Soviet Union managed to distribute in total some five million iodine tablets, but clearly these did not reach all the children most at risk.

One example of change in iodine countermeasure policy is France's decision in 1997 to pre-distribute iodine tablets to some 600 000 people living in a 10 km zone around 24 nuclear installations. A NEA seminar held in 1994 on short-term countermeasures revealed major differences between different OECD countries and their practices regarding the various countermeasures. It was also evident from the seminar that the US has a less positive attitude towards iodine distribution, especially that aimed at the general population; pre-distribution in the US seems unlikely (Kantor, Hogan and Mosheni 1995). The Federal Radiological Preparedness Coordinating Committee (FRPCC) issued one Federal policy statement on the distribution of potassium iodide (KI) around nuclear power plants in 1985. The policy recommended stockpiling of KI and its distribution to emergency workers and institutionalised persons. It did not recommend that the predistribution or stockpiling of KI be required for the general public. Both State and local authorities retain their decision authority in regard to these recommendations, and at least three States have decided to stockpile or predistribute KI. The statements of the NCR[29] commission are quite revealing of both the different opinions about KI and the US opinion: "Ingestion of KI will serve only to help to reduce the dose to the thyroid caused by intake of radioiodine. The primary risk of the population from a severe accident is whole body dose, not the radioiodine dose to the thyroid" (Kantor, Hogan and Mosheni 1995, p. 286). This statement by NCR representatives regarding the relative importance of the thyroid dose versus the whole body dose is in strong contrast to the statement made by WHO representative Dr. Baverstock during the same seminar: "doses to the population close to the Chernobyl accident

[29] NRC = U.S. Nuclear Regulatory Commission

[…] shows that the thyroid doses were typically some 20 to 50 times[30] those to the whole body, over the four years after the accident" (Baverstock 1995, p. 16).

However, intervention using KI use must be very well prepared beforehand because if implemented there are severe time constraints. These constraints are related both to the relatively short half life of radioactive iodine isotopes (for instance 8 days for ^{131}I), and to the great efficiency of the thyroid gland in capturing iodine almost immediately. For instance, 50 percent of the maximum thyroid concentration of ^{131}I is reached only six hours after its ingestion, and the activity reaches its peak in about one day. Another illustration of the immediateness is the fact that the intake of radioactive iodine is blocked some five minutes after the intake of 100mg stable iodine.

Administration of stable iodine a few hours after Iodine-131exposure may reduce the thyroid activity by a factor of two; only a little reduction may be achieved after six hours, and more than twelve hours after the inhalation/ingestion of radioiodine has ceased, this intervention is of no value. On the other hand, if releases continue for days, distribution even several hours after their start will prevent uptake from the later parts of the release. In practice nuclear emergency drills, it was found twice that the distribution of KI downwind of the TVA's Sequoyah Nuclear Power Plant was too slow with regard to plume arrival time to protect residents effectively. Thus Tennessee public health officials decided to predistribute KI to about 3700 households within an 8-kilometre (i.e. 5-mile) radius of the power station (Fowinckle 1983).

One major real life practical experience of iodine tablet distribution was the case in Poland where the authorities decided to distribute iodine tablets to all school children in the eastern part of the country on 30 April 1986. Some 10,5 million Polish school children thus were given KI. There have been major follow up studies of this intervention, but it is too early to say how effective it was in preventing childhood thyroid cancer. One major finding, however, is the fact that the extent of any adverse effects has been found to be smaller than expected (Naumanan and Wolf 1993).

The main objective for this countermeasure should be to reach the most critical group namely children, thus the implementation efforts should be directed at their parents, and various institutions involved in their daily care (e.g. kinder-

[30] Baverstock here uses estimates of children's thyroid doses. One important consideration here is the significant differences in isotopic composition (especially the ^{131}I / ^{137}Cs activity ratio) of the contamination in various parts of the former Soviet Union after Chernobyl fallout. In the western parts of Belarus the ^{131}I / ^{137}Cs activity ratio was some 50-60, in the south western parts of Ukraine the ratio was 25-30, whereas in Kaluga and Tula Oblast of the Russian Federation the ^{131}I / ^{137}Cs activity ratio did not exceed 10 (Orlov, M., Snykov, C., Khvalensky, Yu. and Volokitin, A. 1996, p. 37).

garten and schools). The special vulnerability of children's thyroid gland is again underlined in a recent review of radiation and thyroid cancer. In the review the vital role of the age at radiation exposure is again stressed, it is even suggested that: "For radiation-induced thyroid cancer, however, age may be more influential than dose" (Boice 1998, p. 321).

Given the important time constraints of this intervention, the efficient distribution of iodine tablets may pose serious problems, especially when large population centres and large geographical areas are involved. When one tries to predict possible accident scenarios and in addition looks back at past experiences in accident situations, it seems reasonable to estimate as unlikely the achievement of a proper immediate warning and information. Thus when the general population is informed about a radioactive cloud, the option to reach maximum benefit by having the exposed population take (predistributed) tablets even before radioactive iodine exposure may be unrealistic. However, one can also predict that the release of iodine may last for some time. Hence, even if protecting populations from an earlier thyroid dose impact cannot be achieved, the dose received from releases later in the accident situation may be an important target of the intervention. Note that if the exposure from radioactive iodine continues beyond some 48 hours after the first tablets have been taken, further tablets may be required. One objection often heard against making iodine tablets readily available is a fear that the public will ingest them in situations where this is not called for, or ingest too large a dose and expose themselves to health risks linked to overingestion of stable iodine. Side effects from an overdose may include iodine allergy, asthma and skin sensitisation. In cases of high intake of iodine for long periods, thyroid malfunction and struma may evolve. However, there is not much research available to substantiate the belief that the general public, given proper information from trusted sources, will inflict harm upon themselves in such a way[31]. Authorities who fear overuse should reject plans for storing iodine in secret places, and instead favour proper prior information and high availability of tablets. Given the severe time constraints of this intervention, as described above, emergency drills where distribution time etc. are investigated through practical rehearsals are advisable in vulnerable areas. In the light of such practical experience the decision whether to predistribute KI or not will be taken on a better-informed basis.

[31] One case in point here is the fact that several Gulf War fatalities in Israel in 1991 were related to the mistaken use of gas masks. Observing the preparations made in Israel during the weapon inspection crises in Iraq, one is led to think that better preparedness information about how to optimise gas mask use is much preferable to making gas masks harder to obtain so as to avoid mistaken use.

Sheltering

In a radiological emergency situation with severe release, adhering to authorities' advice to stay or to go indoors may reduce substantially the populations' possible exposure. Sheltering may be a very effective intervention, especially early in an emergency situation (i.e. when a plume is passing). The averted dose depends upon the type and construction of the buildings available for sheltering; if cellars are included, the reduction may be in the range of factor ten and even more. To reduce the radiation intensity (dose rate) from close radioactive fallout by a factor of ten, one could theoretically take shelter behind either: some 25 centimetres of concrete or stone, some 90 centimetres of wood, some 50 centimetres of water/ice, or some seven centimetres of iron/steel. The averted dose then would be dependent upon how long one stays in the shelter. One aspect of the shielding factor indoors is the size distribution of the fallout particles and the type of ventilation filters available in the indoor shelter.

In the region under study it is reasonable to estimate that, since some 80 % of all blocks of flats have 5 or more floors (ref. Part I, Chapter 6 – Housing), the shelter provided by some 25 centimetres of stone/concrete will be readily available in the cellars. It is thus a matter of educating the population to the advisability of this intervention.

ICRP recommends on a generic basis that sheltering almost always will be justified provided that an averted dose of 50 mSv can be achieved during the time considered feasible for sheltering.

Evacuation

Evacuation implies urgent temporary removal of the population from the affected or potentially affected area (ICRP 1991). It is of course most effective if taken as a preventive action before any release of radionuclides has occurred; however, preventive evacuation is one of the most disruptive early actions. To achieve such an evacuation a decision may have to be taken based on quite limited information about the emergency. The temporal aspects of the term evacuation are quite strongly defined by ICRP: evacuation lasting beyond a week should instead be considered as relocation and be justified and optimised accordingly.

It can generally be said that a major aspect will be self-initiated evacuation versus evacuation decisions taken by the authorities. In fact, one of the major subjects of this part of the study has been to make the respondents elaborate on their thoughts of various self-initiated flight scenarios.

To illustrate something about the distances involved: the daily train from Murmansk to St. Petersburg takes some 28 hours for a distance of some 1445 km, and the distance by train from Murmansk to Kandalaksha is 277 km with a travel

time of about 5 and a half hours. The average speed on the railway stretch Nikel-Murmansk is much lower and produces a travel time of some 8 hours. Looking further at the communication infrastructure, the Oblast has some 933-km of public railway tracks of which some 50 % are electrified. There are some 2500-km of public roads in the Oblast of which more than 90% are surfaced. In 1994 there were some 2700 buses and some 126 000 privately owned cars; the latter have nearly doubled in number in barely a few years. The number of privately owned cars in 1994 was some 112 per 1000 persons, where as one in four households in the present study reported owning a car. Given an average household size of 3,34 household members this comes to some 75 cars per thousand, indicating a clear underreport of car ownership in the present study. As a continuation of tradition from the Soviet Union era, the railway still plays an extremely important role for passenger transport. Looking at passenger transport after the transition to market economy, one major shift besides the increased number of privately owned cars has been the dramatic decrease in overall air passenger transport, whereas rail passenger transport has not experienced a correspondingly dramatic reduction.

A hypothesis of the current project was that there might be a scenario-congruent effect on self-initiated evacuation tendencies. For a radiological emergency involving a military nuclear installation, an evacuation to major population centres would imply "turning one's back on the epicentre" of the emergency, whereas an radiological emergency involving Kolskaya AES, for a major part of the population, would imply travelling through the epicentre of the emergency. Both the railway and the main highway southbound (M18) pass quite near the Kolskaya AES. In an attempt to investigate such tendencies the respondents were asked about their possible travel preferences in both a military and a Kolskaya AES radiological emergency situation.

In a historical context, it should be remembered how strongly the former Soviet Union weighted the dispersal and evacuation of their major cities, with rapid rural relocation of the population, as their principal civil defence action. In the former Soviet Union civil defence system, dispersal and evacuation were two different concepts. The concept of dispersal meant the relocation outside the cities of workers and their families attached to plants whose continued production was required. The concept of evacuation covered those plant workers and their families who were supposed to be transferred to remote location, and in addition also covers those unable to work or not employed within the national economy (Akimov 1969). The civil defence plans of the former Soviet Union were quite advanced, thorough and detailed, and were viewed by the US as impressive both in their practicality and completeness. The US side was especially impressed by the plans for

the evacuation and dispersal of the urban population into rural areas[32]. The former Soviet Union's stress on early dispersal and evacuation was of course a cold war rationale, and it was estimated that the loss of life from a nuclear attack on an unprotected large city would be reduced by as much as 80% if early dispersal and evacuation were implemented. The size of the outlying areas for dispersal was defined according to worker commute time. With a 12-hour factory shift plan, it was decided that the round trip should not exceed a maximum of four to five hours, which meant the dispersal areas had a radius of some 60-80 kilometres. For the non-working population the evacuation plans were made according to their residency (the housing office), whereas for the rest their place of employment was the basis for evacuation plans. For the concept of evacuation, travel time to the former plant location was not relevant; thus, typically the areas for evacuation were even farther away from the cities than the dispersal areas.

Given the strategic importance and characteristics of the various industrial combinates in Murmansk Oblast, it seems reasonable to surmise that the dispersal concept was retained for a large proportion of the worker population. In the geographical context, circular dispersal clearly would be difficult for many of the cities in the Oblast given the narrow strip of road and railway, mainly running north south.

Combining the sections on possible scenarios, pathways and interventions we must stress once again that an emergency perspective have been chosen as the context of this report. The more slowly developing scenarios of radioactive pollution of the environment from various waste sites have thus not been given any weight, although they clearly represent important environmental problems. We would also stress that the emergency and short-term perspective has been taken for the description of various interventions. There has been no consideration of coping with life in a polluted environment for an extended period, but only focus on short-term strategies for the application of countermeasures.

To summarise one has very few easily available countermeasures applicable to the public. Given the findings from various disasters and trauma research, where perceived control is a key element, the importance must be stressed of developing further preparedness measures to enhance the perceived control among the public of adverse health effects. While evacuation as a countermeasure typically "should" be more centrally decided, our study demonstrates that probably all too many persons would decide on their own initiative to flee the scene— thereby exercising

[32] An illustration of the US appreciation is the fact that the US atomic energy commission in 1970 decided to support a translation of the Soviet Civil Defence Handbook (the translation was made by the US Oak Ridge Civil Defence Research Project). The translation was made in order to make the extent and character of the Soviet Union civil defence preparation better known, and also because: "no comparable handbook has been published by our own government" (p. i,)

illusory control— and this likely would result in a chaotic transport situation with its implicitly higher dose burdens. For this reason, information and education about effective and efficient self-measures should be a priority in emergency preparedness planning.

Chapter 12 Concerns and Risk Perceptions

Before presenting the results the major research hypothesis of this Part II of the current study will be briefly outlined:

1. It was anticipated that the economic hardship currently endured by the population would be the major concern of the respondents, whereas environmental issues including nuclear hazards, were expected not to be a major personal concern. This contrasts somewhat sharply with research findings in the Norwegian context, where quite a few respondents regard the nuclear threat from the Kola Peninsula as of both a personal and general concern (Tønnessen et.al, in prep).

2. There was no clear-cut hypothesis regarding the weighting of the various environmental hazards by the respondents. However, the regional differences found in Erik Hansen's 1992 study were expected to be somewhat replicated.

3. As explained in Chapter 9, some of the world's largest point-source SO_2 emitters are located in this region. Thus, it was expected that respondents living nearby such enormous polluters (e.g. Pechenga) would put particular stress on such hazards.

4. The respondents' knowledge and awareness, as far as the many nuclear installations of the region are concerned, was not subject to a particular specified hypothesis, but such risks were portrayed in a broad setting of 33 hazards to be evaluated both in a personal and a general perceived risk context. In addition, some indicators of the respondents' involvement in the issue of radiological emergencies were applied.

5. The most important hypothesis was related to reaction patterns in the population in radiological emergencies, as the respondents anticipated them to be. Because a large proportion of the population of the region previously in their life had exhibited a pattern of active coping[1] it was postulated that a larger population share would exhibit a tendency towards similar active

[1] Seeking work in a region with better compensation etc.

coping behaviour. Secondly, as "*travelling away*" in a radiological emergency may constitute an important part of such an active coping pattern, and as a major proportion of the population does not have "roots" in the region, the hypothesis was postulated of an increased tendency for "travelling away", as compared to the findings in the various reference material.

6. Based on the geographical localisation of the various nuclear installations in the region and the sample areas selected, it was expected that the anticipated travel pattern in a radiological emergency might show some scenario congruent characteristics. To investigate the possible effect of the localisation, the respondents were asked to consider a hypothetical radiological emergency in both a civilian, and a military context, and their travel preferences. More specifically, as Kolskaya AES is situated near the main road and railroad connection southbound, it was predicted that an emergency here could imply other preferences of methods of travelling different from those for an emergency situation at one of the military nuclear installations.

After the first three background information chapters, we now turn to the results of the present study where we first will present the findings as far as the respondents' daily worries are concerned. The results will be presented in the following manner; firstly the frequency distribution will be commented on and eventually compared to the various reference materials. Secondly, if the statistical analyses demonstrate main effect of background variables such as gender, age, education and sampling area, then these effects will be described. No main statistical effects described therefor imply that there is no major difference in these background variables for the current question (variable).

12.1 Personal and general concerns

The questions regarding the respondents' concerns were asked in an open ended format, but with precoded alternatives for the interviewers. The respondents were asked to give three responses about their personal concerns and three responses regarding their evaluation of concerns for the Russian population in general. The interviewers wrote down the three + three responses and used about 100 precoded alternatives to categorise the answers. The alternatives for coding were drawn up based on results from similar open questions asked in Norway in 1996. In addition, categories anticipated to be of importance were offered to the interviewers. The results of the open question will be given in this report by using the information from the pre-arranged codes. The results show that in the main the coding has

functioned satisfactorily, but as up to one fifth of the responses in some of the sample regions has been consigned to the "other answer" category, there clearly is potentially more information available. However, resources for recoding open ended questions unfortunately falls outside the possibilities of this project.

Given the format of three responses, one can report the total picture, what has been mentioned, and in addition, what is mentioned "first". The respondents were not asked to give their responses in any particular ranking, but a more or less reasonable assumption will be that the first mentioned worries are the most "prominent".

The some one hundred precoded alternatives offered to the interviewers for the categorisation of the problems have been merged into broader categories, and the distribution of the problems mentioned is shown in Table 12.1.

From Table 12.1, we can conclude that economical difficulties are the main worry for the respondents. It is also a clear result that economic difficulties at the personal level are the first mentioned problems. A more detailed look at the category shows that it is constituted of responses related to the respondents' personal economical situation, e.g. delayed wages, unemployment and also problems regarding overexpensive food. The last column "percentage of cases" can add up to more than 100 as some respondents may have referred to, for instance, three different kinds of economic problems.

Table 12.1 Personal Worries. Percentages

	First response	Second response	Third response	Of Responses	Of Cases
Dire financial straits (delayed wages)	56	30	17	34	76
General economic problems	9	6	4	6	17
Problems with health care /illness etc.	6	12	15	11	31
The situation for the elderly (pension etc)	8	8	5	7	20
Children's conditions and future	3	6	10	6	19
Government, leadership of the country	2	4	5	4	11
Violence and crime	2	7	6	5	15
Environmental protection/pollution	2	6	8	5	16
Radioactive pollution	0	1	1	1	2
Clean drinking water/food problems	1	1	3	2	5
Other answers	10	17	19	16	37
Missing response	1	2	7	3	7
Total	100	100	100	100	256

We can compare this picture to the issues cited as being of concern to the "people of Russia" in general.

Clearly, the dominant features of the worries attributed to this more general context are also economic worries at the individual level.

Looking at the differences between the frequencies in the general versus personal context, the issues more often mentioned in a general context are not surprisingly: leadership of the country and more general economic problems. More interestingly, violence and crime and also the environment/environmental protection issues are more often mentioned in the general context as more of a problem for the general Russian population than for the respondents themselves.

The concerns more typically raised in the personal context are health related issues (illness/problems with the health care system), children's future / upbringing and also "other answers".

There are indications of coding difficulties regarding the open-ended questions, in that the share of "other answers" is too high. For instance, one fifth of the third responses about personal worries are listed as "other answers" (Table 12.1) and should be considered too high a rate. It is not within the resources of the current project to further utilise the information written down in Russian in the questionnaires. However, there are other specific categories not reported here, and in the tables these are "pooled" together in the "other" category.

Table 12.2 Worries for the "general population". Percentages

	First response	Second response	Third response	Of Responses	Of Cases
Dire financial straits (delayed wages)	50	33	18	34	73
General economic problems	23	7	5	12	34
Problems with health care /illness etc.	1	5	8	4	13
The situation for the elderly (pension etc)	4	8	4	5	15
Children's conditions and future	0	1	4	2	6
Government, leadership of the country	11	13	15	13	36
Violence and crime	3	12	13	9	28
Environmental protection/pollution	2	9	12	7	23
Radioactive pollution	0	1	1	1	2
Clean drinking water/food problems	0	1	2	1	3
Other answers	4	7	11	8	20
Missing response	2	3	7	4	7
Total	100	100	100	100	260

It is quite striking from both the tables of personal and general concerns that foreign policy issues and conflict areas are nearly missing completely. Acting on a hunch and after media reporting of the enlargement of NATO, this item was included among the coding possibilities but was hardly mentioned by the respondents. All in all, 25 respondents mentioned the enlargement of NATO as a concern for the general Russian population (this compared to for instance 112 respondents who mentioned Tchetchenia); only three respondents mentioned NATO enlargement as a personal concern. One might expect that "other" foreign policy issues besides NATO enlargement would be mentioned as a concern for the general population, but only 26 respondents mentioned this as a concern for the Russian population in general. Clearly, the various internal domestic conflicts are of greater concern to the respondents than other conflicts of a more foreign policy character.

The proportion of respondents who mention health issues and concerns related to violence and crime is quite comparable to those found in Norway in 1996. Furthermore, the finding that health is generally seen as a personal worry and not so much a concern for the general population accords well with the Norwegian data set. The opposite pattern for violence and crime is found both on Kola and in Norway, i.e. violence and crime are more often mentioned by the respondents as a matter of concern for the general population.

Concerns expressed by the respondents seem to fit nicely into the conceptual framework of Abraham Maslow's motivation theory (Maslow 1954). Maslow proposed a theory of motivation in which he mapped out a hierarchy of needs that direct behaviour and require fulfilment. The need hierarchy ascends from the basic physiological needs (survival, food, drink, health); safety needs (clothing, shelter, protection); affection needs (family, a sense of belonging, companionship); esteem needs (self-respect, achievement, appreciation); to self-fulfilment needs (fulfilling one's potential). In Maslow's theory, needs at any given level must be at least partially satisfied before those at the next level become important determinants of action. Thus as more primary needs are threatened, it is likely that more hypothetical threats are not as present as motivational factors. When applying such an approach it must be remembered that radiological emergencies in a factual situation may indeed imply a threat to safety aspects of the physiological needs of hunger and thirst, one also may inquire whether the threat from radiological emergencies is mainly perceived as a threat to safety or to basic physiological needs when these are related to Maslow's Theory.

In his work with UK survey data Professor Robert M. Worcester has also placed expressions of environmental concerns into the perspective of Maslowian theory. Worcester explains the heightened level of environmental concern in UK at the end of the eighties as a result of economic growth or, in his own words: "Following Maslow and Inglehart, the economic boom years of the eighties shifted

attention from more basic values and needs to higher levels of concern for quality of life in most developed countries." (Worcester 1996, p.3). Given the fact that the expression of environmental concerns in Britain has levelled off quite strongly since a peak in July 1989 when more than one third of the respondents nominated green issues as the most important issue facing Britain, the linkage between economic growth and Maslowian higher order concerns should perhaps must be seen as a necessary but not sufficient criterion? For comparison, in 1996 well below 10% of UK respondents nominated green issues as most important, and more than one in five agreed with a statement that: "Too much fuss is made about the environment these days" thus giving a clear indication that green issues are "off the boil" in political terms. Although not directly comparable data are available, the RISKPERCOM data indicates that green issues are "off the boil" in the Norwegian context as well today. Professor Worcester regards the response to the open- ended "most important issue question" as a kind of zero-sum game. Worcester finds in the UK data an strong correlation between an economic optimism index and an expression of environmental concern: the more respondents believed that the state of the British economy would get better over the following 12 months, the more they mentioned green issues as important, while the issue of unemployment is mentioned more often when respondents reported a more gloomy outlook on economic development. The findings of Professor Worcester match quite closely the reported concerns on the respondents on Kola; given the current economic hardships being endured, it is little wonder that the economic issues maintain the top position of concerns.

With regard to the extent to which respondents experience a situation of unfulfilled basic needs, it was found that about one out of ten households may be termed poor (ref. Chapter 8, Part I). A concrete example of hardship related to foodstuff expenditure is the fact that about one in ten respondents have experienced not being able to afford to buy meat or fish once a month ore more often during the last year. The one-out-of-ten gross estimate concurs very much with the finding that about one in ten respondents are personally worried by the fact that food is too expensive. One may go on to argue that the population's calorie intake in a WHO/FAO sense has definitely been ensured, but then in Murmansk Oblast, as in other parts of the former Soviet Union, there used to be a very high per capita consumption of for instance meat; in other words a net deprivation is experienced compared to the earlier perhaps unhealthily high consumption pattern. On a macro level one may observe from official statistics that potato production has risen and that the per capita potato consumption is one of the very few food items showing an increase in consumption since 1992, the year of the "big bang" in economic reforms.

The findings document how education level (more now in a market economy than before) act as a buffer against economic hardships such as unemployment.

The segments of respondents experiencing less economic hardship are more apt to express concerns about the general environmental situation. Thus, we have an indirect indication that those more likely to be satisfied regarding basic needs will have surplus capacity to express their concerns about the environment, having dealt with the demands of daily life.

Engels' law can provide yet another theoretical framework for the understanding of respondents' adaptation to the economic hardships. It deals with the declining share of food in household expenditure as income rises, the same principle as described in the theory of inelastic demand coefficients in economics. Although Engels' Law is related to a situation of rising rather than falling income, it was nonetheless an early approach to understanding how households weight and adapt their demand for various goods representing expenditure[2]. Engels' Law could be hypothetically applied in a reverse manner for the current situation on the Kola Peninsula, i.e. as the respondents' income has been reduced, expenses for food will take an increased share of household expenditure. Put differently, the demand for basic foodstuffs is inelastic; thus, higher prices will imply slightly lower consumption yet an overall increase in expenditure on those basic foodstuffs. The Engel elasticity coefficient for food in Norway has been estimated from consumer surveys to be 0.28, i.e. if income is raised by one percentage point, expenditure on food increases by only 0.28 percent (SSB 1993). Put the other way around, if income decreases one percent, expenditure on food will only be reduced by 0.28 percent and hence becomes relatively more important with reduced income. In economics, an Engels-elasticity figure below 1 for a consumer category indicates that this is to be seen as what is termed prime necessity goods. Purely for illustrative purposes one may take the Engels elasticity coefficient for foodstuffs in the Norwegian context and apply it to the "big-bang" in the context of Russian reform. It is estimated that real wages in Russia were reduced to one third of the 1991 level by December 1992 (ref. Chapter 8, part I). If this estimate is generalised for pensions and other benefits, one may state that the total household expenditure had to be reduced by 67% from 1991 to December 1992. If one chooses to apply the Engels coefficient from the Norwegian context in a reverse manner the reduction in foodstuff expenditure could be modelled[3] as only amounting to 19% in the same period, and hence the *increase* in

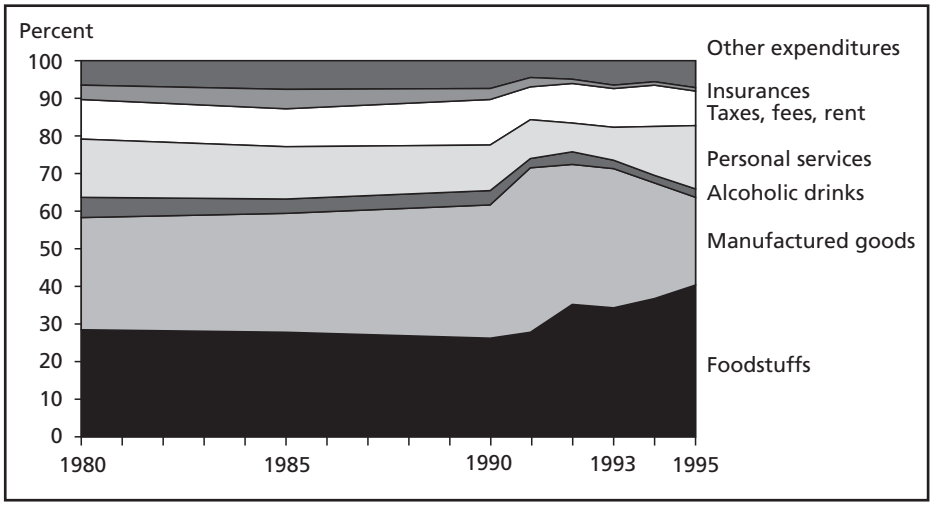
[2] Engel's Law was formulated in a paper published in 1857 by Ernst Engel (1821-96) the director of the Bureau of Statistics Prussia.

[3] Thus using in a "reversed manner" the parameter of 0,28 for basic foodstuffs in a Norwegian context of income increase.

the ratio of total household expenditure to foodstuff would be about 1.5 of the original share[4].

Leaving the theoretical domain for real life figures one also may note from the figure below how the proportion of income expenditure on foodstuff in reality has steadily increased in the Murmansk region. From a 28.5 percent of total income in 1980 to a staggering 40.3 percent in 1995. Thus in 1995 households were using an average of 40% more of their total income on foodstuffs, even though one knows from per capita consumption statistics that the consumption of many foodstuffs clearly has decreased.

Figure 12.1 Household expenditure on various types of goods in Murmansk Oblast, percentages



Source: Murmansk Regional Committee of State Statistics, 1996 (Osnovnoye pokazateli vyborochnogo obsledovaniya byudzhetov domashnykh khozyaystv v 1995 godu) p. 15

[4] One can illustrate these dramatic changes by using hypothetical figures. In a situation where foodstuff expenditure in 1991 took for instance 25 percent of household income, then by December 1992 that proportion would have increased some 37 percent points (1.46*25%=37%) yielding a total share of about 62% of total expenditure in the household. Furthermore, it is estimated that the real wages had grown to about 74 percent of pre-reform levels by 1995, given the same preconditions one could project the increase in the proportion of household expenditure by foodstuffs to about ¼ of the pre-reform foodstuff expenditure proportion, i.e. if 25 percent were used for foodstuff pre-reform this would have increased to 25+ (1/4*25%) = 31% of total expenditure. According to household survey performed among 250 families by the Murmansk Regional Committee of State Statistics in 1993 and 1994, food products in 1994 counted for some 35 percent of total family expenditure.

Environmental concerns in the open ended replies.

Across both the general and personal "worry" context about one third (34 %) of the respondents mention some kind of environmental concern. All in all, 715 respondents gave a total of 908 responses that are classified in the category of environmental concerns. The context in which the environmental concern is mentioned is most often very "general" as in "the environment"/environmental protection etc. The most frequently mentioned specific problem is air pollution. This distinction between responses making general non-specific mention of the environment and specific environmental problems raised can also clearly be seen in the French and Norwegian data sets from the RISKPERCOM study. However, summing up both the reported general and specific problems, the proportion of Kola respondents mentioning the environment is clearly lower than among French and Norwegians (Mays, Marris, Bonnefous and Brenot 1997; Tønnessen et al., in prep.)

Who reported environmental concerns?

A larger share of the respondents (55 %) in Pechenga mentions environmental problems than in the other sampling areas, while Kandalaksha and Apatity have the lowest proportions of respondents that mention environmental problems in the open ended questions. Within Murmansk City, there are some variations between the different city districts, with the October District showing more responses in the environmental concern category.

The majority of environmental concerns are framed in a very general context within the Pechenga sampling area as well, but of the more specific problems mentioned, pollution from melting furnaces or heavy industry, and air pollution are, not surprisingly, dominant.

There is also a tendency for younger respondents and also those with higher education to mention environmental issues more often. In addition there are indications that respondents that report environmental issues more often possess more domestic appliances and report less hardship from economic difficulties; all in all indications that respondents from higher socio-economical layers more frequently list environmental concerns. There are, however, no gender differences in the proportion of respondents mentioning environmental issues in the open-ended questions.

As mentioned in the beginning of this chapter, one hypothesis within the current project was that, regardless of the factual state of affairs concerning the environmental situation in these regions, the more pressing needs with respect to employment, wages/daily requirements etc. would be concerns of a "higher" priority for the respondents. The results from the open-ended questions support this hypothesis, as economic difficulties represent the respondent's main response to

present concerns. The tendency for respondents with indications of a better economic standing to mention environmental issues more often may also indirectly support this hypothesis.

Radiological concerns in the open ended replies

The more specific question of radioactive pollution was mentioned in one form or another by 86 respondents (around 4%) across both the general and personal contexts. The responses related to the issue of radioactive pollution can be roughly divided in three issues; the perceived threat from the Nuclear Power Plant in Poliarny Zory, the perceived nuclear threat from Military installations and "other issues" concerning radioactivity / nuclear installations, the latter option of "other"[5] being most often used. There are about as many respondents who mention radioactive pollution issues both in the general and the personal context; the overlap between these contexts is fairly small, about 16 %.

The proportion of respondents mentioning these issues is in quite strong contrast to that found in the Norwegian population in 1996 where some 14 percent of the respondents mention "nuclear accident issues" as a personal worry, and even higher, around 21 percent mentioned nuclear accident issues as a concern for the Norwegian population in general. However, these figures from Norway are very high compared to the proportion of respondents who have mentioned these issues in the other European countries[6] participating in RISKPERCOM (Sjöberg et.al. in prep.)

Who reported radiological concerns?

As the cell size is quite small (around 4%), further crosstabulation must be done with great caution. Nevertheless some connections to background variables can be seen. The gender distribution is quite even among the few who mention radioactivity concerns as a personal worry, whereas more men mention radioactivity in the general context. There is no clear-cut effect of age, but the age group with the highest proportion of reference to radioactivity is found in the 40-49 segment. There is also a slight tendency for respondents with higher education to mention radioactivity threats as a personal worry, but the same does not hold for radioactivity concerns mentioned in the general context. When it comes to the sampling area there is a

[5] A further analysis into the other coding category seems to indicate that a fair share of other replies are related to respondents who have mentioned both civilian an military installations (Tønnessen et al., in prep.).

[6] France, Spain, UK, Sweden

tendency for a lower proportion of respondents in Apatity and Kandalaksha to mention these issues.

In summary, economic difficulties are totally dominating the response first given in both the personal and general context, while other issues are more pregnant among the worries last mentioned. Issues such as: problems in the health care system, leadership of the government, violence and crime, the future for children and adolescents, and also environmental protection /environmental problems typically have a higher share of the "last mentioned" response. About one third of the respondents have mentioned some kind of environmental concern across both the general and personal context, while radiological concerns are mentioned by only a very small fraction of respondents (4%).

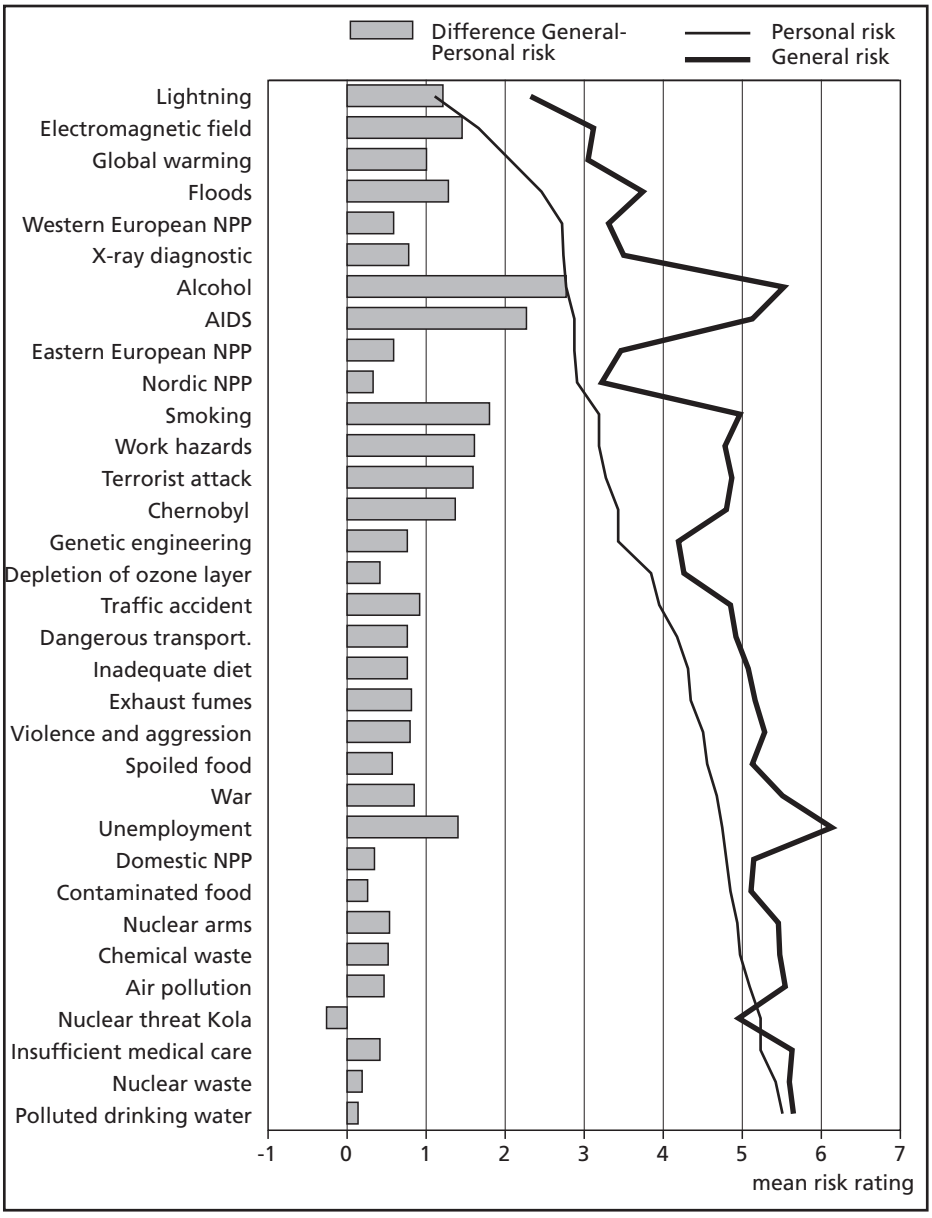
In conclusion, the hardships endured by the population during the difficult "market economy" transition are clearly reflected in concerns expressed by the respondents. One may say that the overall general economic difficulties override other possible concerns. Furthermore, it is reasonable to assume that the recent dramatic developments in the grave economical crises in Russia have further accentuated this. A region like Murmansk Oblast with its heavy dependence on supplies from the central government is especially vulnerable to such a situation. An indication of the seriousness of the current situation in the Oblast is the request from Governor Jedakimov in September 1998 to counties in neighbouring countries for relief aid in the form of food and clothing for the orphanages in the Oblast.

12.2 Risk Scale Evaluation

The respondents were asked to rate the personal and general risk for 33 risks. The risk rating questions have been adopted from the above mentioned European research project RISKPERCOM. The hazards listed ranged from those related to an individual respondent's behaviour such as smoking, alcohol and inadequate diet, to different pollution concerns e.g. air pollution, chemical waste, polluted drinking water, global warming, depletion of the ozone layer and also more specific radiation threats for example Western nuclear power plants, domestic nuclear power plants, radioactive waste, and "the nuclear threat from the Kola Peninsula". These items with personal and general risk ratings fall well within the psychometric tradition of studying risk perception employed in several different countries (Slovic et al. 1980).

The respondents were asked to rate the 33 risks in a general and personal context, and to evaluate each risk on an eight point scale from non-existent (zero) to very great (seven). The mean ratings are shown in figure 12.2.

Figure 12.2 Mean ratings of personal and general risks rated on an 8-point scale from 0 = non-existent risk to 7 = very great risk. Risk items sorted by ascending means of personal risk ratings



From the figure we see that polluted drinking water, nuclear waste, insufficient medical care, the nuclear threat on the Kola Peninsula and air pollution are the five risks with the highest mean personal risk rating. Lightning, electromagnetic field, global warming, floods and western European nuclear power plants are the 5 risks with the lowest mean rating.

The differences between the general and personal mean risk ratings are illustrated by the bars in the figure. These differences are often termed optimistic bias in risk perception research, or third person effect in mass media research, and may be seen as an effect of the framing thought: *it will not happen to me*. Some of the risks with the largest optimistic bias such as alcohol, AIDS and smoking are items related to respondents' individual behaviour and are differences found also in Norway (Tønnessen et al., in prep.) and other European countries (Mays et al. 1997). One may conclude that across at least these European cultures risk related to the respondents' own behaviour e.g. smoking, drinking and risky sexual behaviour, is higher for everyone else than for the respondents themselves.

Terrorist attacks and lightning are items that stand out with regards to an optimistic bias finding in the current material compared to results in other countries. Our meteorological knowledge about lightning frequency in this district compared to other parts of Russia is limited, but in other countries, personal and general risk ratings for lightning are usually low and quite comparable, while on Kola there is quite a marked difference, with the general population being seen to be at a higher risk. Perhaps more interesting, terrorist attacks are clearly seen as more risky for the Russian population in general than for the respondents on the Kola Peninsula.

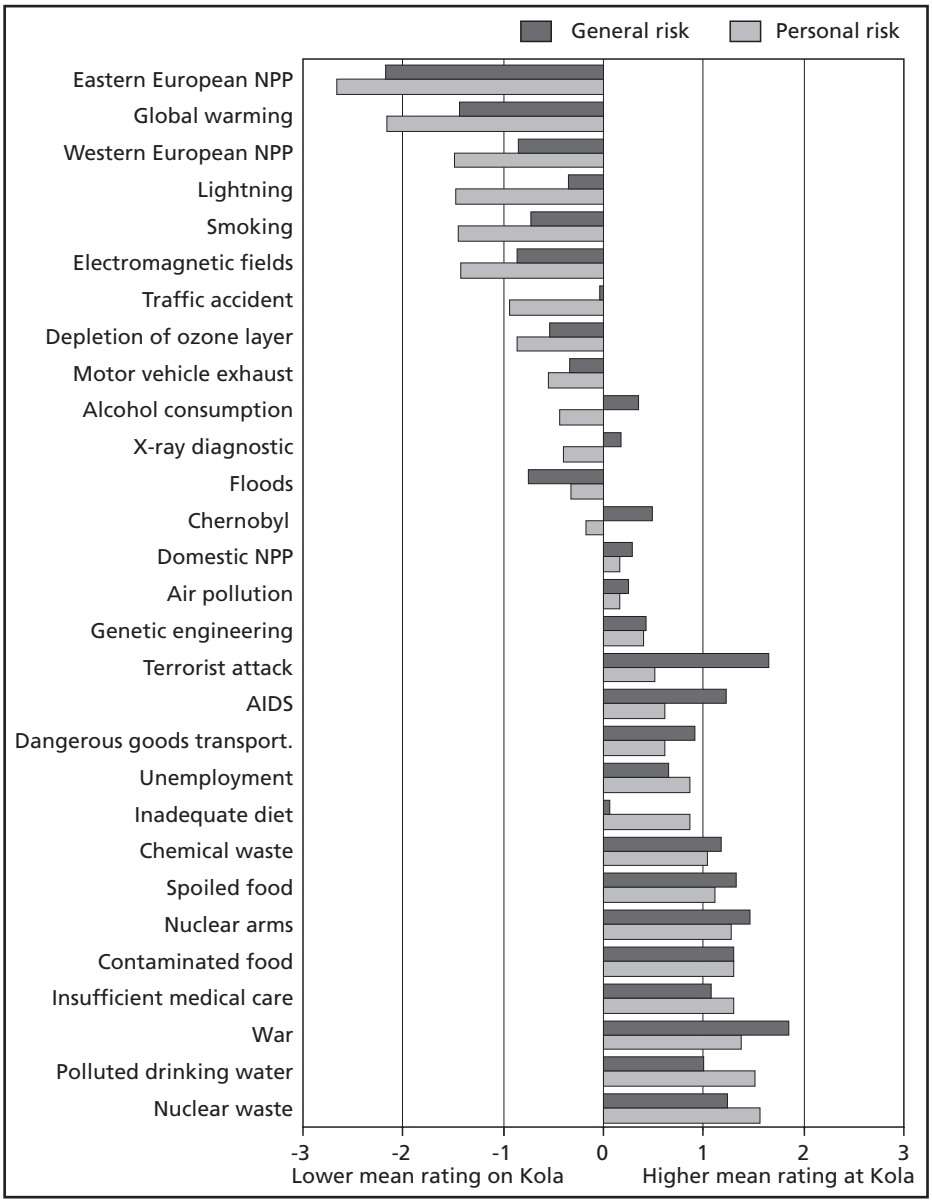
The risk with the highest non-response was genetic engineering, an item that about one third of the respondents did not know how to evaluate. In addition, the rating of the risks related to nuclear power plants located in the Nordic countries, and nuclear power plants in *Eastern Europe*, as well the environmental issues of global warming and depletion of the ozone layer, had a high share of *don't knows*.

Differences in risk ratings between Kola and Norway are illustrated by the bars in figure 12.3, where risk items are sorted in ascending value of the difference in mean personal risk rating.

Before addressing the specific differences between the data sets it should be generally noted that the scale use among Kola respondents are somewhat different than what was observed in Norway. Firstly the average of the mean ratings across all of the 33 risk items are as much as 1,3 scale units higher on Kola for the general risk context and some one scale point higher for the personal risk context. Thus, generally the 33 risks are rated somewhat more risky among Kola respondents than in Norway. However, an overall elevated mean is an all to simplistic description of the differences in scale use. For instance, the mean personal risk rating of lightning among Kola respondents are 0.6 scale units lower than the lowest personal mean

rating to any risk item in Norway (the lowest mean personal risk rating in Norway is also lightning). This illustrates that comparisons of ratings also may have to take greater variability in scale use in different cultures into considerations. One way around this is to make z-score transformations within each respondents response over all the 33 risks. It is interesting to note that the style of scale use among Kola

Figure 12.3 Differences in mean risk ratings: Kola Penninsula - Norway



respondents in many ways seems to be more similar to what is found among respondents in Southern Europe (e.g. France and Spain (Mays et al. 1997, Prades et al. 1997)), than to that of respondents in Norway (Tønnessen et al., in prep), Sweden (Sjöberg et al., in press) or U.K. (Frewer et al. 1997)[7].

The one risk item with clearly the most different mean rating in personal risk is the mean risk rating for Eastern European nuclear power plants. While these have quite high risk ratings in Norway, the response is quite different among respondents on Kola. It is, however not totally clear how the respondents interpreted the concept of "Easter European" and how nuclear power plants on the territory of the former Soviet Union are categorised. As a concrete example, is Ignalina (former SUS) seen as some kind remnant of Soviet-era, easily seen as part of the domestic nuclear power plant term, and thus not seen as Eastern European? Nuclear power plants in Western Europe also have much lower mean personal risk ratings than those found among respondents in Norway; the same is also valid for the currently much debated environmental issues of global warming and depletion of the ozone layer.

Not surprisingly, domestic nuclear power plants have higher risk ratings among the respondents on Kola, than in Norway, but of course few of the respondents in the Norwegian population are aware of the nuclear research reactor activity in Halden, and so this item is not easily comparable across the two countries. Mean risk ratings for items related to traffic accidents and electromagnetic fields from overhead power lines are also lower while war, polluted drinking water, nuclear arms and nuclear waste are items with much higher mean ratings among respondents on Kola.

Regional differences in mean Personal risk ratings

Looking at the means for personal risk in different sampling areas there are some quite clear differences; the means will be briefly listed within each area. In Murmansk, the mean risk from nuclear waste is highest, followed by polluted drinking water and the nuclear threat on the Kola Peninsula. The quite high risk rating of drinking water is in well accordance to findings in a recent study made by Barlindhaug A/S, a Norwegian Consultant company that has made a project investigating drinking water quality on the Kola Peninsula. The project raises concern about the release from the large poultry farms into the Kola river watercourse in the proximity of drinking water inlet to Murmansk City (Fossum 1998). The mean personal risk rating for nuclear arms is also high in Murmansk comparative to the other areas.

[7] Comparing the patterns of mean variance across risk rating variables, the RISKPERCOM material may be divided into two categories, on that consist of France & Spain and the other of Sweden, UK and Norway. The pattern of mean variance in variables in the Kola material clearly reassembles that of the France & Spain category.

Quite naturally, Murmansk as a large city also has slightly higher mean ratings for exhaust fumes from motor vehicles.

In Pechenga the risk from *air pollution* has the clearly highest mean, and the mean rating is above those observed in the other areas. This is quite a common sense finding when seen in the context of the large emissions from the Nikel smelter. Second in the mean ratings is *polluted drinking water*, followed by *inadequate medical care*, and then as the forth-highest mean is the personal risk of *unemployment*. As the first "nuclear" item to follow in the mean ranking in Pechenga is *nuclear waste* the issues of radiological threat are thereby lower in risk ratings in Pechenga compared to the other areas.

In Apatity, the mean personal risk from *polluted drinking water* is at a quite much higher level than what was observed in the other areas. Unfortunately, our research group currently does not have enough background information to evaluate whether Apatity in particular has more well known problem with the quality of its drinking water. According to the before mentioned Barlindhaug A/S project, Apatity has a waterworks of quite good technical standard. However, one problem reported to Barlindhaug in Apatity was related to rumours connected to the release of cooling water from Kolskaya AES. The Apatity waterworks has a very long supply piping to its intake in lake Imandra, and there was reported to Barlindhaug about local rumours connecting the water inlet of the waterworks to releases of cooling water from the Kolskaya AES (Fossum 1998). If such rumours had any influence on the elevated ratings of personal risk from drinking water in Apatity is not for anyone to conclude. However, as local kids can be seen going for a dip in the cooling water from Kolskaya with it's elevated temperature levels, clearly widespread fear of the release from the spillwater seems unlikely.

Second on the list in Apatity, are problems of inadequate health care, followed by the *nuclear threat on the Kola Peninsula,* followed by *air pollution*. *Radioactive waste* has a comparatively lower mean rating in Apatity. Somewhat surprisingly, the risk from *violence and aggression* is slightly higher in Apatity than the observed level in the much larger city of Murmansk.

In Kandalaksha *inadequate medical care* has the clearly highest mean personal risk rating, followed by the *nuclear threat here on the Kola Peninsula* and *polluted drinking water* with equal means.

Gender differences in personal risk ratings

Both at the general and personal levels for risk ratings: inadequate dietary habits, the threat of war, air pollution, radioactive fallout from the Chernobyl accident, food contaminated with radioactivity, and radioactive waste have higher mean risk ratings among female than male respondents.

Dangerous circumstances in the work place is an interesting hazard when related to gender differences as this item has a clear gender difference for personal but not for general risk. One interpretation of this may be that male respondents clearly see their work place as exposing them to a higher degree of risk than do the female respondents. Looking further into the male respondents replies that their work place exposes them to a higher degree of personal risk one can note a clear tendency for male respondents working in the industrial category termed "heavy industry/mining" (ref. Part I Chapter 7 (section 7.5)) to have the highest mean risk rating related to dangerous conditions in the work place. As an outside observer of the harsh conditions of the labour force in the heavy industry/mining combinates one may not see this finding as surprising, but this finding confirms that also the work force experiences their working conditions as exposing them to risks.

Risk rating response to the item of unemployment exhibits quite an opposite pattern, where female respondents have a higher mean rating for this risk at the general level, i.e. female respondents see unemployment as a greater risk for the Russian population in general than do the male respondents. This finding is well in agreement with the unemployment figures previously detailed in this report (ref. Part I, section 7.2), i.e. the unemployment figures observed are higher among male than female respondents.

The statistical analysis shows some main effects due to the respondents' age as far as personal risk ratings are concerned. The more obvious of these differences is the risk of unemployment, which accords well with the fact documented earlier in this report that the actual unemployment rates in the younger segments are higher as are also the ratings of personal risk of unemployment in the same segments. The personal risk of dangerous working conditions, of getting AIDS, smoking, and alcohol also show higher risk ratings among the younger respondents, but only for the personal and not for the general risk ratings.

Risk ratings to the nuclear risk items

Among the 10 risk-items with the highest mean personal risk rating there are found four nuclear risk items. The items of nuclear waste, and the nuclear threat on the Kola Peninsula have the highest mean personal risk of the nuclear risks mentioned. In addition, these risks have also a high mean general risk. A common-sense finding is that the nuclear installations on the Kola Peninsula is seen as more risky to the respondents (higher mean personal risk), than to the general population of the Russian Federation. Another reasonable finding is that there seems to be awareness in the region that radioactive fallout from the accident in Chornobel is a higher risk to the general population in Russia than to the respondents on the Kola Peninsula.

A finding well in accordance with the low levels of radioactive fallout from the Chornobel accident in this region, compared to the regions more severely affected.

The risk ratings towards domestic Nuclear Power Plants (NPP) only comes forth of the nuclear risk items, with a considerable lower mean personal risk than that of nuclear waste, but comparisons can also be made between the four NPP risk items. Such an approach implies to look into the differences in mean risk ratings to the items of Western European NPP, Eastern European NPP and domestic NPP. The risk ratings to domestic NPP are clearly higher than the mean ratings to NPP in other countries. Furthermore, the mean risk ratings of Western European NPP are even lower than that of x-ray diagnostics. A more negative evaluation of the domestic NPP than foreign NPP is not so exceptional, as the Spanish partner in RISKPERCOM (Prades et al. 1997, p. 8) also found this, but the magnitude of the more negative evaluations of domestic NPP is striking. To conclude, comparing the ratings toward the various NPPs documents relative distrust in the safety of domestic Nuclear Power Plants (NPP) among Kola respondents.

In summary, quite a different picture emerges from the mean risk scale evaluation than from the open ended "worry" questions of the previous sections, in terms of the issues made salient. One clear exception is the issue of unemployment: many mentioned this both as a personal and general concern, and the mean rating for the risk of unemployment in the Russian population in general is clearly the highest of all evaluations. Differences in what is mentioned as personal or general worries together with the mean risk ratings can be parsimoniously explained by the fact that hazards perceived as risky and mentioned in the open ended questions are simply not present in the long list of hazards proposed for these closed ratings (Mays et al. 1997). However, a more intriguing finding is that alcohol consumption actually receives the sixth highest mean general risk rating, whereas only about one percent mentioned the same issue as a worry for the Russian population in general in the open ended items. The same pattern, with quite a high mean risk rating for the Russian population in general but nearly no mention in open ended general concern, holds also for AIDS.

As regards the mean personal risk, the various environmental hazards receive much more attention in this response mode than in the open-ended section. Of the more conventional environmental issues, those of polluted drinking water, air pollution and chemical waste all receive a high mean personal risk rating. Among the more conspicuous issues of nuclear threats, the radiological hazards of nuclear waste, the nuclear threat on the Kola Peninsula and nuclear arms are all among the seven items with the highest mean personal risk ratings. To conclude, there must be important methodological challenges when it comes to which aspects of "worry" are embraced by the risk ratings as compared to open ended worry items. Judging from

the mean personal risk ratings, clearly both conventional environmental issues and radiological threats are seen as important by many respondents.

12.3 Risk perception from various industrial installations

To get a more detailed picture of the perceived risk from various industrial activities we chose to apply an item from Eurobarometer regarding the threat from different industrial installations for those living nearby. The original Eurobarometer item was used in Eurobarometer 17,22 and 26. In the original Eurobarometer question, the respondents were asked to select three out of ten different industrial installations that posed the greatest risk for those living nearby. Of the original ten items used in Eurobarometer, one, namely "furniture manufacturing", was dropped, and the more relevant items of a metallurgical factory and mine operations were instead introduced. One of the 11 industrial installations the respondents could choose from was a nuclear power plant. They were asked to choose three alternatives out of eleven industrial installations that in their opinion exposed those living nearby to the greatest risk. In general, the interviewers and the respondents managed to comply with this and an average of 2.99 responses were made. As the final list included one item more than in Eurobarometer, an average of "lower" percentages may be expected. The frequency distribution of percentages of respondents choosing an installation is shown in table 12.3 compared to a "grand total European mean".

The proportions are quite similar across respondents on Kola and the other European respondents. The only item with a marked difference is that of an explosive factory. For a chemical factory, there is a tendency for a smaller proportion among the Kola respondents to see these installations as posing a risk for those living nearby. The proportion of respondents selecting a Nuclear power plant is quite similar across different cultural settings. In the last Eurobarometer survey (autumn 1986), the proportion was more identical (i.e. 77%) but as this was only half a year after the Chernobyl accident, we chose here to use an arithmetic mean between the EB surveys performed before and after Chernobyl.

We also see that of the two extra items included, clearly the metallurgic factory is seen as the more important risk. Looking into what is more or less frequently mentioned in the various sampling areas, some of the patterns seen in previous sections again appear. Again respondents in Pechenga distinguish themselves: nearly 80 % of them, twice as many as in Murmansk, have mentioned the risk that a

metallurgical factory poses for those living nearby. In addition, respondents in Pechenga mention more often the risk of living near a mine. In Apatity, more respondents mention the risk of living near a chemical factory. The risk of living near a nuclear power plant is mentioned by quite a few in all the sampling areas, although about 10 percent points more did so in Kandalaksha, the city closest in air distance to Kolskaya AES. This expression of a greater risk from living near a nuclear power plant in the area closest to Kolskaya AES is also slightly evident in the mean personal risk ratings for nuclear power in Russia, where again Kandalaksha has the highest mean risk ratings of the sampling areas, and Pechenga, the sampling area farthest away from Kolskaya AES, shows the lowest observed mean. However, the differences observed in mean risk ratings mentioned here are of only a minor magnitude.

The statistical analysis shows that male respondents with higher educational levels in the Kola sample typically mention a nuclear power plant less often, whereas this effect is hardly detectable among female respondents (e.g. a gender by education interaction effect is observed). In contrast, this gender by education effect was not observed among the Eurobarometer respondents.

For the purposes of looking into some of the typically feared consequences of an NPP a Eurobarometer item regarding increased cancer risk damage to offspring was used.

Table 12.3 "Risk of living nearby various industrial installations" Percentages based on cases/respondents:

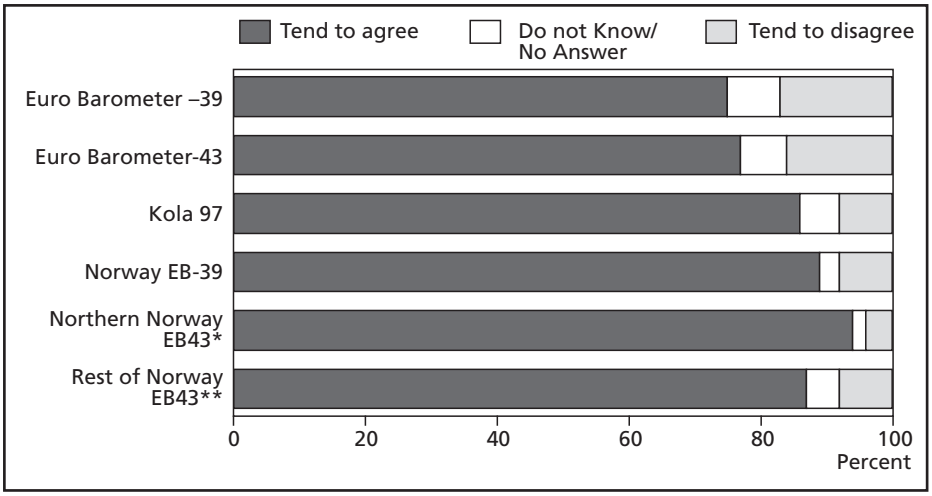
The risk of living near:	Kola 97	"European mean" 84/86
Oil refinery	20	23
Coal plant	6	9
Airport	16	12
Food factory	2	1
Nuclear power station	79	73
Chemical factory	63	78
Explosives factory	32	64
Natural gas factory	6	11
Hydroelectric power dam	3	1
Metallurgic factory	45	
Mining enterprise	27	

The finding from figure 12.4 is that respondents both on Kola and in Norway, compared to the response in the other European samples, agree to a larger extent that the risk of such adverse consequences is increased by proximity to a plant.

As far as agreement with an increased risk of such health effects is concerned, the same gender differences, although not of equal magnitude, were observed both in the Kola, Norwegian and European samples: a larger proportion of female respondents tend to see an increased risk of such adverse health effects for those living near a nuclear power plant.

To summarise the section concerning risk perception from different industrial installations one may state that a nuclear power plant as an industrial activity is perceived among Kola respondents to pose a risk for those living nearby in nearly the same proportions as among respondents across a wider European sample. When it comes to the perceived risk of adverse health effects, such as cancer and birth defects, the respondents on Kola and in Norway are more similar than what was seen in the general European response. Only about one in twelve respondents on Kola and in Norway disagree with the statement that living near an NPP increases the risk of such adverse health effects.

Figure 12.4 Percentages of respondents agreeing or disagreeing with the statement "Living near a Nuclear Power Plant increases the risk of cancer and having abnormal children"



* The counties of Finnmark, Troms and Nordland
**Norway except the three northernmost counties of Northern-Norway

Chapter 13 Attitudes to Environmental Problems

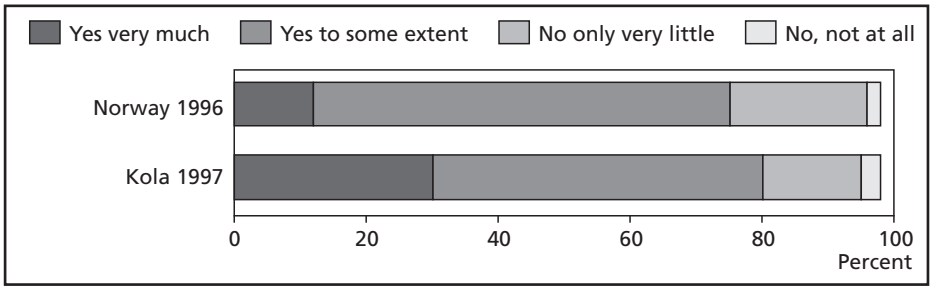
13.1 General environmental attitude issues

The respondents were asked three general attitude questions regarding their perception of environmental issues: 1) about their interest in the issue; 2) to what extent they do anything actively to protect the environment and 3) an evaluation of the tendency in development of the global environment. The three items are the same as were asked in five European countries including Norway in the RISKPERCOM project (cf. Appendix).

Figure 13.1 illustrates that in Norway the expression of interest, and more particularly *strong* interest in environmental issues is much less than on Kola.

In fact, the interest expressed in environmental issues on Kola is much more similar to the response from other European countries in the RISKPERCOM project; for instance in France some 43 percent of respondents stated that they were very much interested in these issues (Mays et al. 1997). The observation that interest in general environmental issues is lower in Norway than in other European countries is in strong contrast to the interest and attention expressed elsewhere by the Norwegian population in the same questionnaire in radiological emergencies (Tønnessen et al. forthcoming).

Figure 13.1 Frequency distributions in response to the question: "Are you interested in environmental issues?"



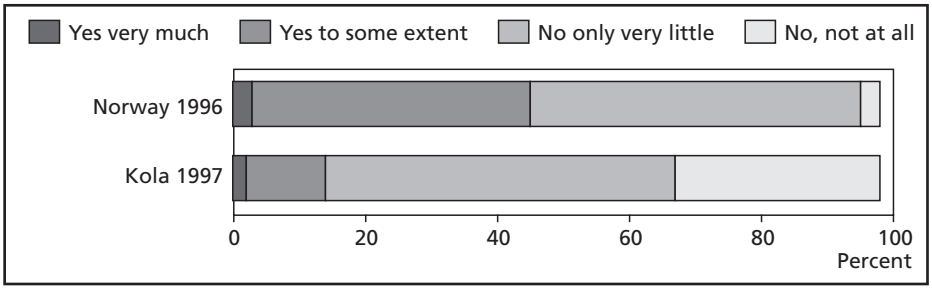
Thebars do not reach the 100 % level because the answer Don't know and those that refused to answer is not shown. This is the case in all the charts in the following chapters, except where the category Do not know/No answer is shown.

Even though a larger proportion of the respondents on Kola express an interest in these issues than in the Norwegian sample, this does not imply that a larger proportion than in Norway state they act in order to preserve the environment. From figure 13.2 one may conclude that a larger proportion of the respondents in Norway feel that they actively do something in order to protect the environment.

Of course, we do not know exactly what the Norwegian respondents have in mind, but maybe the more widespread use of different household waste recycling methods is an explanation for the observed difference. Put a bit differently, there may not be many environmentally friendly actions available for an ordinary consumer in the Murmansk region, whereas respondents in Norway can choose "green" products for consumption (for instance with the Swan[1] label), and also demonstrate concern for the environment by recycling different household items such as batteries, paper, milk containers, etc. These may have been the kind of actions that the Norwegian respondents had in mind when answering 'yes, to some extent'. There is a tendency in the Kola data set for respondents with higher levels of education to reply to a larger extent that they do something actively to preserve the environment. Looking closer into the differences, this is mainly due to the fact that respondents with higher education more often report "*doing only very little*" whereas those with lower education are more apt to use the response alternative "*doing nothing at all*".

Both among respondents on the Kola Peninsula and in Norway, there is a correlation between the interest expressed in environmental issues and the respondents' own actions for the preservation of the environment. Whereas about seven out of ten Norwegian respondents expressing great interest in environmental issues either

Figure 13.2 Frequency distributions in response to the question: "Do you act so as to preserve and protect the environment?"



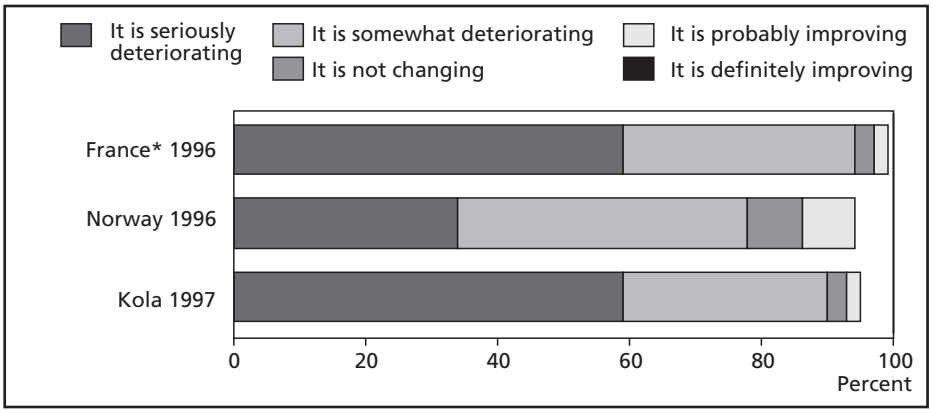
[1] The Swan label is a Nordic eco-labelling scheme, which uses a swan as its symbol. The label was established as a result of an initiative taken by the Nordic Council of Ministers in 1989, and is the first international scheme of its type in the world. As of April 1996, labelling criteria have been drawn up for about 40 product groups and almost 300 products have been licensed to use the label. In addition to Norway, Sweden, Finland and Iceland are taking part in the project

acted in this direction to a very large or fairly large extent, only about two out of ten "very interested" respondents in Murmansk acted to a very large or fairly large extent. Perhaps more puzzling is the observation that one out of four "very interested" respondents reported doing nothing at all themselves in order to protect the environment. Possible explanations for this may be found in the lack of available alternatives for action, or in the economic hardship endured.

Investigating the respondents' judgement of the trend in the development of the global environment, the respondents on Kola clearly express more concern for the current global situation, as can be seen from figure 13.3. When their scores are cross-tabulated with interest in environmental issues, about four out of ten respondents with a perception of a "seriously deteriorating" global environment express a very high degree of interest in environmental issues, and this is a stronger correspondence than in the Norwegian material. That this is a more pessimistic outlook on the situation may be an important factor behind the interest expressed in environmental issues. An alternative explanation could be that the respondents were not really answering about the global situation, but that the many environmental problems seen locally in their own region were affecting their response, even to the global outlook question. To indicate that this is not necessarily so, the frequency distribution to the same item in the French data set of RISKPERCOM has been incorporated into the figure, since this shows a remarkably similar response pattern. The French data are for the French population in general and hence indicate that an urgent local environmental situation does not necessarily influence the response of the respondents on the Kola Peninsula.

The respondents were further asked whether they perceived the current environmental situation as a threat to their own and their families' health. The reported

Figure 13.3 Frequency distributions in response to the question: "What is your opinion about the state of the global environment?"



* Data kindly provided by Jean Brenot, French Coordinator RISKPERCOM (IPSN)

level of health concerns related to environmental degradation is pronounced, and range around 80 per cent affirmative. However, this question was asked in an agree/disagree manner, and this may have caused an upward bias in the response.

Not surprisingly, the respondents who perceive the current environmental situation as a health threat also to a larger extent see the global environment as generally deteriorating. There is also a slight tendency for female respondents to a larger degree to experience the environmental situation as threat to their own or their families' health. There is no particular observed effect from having small children in the household on the perceived environmental health threat. However, the results show an obvious ceiling effect, i.e. with such a large majority agreeing with the statement it is difficult to detect group differences.

As far as the section about general environmental attitudes is concerned, one can summarise by stating that the respondents on Kola express quite a high level of interest in environmental issues, and some six out of ten perceive the global environmental situation to be seriously deteriorating. This proportion is quite similar to the response in France and Spain in the RISKPERCOM data set. As many as eight out of ten respondents on Kola perceive the current environmental situation as a health threat to themselves or their families, but quite few report doing something actively for the environment. This low practical involvement may be related to the few options available or possible, for environmental friendly consumer behaviour.

13.2 Regional differences in the weighting of different environmental issues

In order to investigate the relative weight the respondents attach to different environmental problems some further items were asked. The respondents were asked to agree or disagree with the statement: "In our *country* the risks of radioactive pollution is less than the risk of chemical pollution" , and also to agree or disagree whether; "In our *Oblast* other environmental problems (for instance air pollution) are more serious than the radioactive threat". Finally, the respondents were asked whether foreign authorities in their efforts to contribute to an improvement in the environmental conditions should give priority to radioactive pollution or to other environmental problems.

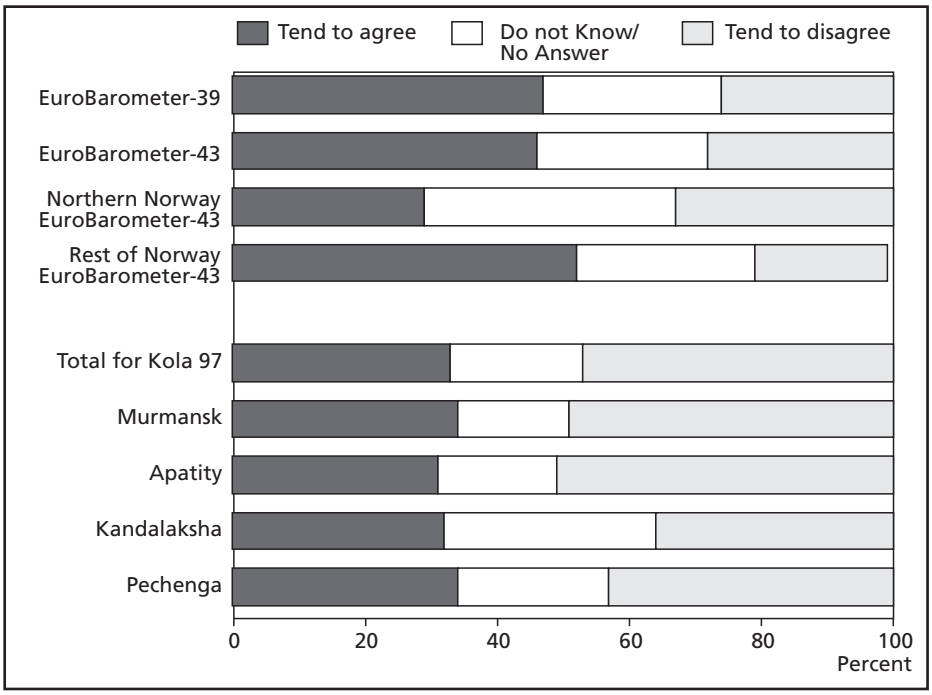
Generally, we see from figure 13.4 that respondents on the Kola Peninsula tend to disagree with the statement when considering Russia as a whole, i.e. the risk of pollution in the form of radioactive contamination is *not* perceived as lower than

the risk of chemical pollution. We also observe that the general problem with this type of difficult item with a "double negative" is reflected in the high share of "don't know" / "no answer". It is also quite important to note that the proportion of 'missing' is comparable to or less than the 'missing' levels in the Eurobarometer data sets. It is also quite interesting to note that among both respondents in Northern Norway and on Kola, the majority disagrees. Clearly the responses from respondents in Northern Norway are more similar those from respondents on Kola, than those from respondents in "the rest of Norway".

We also asked an item framed in a more local context, i.e. if the respondents agreed or disagree with a statement that: "in our *Oblast* other environmental problems (for instance air pollution) are much more serious than the radioactive threat".

The responses to this item are somewhat difficult to interpret, although the largest share of respondents agreed with the statement. On the one hand, Murmansk City and Kandalaksha are those sampling areas where most disagree with the statement. On the other hand, in Pechenga other environmental problems are clearly a

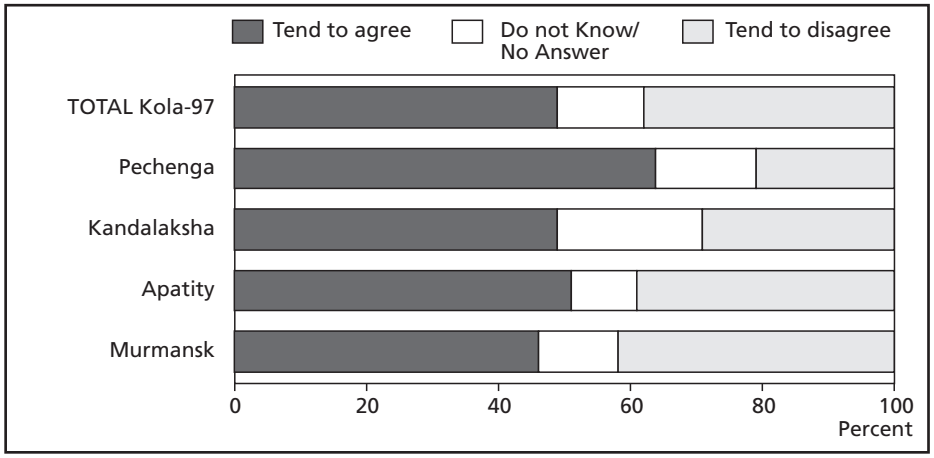
Figure 13.4 Percentages of respondents agreeing or disagreeing with the statement: In our *country* the risks of radioactive contamination are lower than the risks of chemical pollution



greater concern than radioactivity, thus again the same finding as in other sections, the perception of risk from the conventional environmental problems are elevated in Pechenga as compared to the other sampling areas.

When looking into more subtle differences a small difference was observed between different districts in Murmansk City. It is interesting to note that a larger proportion in Leninsky District[2], the northernmost city district in Murmansk City[3], disagree with the statement; so for them the problem of radioactive pollution is evidently a more pronounced concern.

Figure 13.5 Frequency distribution agreeing/disagreeing with the statement: "In our *Oblast*, the threat from other environmental problems (for instance air pollution) is much more serious than the risk from radioactive pollution?"



[2] In the Leninsky district of Murmansk City: 43% agrees, 45% disagrees with the statement, 12% replied do not know / no answer.

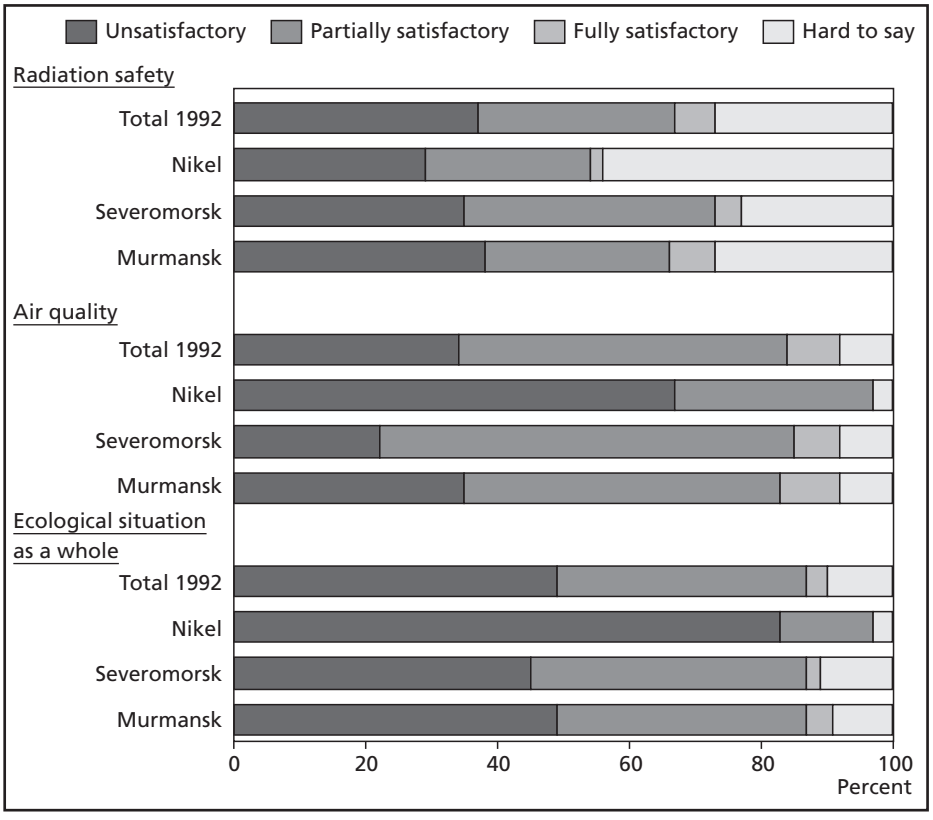
[3] Murmansk City in geographical terms stretches in a quite long and narrow manner along the Kola Fjord. The city district to the south is "The First of May" District, October District is in the middle while Lenin District is to the north. Furthermore, as described in some detail in chapter 10 both the Northern Fleet and the Murmansk Shipping Company have bases very close to the northern outskirts of Murmansk City. The part of Leninsky District close to the Northern Fleet base is named Rosta. Many of those working at Naval Yard 35, often named Sevmorput, live in Rosta. (The base facility named Sevmorput must not be mixed up with the M.S.Co. nuclear powered cargo ship with icebreaking capabilities identically named Sevmorput).

13.3 Regional differences in environmental concerns in the 1992 survey

To further enhance the investigation into the weighting of different environmental concerns in the different regions of the Peninsula cand.polit Erik Hansen has kindly made available to us unpublished data from the 1992 survey. The respondents were asked about their general evaluation of different aspects of the ecological situation.

Figure 13.6 illustrates how respondents in the Nikel sampling area in 1992 had a very distinct negative perception of their own ecological situation, and in addition regarded aspects of the ecological situation other than radiation safety as their major concern. The distinct perception of the Nikel respondents is also illustrated by the low percentage of "hard to say" response. It is also interesting to note that quite a large share of the respondents in the 1992 survey found it hard to evaluate the radiation safety aspects of the ecological situation. Although respondents in the

Figure 13.6 The 1192 data of general evaluation of different aspect of the ecological situation in the different sampling areas



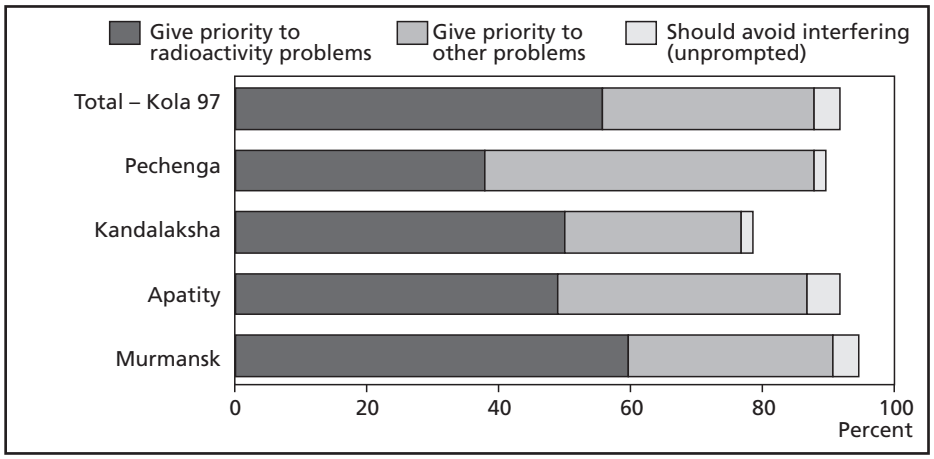
now closed military town of Severomorsk had a slightly more "optimistic" view of the ecological situation it seems fair to estimate that perception of environmental issues is quite similar in Severomorsk and Murmansk, except for the issue of air quality where respondents in Murmansk were less satisfied. A comparative analysis of the issue of air quality and radiation safety shows quite distinctly how many more respondents in the military town of Severomorsk perceived radiation safety to be unsatisfactory compared to their perception of air quality.

Both in the 1992 and 1997 surveys the respondents were asked, as a part of the living condition items, whether they were plagued by dust/smoke from factories in their home environment. The response to this item in the data sets again indicates that the perception of the pollution situation in Pechenga is quite exceptional compared to that of the other sampling areas. This finding is also substantiated if one compares the personal risk rating from air pollution, where a larger share of respondents see air pollution as a large / very large personal risk compared to other sampling areas.

13.4 Preferences for contributions from foreign authorities

In order to investigate the respondents' attitudes towards foreign contributions to the environmental challenges on the Peninsula, the respondents were asked whether

Figure 13.7 Frequency distribution to the item: If foreign authorities shall contribute towards the solution of environmental challenges on the Kola Peninsula, should they in your opinion give priority to radioactivity problems, or other environmental problems e.g. air pollution?



foreign authorities: 1) should give priority to contributions directed at problems of radioactive pollution, 2) should focus on other environmental issues. A third alternative, that foreign authorities should refrain from interfering in this kind of problem, was coded if proffered by the respondent, but not prompted by the coder.

From figure 13.7, it emerges that opinions about foreign authorities are, at best, mixed, as there are clear regional differences with regard to what kind of priority the respondents want foreign authorities to given to different environmental problems. Exactly as in the preceding item, respondents in Pechenga express quite different priorities than respondents in the other sampling areas. There is a clear majority in Pechenga that wants foreign authorities to give more priority to other environmental problems. This finding fits in well with the findings from the personal risk perception scale responses which showed that, for the respondents in Pechenga, air pollution problems were the most important. This is of course not very surprising given the intense local impact from the Pechenga smelter.

Furthermore, on a wider level, it is interesting to note from an examination of the total score for each alternative that as many as three out of ten respondents would re-center intervention on problems other than radioactivity, i.e. clearly the often one-sided focus of foreign authorities on the radioactivity problems of the region appears to be questionable for a large minority. The response of four percent of the respondents that foreign authorities should not interfere is low, but as mentioned above this is an absolutely unprompted response, so this small segment certainly holds a strong opinion regarding this. The main conclusion, however, is that there are diverging opinions regarding what kind of problems foreign contributions should address, and only very few respondents fundamentally question such contributions.

As far as the weighting of different environmental issues by the respondents is concerned, a mixed picture emerges. The more important finding is that of large regional differences among different sampling areas on the Peninsula, differences that are also found to have been quite stable over the last five-year period. In Pechenga, the more conventional environmental problems, for instance air pollution, hold the more central position, whereas in Murmansk City a clear majority prefers that foreign authorities give priority in their contributions to radiological issues, even though a slight majority perceives other environmental issues than radioactivity to be much more serious.

Chapter 14 Ionising Radiation Threats – A Steady State and An Emergency Perspective

When investigating the perception of the threat from radioactive pollution and nuclear accidents, it is very important to differentiate between a *steady state* situation and perceptions related to a more acute *accident* situation (Waldahl 1995).

In order to relate the nuclear threat to a steady state context, the respondents were asked how important they thought the issues of radioactive pollution and possible nuclear accidents are currently. Furthermore, they were asked about their preoccupation with this issue and how often they discussed it.

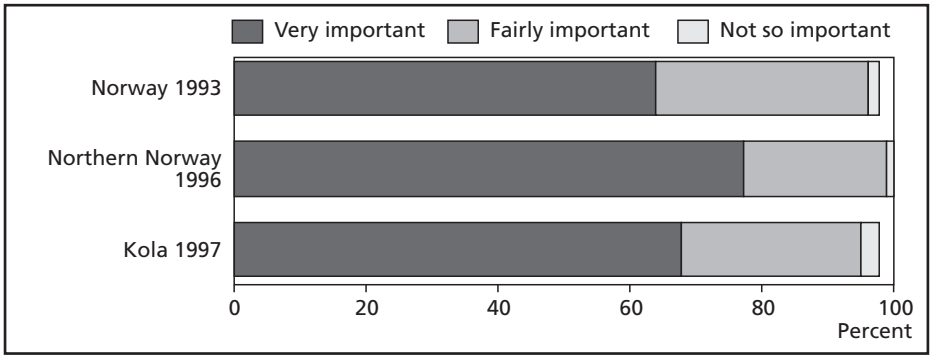
In the current situation, although there are serious problems, these are fortunately not acute, and hence we asked the respondents for their expectations for and anticipations of a hypothetical accident situation. Included in this section are questions about the perceived probabilities for a nuclear accident, whether the respondents have given any thought to their own behavioural response to such an accident, and the probabilities of different specific behavioural responses.

14.1 The issue of nuclear accidents and radioactive pollution in a steady state perspective

In order to estimate their involvement in the issue of radioactive pollution and nuclear accidents the subjects were asked to respond to three items: 1) how important such issues are, 2) do they discuss the issue, and 3) how occupied they are with this issue on a daily basis. The three items are identical to ones used in the Northern Norway survey in 1996 and the nation-wide survey of 1993.

Clearly the frequency distribution is comparable in all the three survey sets; a large majority sees the issues of radioactive pollution and nuclear accidents as very important. The finding that the data set from Northern Norway has the largest share of respondents giving a *very important* response fits nicely into the findings of Smith-Sivertsen et al. As described in section 9.2 they did a large cross-sectional study of

Figure 14.1 Frequency distributions in response to the item: In today's society how important would you consider the issue of radioactive pollution and nuclear accidents to be?



pollution and health effects (Smith-Sivertsen et al. 1997). Included in their questionnaire were a few items about their respondents' perception of the pollution situation. Among both male and female respondents in Sør-Varanger, the concern about radioactivity is the most cited worry; about seven out of ten have checked off radioactivity, whereas some four out of ten respondents in the Apatity/Kirovsk area did the same. Thus, the finding of Smith-Sivertsen et al. was that an expression of a worry related to radioactivity is more apt to be found in Northern Norway than among respondents on the Kola Peninsula.

The importance attached to the issue serves as a very broad indicator of general involvement, whereas the two items, discussing the issue and daily preoccupation are meant to reveal more about specific involvement.

A larger share of respondents in the Kola material shows a day-to-day involvement with this issue.

Figure 14.2 Frequency distributions in response to the item: How often do you discuss the issue of radioactivity and nuclear accidents?

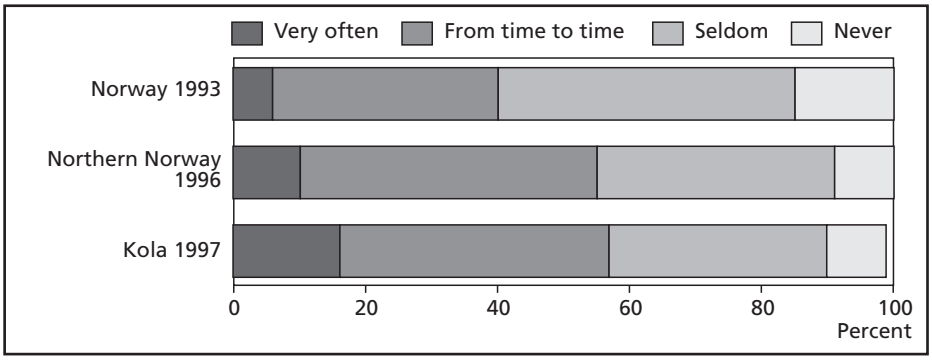
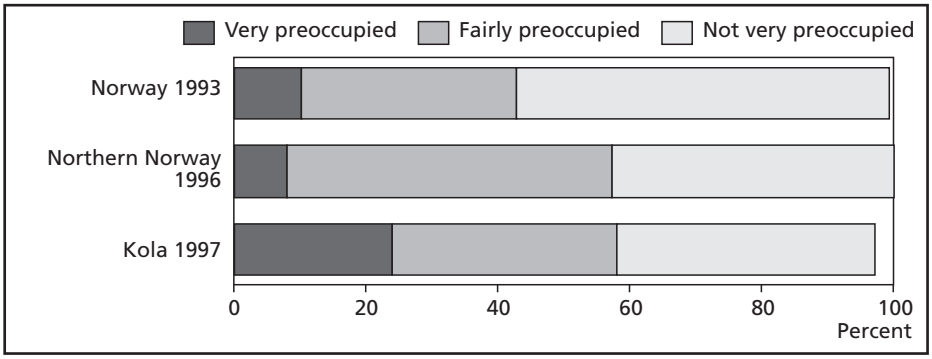


Figure 14.3 Frequency distributions in response to the item: On a daily basis, how preoccupied will you say you are with the issue of radioactivity and nuclear accidents?



It is also quite interesting to note that in the Northern Norway material and the Kola material the share of respondents with little mental involvement is quite comparable, whereas the nation-wide Norwegian material stands out with a pronouncedly higher degree of non-involvement. From the frequency distributions for both items we see that a larger share of Kola respondents chooses the 'most involved' category, i.e. a larger share discuss it very often, and are very preoccupied.

The statistical analysis shows a strong main effect of age; both among male and female respondents, with older persons being more preoccupied on a daily basis with these issues. Whereas less than one in six respondents in the 18-29 year old segment are very preoccupied with the issue, more than one out of three in the 60 plus segment is very preoccupied. The same age effects cannot be observed when it comes to discussing these issues. One may therefore inquire whether the observed age effect is spurious but the size of the effect is strong, indicating that this is not just an artifactual finding. Thus, an explanation that seems to fit the data set better is that, although the older respondents are more preoccupied in these matters, this does not necessarily lead to a daily discussion of their involvement.

In all three data sets, the "importance" item is the broadest indicator of involvement and there is a pattern in which the "very involved" respondents constitute a subgroup of the "very important" response category. Put another way, seeing the issue of radioactivity and nuclear accidents as very important appears to be a necessary but not sufficient criterion for involvement. The finding that one in four of the respondents on Kola are very preoccupied on a daily basis and some one out of six respondents discuss the issue of radioactivity very often indicates that a large segment of the population feels preoccupied with these issues.

To summarise this steady state perspective, some seven out of ten respondents on the Kola Peninsula perceive this issue as very important, slightly less than in Northern-Norway. When it comes to involvement as indicated by discussing these

issues or their daily preoccupation, the proportion of radiological concerned respondents is substantially greater on the Kola Peninsula than among Norwegian respondents.

14.2 Respondents' expectations of another nuclear accident within ten years

The respondents' expectations of another nuclear accident may be seen as a bridge between the steady state attitude questions about importance and involvement, and a context of anticipated reaction patterns in a radiological emergency situation. The respondents were asked to estimate the probabilities of another nuclear accident affecting their own country with radioactive pollution in the next ten years, and to judge the risk of local impact in case of such an accident.

We see that there is a tendency in the probability estimates given by the respondents on the Kola Peninsula of another accident, to perceive such an accident as a bit more likely. From previous research it has been found that even though about seven out of ten respondents in a Norwegian sample consider that it is very likely or fairly likely that another nuclear accident will happen in the next ten years (Tønnessen et al. 1995), the proportion anticipating local impact from such an accident was much smaller in the total Norwegian population (about four out of ten).

The question regarding probability estimates for another nuclear accident affecting Russia is followed up with an item regarding the respondents' perception of local vulnerability to such an accident.

When prompted to consider an accident situation, a larger proportion of respondents on the Kola Peninsula expects to be affected. Consulting figure 14.5, we

Figure 14.4 How do you estimate the probability in the next ten years of another nuclear accident taking place that might affect your country with radioactive fallout?

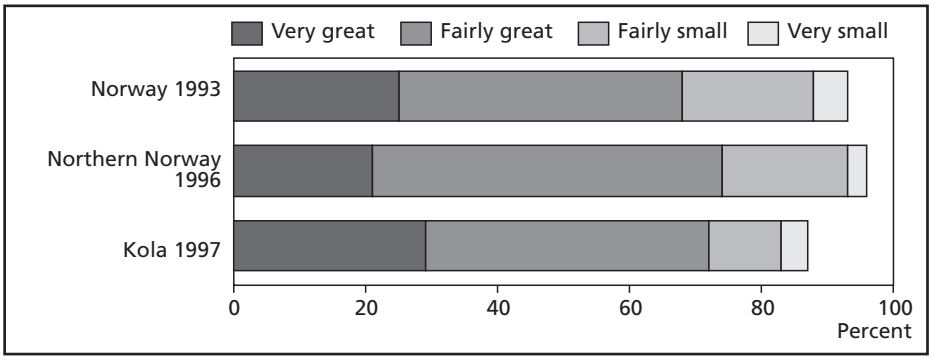
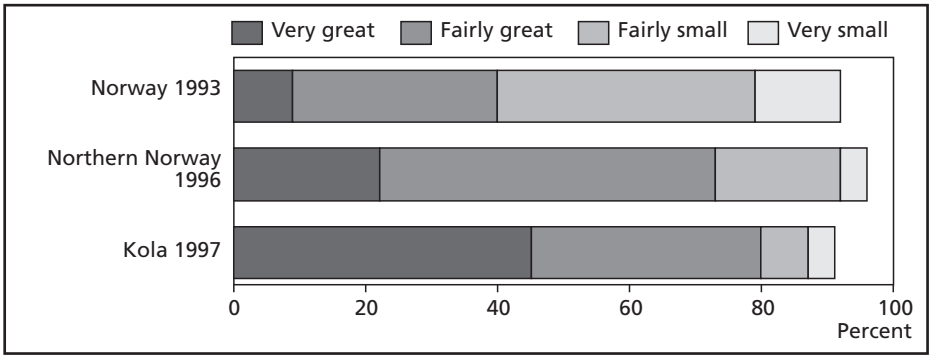
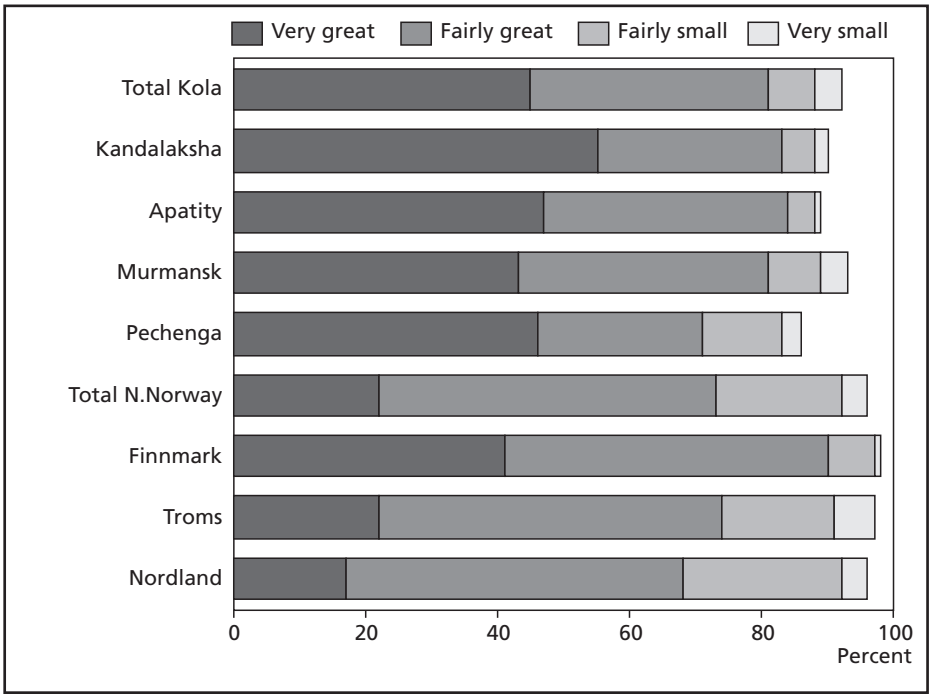


Figure 14.5 And if another such nuclear accident happened how likely is it that the district where you live would be affected?



see a more obvious difference in the very great/fairly great proportion. However, if the responses from Northern Norway are examined on the level of the three counties (Nordland, Troms and Finnmark) a clear geographical gradient appears: the proportion within each county anticipating being affected increases with proximity to the Kola Peninsula.

Figure 14.6 Estimates of risk of local impact from a nuclear accident in different geographical areas based on the different surveys



To what degree this evident geographical gradient is a realistic evaluation of vulnerability is not for anybody to conclude. Nevertheless, it is an important trend that the proportion of high vulnerability estimates received within the county of Finnmark and Murmansk city is quite similar. It is also quite striking that in both the county of Finnmark and Kola nine out of ten respondents think that the risk of local impact is very great or fairly great. Respondents in the geographical areas studied rate the probabilities of another accident similarly, but they clearly perceive the risk of becoming affected in their own local district differently.

The statistical effect of age observed as far as being preoccupied with the issue is concerned was not found regarding the perception of local vulnerability to a possible accident. However, a larger proportion of the older respondents see the probability for another accident as very great (three out of ten among the youngest, four out of ten in the older segments).

To summarise, the perceived probability of another radiological emergency affecting their country is quite similar in Norway and on the Kola Peninsula, whereas there seems to be quite a high level of awareness of the various respondents' geographical proximity to various nuclear installations. Generally, the Kola respondents communicate their belief that if another nuclear accident happens it will quite probably affect the region of the respondent.

14.3 An emergency perspective: Coping styles and anticipated behavioural response in the case of a radiological emergency.

One major hypothesis in the study, as far as coping patterns are concerned, was that a larger proportion of the inhabitants on the Kola Peninsula in general would exhibit an active coping pattern compared to other regions. This hypothesis was made with the knowledge that a rather large proportion of the population had moved to this area in order to achieve better compensation (i.e. the Arctic Coefficient described in Part I, Chapter 2, section 2.6 Migration). Thus, it was assumed that this tendency in the past to take active steps to deal with their situation could be generalised to a certain degree to coping patterns in radiological emergencies. Furthermore, it was well known that the large proportion of inhabitants without any longstanding attachment to the region could imply that these "immigrants" perceived the option of travelling away from the region in an emergency as more likely. One important aspect of the Arctic Coefficient was an extended summer vacation, implying that many inhabitants in this region kept a close connection to other parts

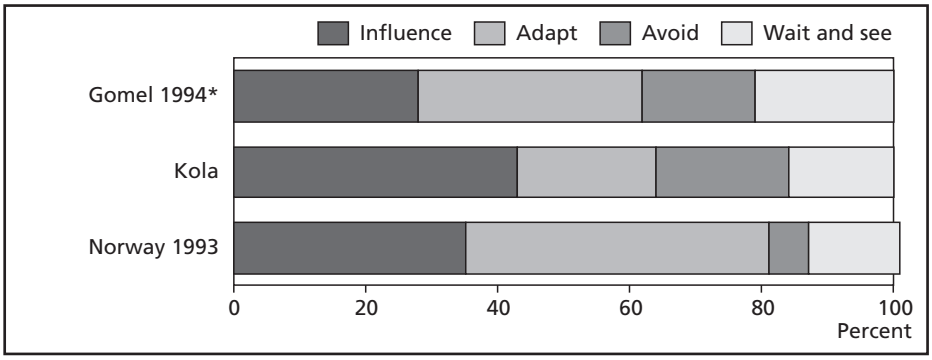
of the former Soviet Union. Thus, both a generally more active coping pattern, less attachment to the region, and closer bonds to other parts of Russia /former SUS were drawn together in the hypothesis that quite a large proportion would see travelling away in a situation of radiological emergency as likely, and that the destination of their eventual 'escape' would be other parts of Russia / Former SUS.

A confirmation of the more general concept of an active coping style among Kola respondents can be seen in the response to one general coping item related to Rotter's concept of locus of control.

Figure 14.7 indicates that the avoidance option is more often chosen in the Russian context. The option of adapting to the situation is found less representative of Russian respondents' general coping style than in the Norwegian data. In addition, the figure indicates that the more urban population on the Kola Peninsula perceives itself more strongly as "influencers" than do the more rural population in the two small villages in Gomel. This centre/periphery gradient in expressed coping style is also observed in Norway (unpublished data).

From previous nuclear accidents, for instance the accident at the nuclear power plant at Three Mile Island (TMI), or the accident involving dumped medical diagnostic equipment in Goiãnia, Brasil, it is known that nuclear accidents have considerable potential for causing strong reactions in the population, as well as resulting in a variety of behavioural responses (Curado 1996). Of course, to ask respondents to predict their own responses in a hypothetical situation will not result in a valid prediction of their actual behaviour. However, given the uncertainties involved, it is nevertheless possible to assess certain preferences for different behavioural responses.

Figure 14.7 Frequency distribution for an item concerning general coping style "When you face a difficult problem do you usually try to influence the situation, avoid the situation, or do You usually wait to see if the problem hopefully disappears?"



* These figures have been taken from a study of coping with living in areas highly contaminated by Chernobyl fallout (Tønnessen et al. 1995).

At the outset of this sequence of items, respondents were asked whether they had given any thought to their own reaction in the event of such an accident. There is no available reference material about this subject for comparison purposes, but six out of ten respondents on the Kola Peninsula reported having contemplated what they would have done given such an adverse situation. This may be seen as an indication of the seriousness with which respondents view such a scenario.

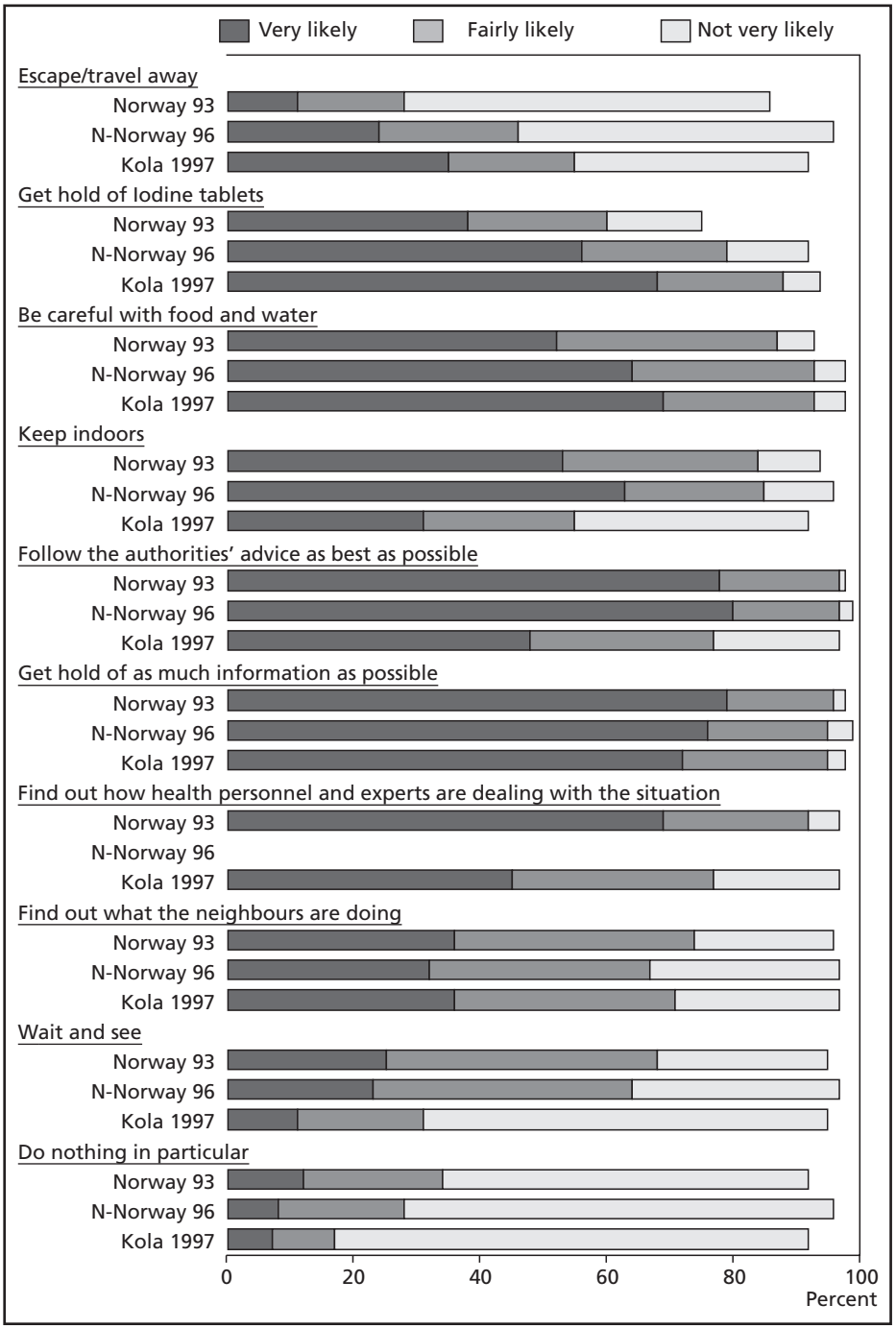
Respondents were also asked to rate ten different alternative responses in terms of how likely these might be chosen , and the results are shown in figure 14.8.

The alternative considered as very likely by the largest proportion of the respondents was "to seek as much information as possible", this agrees with the responses seen in Norway. To obtain iodine tablets and to be careful with food and water are also among the most preferred of the alternatives.

Compared to the Norwegian material, there is one important difference concerning the alternative of 'following authorities' advice as best as possible'. The finding that one in five Kola respondents sees this as 'not very likely' may have implications from the perspective of taking preparedness measures. How are the authorities going to get advice across to the public with advice if a large subgroup of the population already does not think they will follow such advice? Another striking difference is the larger proportion of respondents on Kola who do not consider 'staying indoors' as a likely response. This might well be indirectly related to poor housing conditions nonetheless, as discussed in some detail in Chapter 11, staying indoors might be an important countermeasure in a situation of heavy radioactive fallout. One distinct finding in the 1993 Norwegian material was the importance of experts and health personnel as role models, i.e. "not only what they say, but what they do". The importance of such expert role model behaviour was not observed in the Kola data set.

The alternative of getting hold of iodine tablets is clearly an option that more respondents both on Kola and in Northern Norway in 1996 know how to evaluate compared to the 1993 Norwegian data set. In the sample from the whole of Norway in 1993 as many as one in four respondents did not know how to evaluate this, whereas only one in sixteen respondents on Kola find this option difficult to reply to. Of course here one must have in mind the audible post Chernobyl critiques of insufficient iodine prophylaxis for children even though more than 5 million tablets were distributed to the affected population; this is painfully evident now, with the current excess of thyroid disorders, particularly cancers, seen in children.

Figure 14.8 "Judged probabilities for different behavioural responses"



The estimated prevalence of 'obtaining iodine tablets', or of 'travelling away' as a response is similar in Northern Norway and on Kola, but different from that found in the nation-wide Norwegian data set. One argument for this may be that the latter data also differ because of the timing of the survey, as 1993 is clearly some years ago. However, it can be argued that this finding could be interpreted more from the perspective of geographical proximity. In support of such an interpretation, the 1993 material can be divided into Northern Norway versus the southern part of the country. Given this subdivision, approximately 10 percent points more of the respondents from Northern Norway, even those included in the 1993 material, consider themselves more likely to react by travelling away or by trying to obtain iodine tablets. Note too that in the 1993 material, approximately one in five respondents from Northern Norway regarded travelling away as a very likely response compared to only about one out of ten in the southern part of the country.

Looking at socio-demographic variables such as gender, age, education level and sample area some interesting patterns can be observed. So far as the anticipated reaction pattern of travelling away is concerned, there is quite a strong tendency for respondents with higher levels of education to describe this option as more likely, and also for younger respondents to consider this more likely.

The respondents in the sampling area of Kandalaksha see the option of travelling away as less likely than do the populations in the other sampling areas. This finding may be seen in several contexts. One explanation may be related to the fact that a larger proportion of the respondents in Kandalaksha may be considered to be more permanent residents[4] or feel that they belong to this region. For instance in Kandalaksha, some 62% of respondents had lived their whole life on the Peninsula as compared to 45% in Murmansk. When asked if they had any plans to migrate from the area (Part I, Chapter 2, section 2.6 Migration), Kandalaksha holds a special position as only 12% of respondents there had migration plans compared to a staggering 36% in Apatity, or tothe 28% in Murmansk. Not surprisingly, those that had migration plans generally had reported choosing the option of travelling away as a more likely response. As seen in the steady state situation, the tendency to have migration plans seems to have some influence upon the reported intention to leave the area in a radiological emergency. Thus, one important explanation for the tendency observed in Kandalaksha of being less prone to leaving could be attributed to the general characteristics of the respondents rather than to any conditions related to radiological emergencies.

[4] As described in Part I section 2.6 Migration, the Peninsula has been characterised by dynamic migration flows in the last century. There is a slight tendency for a higher share of non-migrants in 1997 survey as compared to the 1992; this is particularly evident when looking at the proportion of respondents with a length of time of residency less than ten years.

The anticipated preference for obtaining iodine tablets is quite strongly related to sampling area, and it is the respondents in Murmansk who see this behavioural option as very probable compared to the other sampling areas. The same holds for the option of being careful with food and water.

Related to respondents' age and gender is the judged likelihood of keeping indoors and following the authorities' advice: females and older respondents judge these two options as more likely than the younger male respondents. The more "passive" 'wait and see/do not do anything' is particularly consider a more likely response from the older respondents, and this "wait and see" approach is also seen as more likely by respondents with a lower educational level. The reaction pattern of finding out how the neighbours are dealing with the situation is the more likely choice of female respondents and less likely among respondents with higher level of education. To obtain as much information as possible is, not surprisingly, considered more likely by those respondent segments with a higher level of education.

Among both female and male respondents, we observe a main effect on some of the reaction patterns of having dependent children in the household. The some 38 % of respondents with dependent children in their households judge the likelihood of travel away as higher, and likewise they judge the likelihood for the more passive wait and see response as lower.

As far as general coping style related to the ten response alternatives is concerned, the finding is as anticipated: those with a more active coping style see more "passive", "wait and see" alternatives as less likely. Furthermore, the option of staying indoors is perceived as less likely by the "influencers" while those with a more "wait and see" approach regard staying indoors as a more likely response. The respondents with a more avoidance style of coping respond in a similar manner to the influencers as regards the response alternatives: being careful with food and water, obtaining as much information as possible and travelling away. The alternative of staying indoors, however, is viewed as more likely only by the respondents with a more "avoidance " coping style. The response option of obtaining Iodine tablets does not seems to be correlated to coping style in the Kola data set.

The group of younger males who to a greater extent do not consider it very likely that they will follow the authorities' advice poses a challenge for emergency preparedness. In addition, the group that sees "travelling away" as a very probable response is indeed large. Of course, it is nearly impossible for the respondents to accurately predict their own behaviour in a "real" emergency situation beforehand, but clearly at this "steady state" stage many of the respondents anticipate travelling away as a likely choice.

Preliminary factor analysis

We have undertaken some preliminary factor analyses of the three different data sets (Kola, Northern Norway 96 and Norway 93) with Principal Components Analysis as the extraction method and Varimax with Kaiser normalisation as the rotation method. We used the standard criterion of eigenvalues above 1, and also examined the scree plot to estimate the number of components to be extracted. In all three data sets, we come up with a 3-factor solution with only a modest share (in the range of 51-55%) of total variance explained by the three-factor solution. Despite the modest total variance explained it is interesting to comment briefly on similarities and differences in light of the factor analysis performed.

The three factors may be termed; a) "functional coping", b) information/ advice and role model-related coping, and c) a "wait and see" approach. The reaction alternatives of keeping oneself indoors, getting hold of iodine tablets and being careful with food and water and to some extent also travelling away are included in the "functional coping" component. It goes without saying that the strategies of finding out how role models act (i.e. experts coping), imitating neighbours coping and information gathering constitute the (b)-component. While "not do anything in particular" and "wait for further developments" are included in the passive reaction component.

In all three data sets the communalities for the item of travelling away is among the lowest, i.e. the variance in this reaction alternative is poorly explained by the three factor solution. The following finding act as an illustrative difference: while "find out how my neighbours relate to the situation" is poorly explained by the model in both Norwegian data sets, on Kola this item converges more with the option of finding out how experts are dealing with the situation. In addition, in the Kola data set, the item with second lowest communality is the option of following authorities' advice as well as possible. Only in the Kola data set does the "travel away" option have a negative loading on the passive; "wait and see" component.

We would also like to point out that the option of travelling away (that from an authoritative viewpoint in many possible scenarios may be judged counter-productive as a protection measure) is statistically related here to the more functional alternatives of keeping indoors, being careful with food & water, and getting hold of iodine tablets.

To summarise: the respondents' expectations for their own reaction patterns to a radiological emergency confirmed a major hypothesis of this study, namely that the population will generally exhibit an active behavioural oriented coping pattern. Compared to the Norwegian reference material, some additional one out of five respondents on Kola than in Norway consider a wait and see approach as unlikely. The essential role of information gathering and being careful with food and water

as a response alternative is seen on Kola, in quite similar proportions to what has been observed in Norway. However, a dramatic difference is observed when it comes to the response alternative of following the authorities' advice. Some one in three respondents less on Kola than in Norway regard this response as very likely. The fact that one in five respondents will very likely not follow the advice given poses a dramatic challenge to the relevant authorities. Role behaviour as exhibited by experts and health personnel appears to be less important than in a Norwegian context, whereas the role-played by neighbours' reactions seems very similar. The Kola respondents, especially those in Murmansk City, see the response of procuring iodine tablets as very likely. All in all the relevant authorities should ready themselves for an active public response in their emergency preparedness plans. One evident suggestion from these results for optimising coping in an radiological emergency, would be to try to influence the population's evaluation of taking shelter indoors as an active coping measure. As described in Chapter Three, seeking shelter indoors may be an important countermeasure from a radiation protection viewpoint, and the fact that nearly half as many on Kola view this as very likely as compared to Northern Norway indicates a large potential for coping better with this specific countermeasure. Thus, a concrete suggestion relevant for preparedness measures in this study would be the encouragement of the relevant authorities to endeavour to increase awareness of the important role of taking shelter as a short-term countermeasure.

14.4 Anticipated travel Patterns in a hypothetical nuclear accident situation

Respondents were asked for their possible escape preferences in terms of means of transport and destinations. A 'very likely' or 'fairly likely' response to the question concerning likelihood of travelling away was followed up with a question about preferred destination, while those answering not very likely or do not know skipped this follow up item.

In addition, all respondents were asked to consider two different emergency scenarios, one involving an accident at the Kolskaya AES, and another involving a nuclear accident at a military installation. In these scenarios the respondent were prompted to imagine a situation in which, given the accident situation, they had decided to abandon their home. Given such scenarios, the respondents were asked about their preferences for means of transportation and the destination for their escape. The respondents were presented with four alternative means of

transport, and asked to select one: bus/car by road, railway, plane or boat. Respondents were further shown a card with six response alternatives for their destination, and were asked to identify the one preferred.

The results in table 14.1 illustrate the large uncertainties involved when asking such question, and about one in five respondents did not know how to respond to the questions. However, given these limitations we see that the railroad is the transportation method preferred by most of the respondents given a military accident situation, and a plane is the most often preferred alternative given a situation of an accident at the Kolskaya AES. The differences between the different scenarios are quite minor for the overall sample but looking at specific sample locations, some differences that may be scenario-related can be detected. First of all, looking at the map one will notice that the main road (M-18), and also the railroad from Murmansk City pass quite near Kolskaya AES. Based on this one may have as a working hypothesis that sample locations to the north of Kolskaya AES distinguish between the scenarios. One would suggest for these locations that the military scenarios would be perceived as mainly travelling away from "point zero" of the emergency not dependent upon the means of travelling, whereas both the road and the railroad may be perceived as travelling "through" point zero given an emergency at Kolskaya AES. The sampling area of Kandalaksha located to the south of Kolskaya AES, would according to such a hypothesis, be the area with the least difference between travelling modus for the two scenarios. One could also suggest that travel by road and railway are less preferable for locations to the north of Kolskaya AES in an emergency involving Kolskaya AES compared to a military emergency scenario.

One does see a small confirmation in that Kandalaksha is the sampling area with the least difference between scenarios, but the overall significant finding from

Table 14.1 Preferences for transportation method given an accident scenario

Transportation by:	Accident at Kolskaya AES	Accident at a military installation
Bus/car	14	17
Railroad	29	34
Plane	30	28
Boat/ship	7	3
Other means of tr.	0	0
Don't know	18	16
Refused to answer	1	1
Other missing	1	1
Total	100	100

Kandalaksha compared to other sampling areas is the dominating role of the railway as a travel route. More than three out of four respondents in Kandalaksha evaluate the railway to be the most likely travel method, and the category seen as less likely in Kandalaksha compared to other sampling areas is travel by plane (only about 3-4 %). The lower frequency of travelling by plane observed in Kandalaksha may be related to the fact that the closest aerodrome[5] is to the north. If this was the main explanation behind the little anticipated use of a plane in Kandalaksha one would have expected a scenarios effect, because in the Kolskaya AES scenario going to the Khibny airport would imply travelling nearly "through" point zero of the emergency, whereas a military scenario more probably are seen as quite far away to the north. In fact, the respondents in Kandalaksha did not differentiate much between the scenarios, so there must be other more valid explanations for the observed little use of air travel/high preference for the train[6].

In Pechenga the main finding is not related to the suggested working hypothesis; the overall finding here is that travelling by road is the most preferred alternative, not dependent upon the scenario context. This maybe related to the tortoise speed of the railway link Nikel-Murmansk, as the average speed lies below 30 km/h, requiring a total of 8 hours to Murmansk. In addition, the main aerodrome in this region is close to Murmansk city and finally a larger proportion of the respondents in Pechenga live in a car owning household as compared to the other areas.

However, both in Murmansk and Apatity there are some indications of what may be termed scenario congruent travel modus. This is more clearly seen in Apatity where the option of travelling by plane or railway changes some 10 percentage points between the scenarios, whereas travel by road is not so scenario congruent. Although, the option of travelling away by boat is considered as likely by a rather small segment of respondents, it is noteworthy that the proportion is even smaller in the military accident context than in an accident scenario involving Kolskaya AES. Within the sampling area of Murmansk city, for instance, the proportion of about 9 % of respondents who regard boat as the preferred alternative in the Kolskaya AES situation is reduced to about 4 % in a military accident scenario.

Another way to substantiate the given answers is to look into their relationship to other variables. For instance, about 45 % of respondents in car-owning

[5] The closest aerodrome for the Kandalaksha respondents most probably is the Khibny Airport situated between the cities of Apatity and Kirovsk.

[6] Kandalaksha as a town has important "links" to the railway, it is an important railway junction and in addition, Kandalaksha has the regions oldest train depot where the Northern Railroad Museum is situated. In addition, Kandalaksha is a town with different roots than the other sampling area; for instance, historically it is mentioned in historical documents in the 11th century.

households prefer bus/car as a means of transportation in an accident scenario at Kolskaya AES, and about 48 % of them prefer road transport given a nuclear accident at a military installation. The respondents in car-owning households are as willing or more willing to take a plane, but especially the railroad has a low preference among those respondents who have a car in their household (approximately one fourth of the respondents).

Another finding related to the option of travel away by plane is the fact that this is more often considered by respondents who have replied that they have not thought about their own behavioural response. Conversely travel by train and car are mentioned more often by those who replied that they had considered what to do in a radiological emergency situation even before this interview.

Related to background variables a larger proportion of older respondents were found to prefer the railroad as a means of transportation, whereas a plane is the most preferred transportation means for the younger generation. There are no clear-cut gender differences in transportation preferences.

In order to investigate preferences for destinations of an escape, the respondents were asked to select one out of six different alternatives presented to them on a card. As described above, destinations were explored in three different circumstances. The some 56 % of respondents, who answered very likely or fairly likely to the reaction of travelling away, were introduced to a follow up questionnaire item about the destination of this likely reaction. In addition, in order to tap all the respondents' possible preferences, they were all asked to consider two different emergency scenarios, one involving an accident at the Kola Nuclear Power Plant, and another involving a nuclear accident at a military installation. The alternative destinations given were: to family/relatives in other parts of Russia, to family/relatives in other parts of Ukraine/Belarus or other parts of the CIS, to family/relatives in Murmansk Oblast, to Finland, Sweden, Norway, or another destination.

The interviewers were instructed at this point a response of not considering travelling away was also to be regarded as valid, even though this alternative was not offered to the respondent on the card. By way of training and the field manual, the interviewers were instructed to interpret the response in this manner only if it was given *unprompted* by the respondent.

The main finding from the table, even if very hypothetically replied to, clearly shows that the respondents see their family and relatives in other parts of Russia or the CIS as a natural destination given an escape scenario. In addition the *do not know* response is clearly lower than when respondents are asked to consider their preferred means of transportation. This may be related to the fact that they have been presented with response alternatives to choose from on a card shown in the interview situation (in the transportation mode item respondents were offered the response

alternatives only orally). Another possible interpretation is that the respondents find a possible destination easier to evaluate than the practicalities of transport.

It is also interesting to note that the choice of Russia versus Belarus/Ukraine and other parts of CIS may well reflect the ethnic composition of the surveyed population.

A distinct subgroup will never consider travelling away, even given such a drastic scenario. This subgroup is particularly distinct in the Kandalaksha sampling area where as many as one in five respondents has replied in this way. Considering the fact that this alternative was not shown on the response card the proportion in Kandalaksha is large. One must also take into consideration that Kandalaksha is the subsample area closest to Kolskaya AES and this fact combined with the high proportion of "never travel away" is quite intriguing. One hypothesis for the observed difference could have been an artefact in the form of a systematic interviewer bias in this sampling area, i.e. that the respondents were more easily interpreted by the interviewers in Kandalaksha as giving this response unprompted. Such a possible

Table 14.2 Preferences for destination, in three circumstances; a) For the about 56 % of respondents who answered very likely or fairly likely to travel away, what would be their destination? (ref. figure14.8), or when prompted, in an escape situation given a nuclear accident scenario at b) Kolskaya AES, or c) at a military installation

Destination of an eventual "escape":	What will be the destination for those who answered very likely, or fairly likely to travel away?	Destination when prompted with an accident situation	
		Accident at Kola NPP	Accident at a military installation
To family/relatives in Russia	69	59	61
To family/relatives in Ukraine / Belarus or other parts of the former SUS	21	16	16
To family/relatives in Murmansk Oblast	1	1	1
To Finland	1	1	1
To Sweden	1	1	1
To Norway	1	2	2
Other destination	3	3	3
Would never consider travelling away	Not appropriate	6	6
Don't know	4	9	9
Refused to answer	0	0	0
Total	100	100	100

explanation is ruled out by referring to the estimated probabilities for different behavioural reaction patterns. As mentioned before (Figure 14.8), a smaller proportion consider the response of travelling away as likely in Kandalaksha. There is also a marked difference between Kandalaksha and the other sampling areas in as much as nearly one out of five does not know where to travel in the two imposed travel items (i.e. not in the follow up destination item), thus when travelling away is perceived as unlikely, then it is of course also quite hard to indicate a destination.

So far as relationships to general background variables is concerned, the older segment of the respondents was found to be over-represented among those who would never consider leaving.

14.5 Migration behaviour in a steady state and emergency perspective

One important issue of part two of this project has been to study expectations, held among respondents, for reaction patterns in radiological emergencies. The suggested hypotheses, that the population typically exhibits an active coping pattern have been confirmed in this study. Furthermore the explicit hypothesis that related to such an active coping style, quite a large proportion will consider travelling away from the region in a radiological emergency as probable, also has been confirmed. Also as suggested beforehand the target for such an escape tendency will be friends and relatives in Russia/CIS countries. To further validate these findings a more detailed sub analysis have been performed on the respondents tendency for migration in the ordinary steady state perspective. This sub analysis is very much in parallel to section 2.6 of part I, but some points will anyhow be repeated. Looking in more detail into the explanations given for the stated migration plans will do the analysis. The overall migration observation is that of a nearly constant rate of out-migration, and falling number of in-migrants. In the figures from the 1992 and 1997 study there is an increased tendency in the proportion of respondents with plans for leaving the region. It is important to note that this group of migration prone is not the average respondent but indeed typically are the more resourceful ones. Thus when studying various explanation for the held migration plans, the sosio-economical profile of this group must be kept in mind. The same group also se to travel away in a radiological emergency as more likely, in fact there is a high concordance rate between migration plans, and the tendency for travelling away in a radiological emergency.

In Hansen's 1992 survey, and replicated in 1997 (ref. Part I, section 2.6), it was documented that what Hansen has termed "quality of life" factors, were the

more important motivation for migration for those about one in four respondents that held migration plans in a two year perspective. Those of the respondents, that confirmed migration plans, were asked for the reasons behind their migration plans. The respondents were offered 10 different explanations in 1992, including an "other cause" category, and were asked to check out all that applied. On an average 2,1 reasons were given by those respondents that held plans to move within the next 2 years. The explanations most frequently given were pollution and the climate. The respondents that selected only one explanation most often chose termination of military service and the other cause category. As documented in section 2.6 of part I the respondents could in 1997 choose from 4 more explanations giving a total of 14 alternatives. There was an average response of 3,2 responses given among the 29% of respondents with migration plans. As documented in part I, the climatic conditions were the more frequently chosen explanation, followed by pollution, health reason, and radiation concerns. It is interesting to note that not a single respondent in 1997 with only one selected explanation had chosen radiation concern. Similarly the environmental concerns are also infrequent mentioned among the about one in five migration prone with only one selected explanation. Among the migration prone that selected only one explanation, the more frequently chosen are the "other" category, end of military service, education, to live with family, and climatic conditions. Radiation concerns are typically more often selected of those respondents that have given three, four and five explanations. The "other" explanations typically given together with radiation concerns are climatic conditions and not surprisingly conventional environmental problems.

When it comes to a possible migration target, the analysis of part one also has shown that migration abroad is seen as less likely in 1997 than five years ago, and that the overall dominating target is within Russia. Among foreign migration targets there have especially been a reduction among those considering CIS countries and the very small fraction that mentioned Western Europe or the Nordic countries. To illustrate the trend one could use the migration targets of Western Europe/Nordic countries given within Murmansk City, the fraction have been more than halving (down from 8,4% to 3,2%).

To conclude, there is more than one out of four respondents that has migration plans. These respondents are typically among the more resourceful, and among the quality of life factors mention as an explanation, radiation concern are quite common. More importantly, various foreign destinations for such migration plans are infrequent, and even more infrequent than what was observed in 1992. The essence from the migration findings in Part I that validate the travelling away estimates are; yes there is a large proportion of mobile respondents, but no, destinations abroad are not seen as likely targets, either in steady state migration context, or the more spectacular run away from an radiological emergency scenario.

To summarise the emergency"travel away" related questionnaire items, about four out of ten respondents think travelling away is a very likely response given a radiological emergency, but in Kandalaksha to travel away in an emergency is seen as inconceivable by a much larger proportion of respondents than in other areas. In addition, more respondents in Kandalaksha find it difficult to give any clear preferences. Aside from the stated non-travel pattern in Kandalaksha there are relatively minor differences between sampling areas when it comes to destination, while there are more evident differences in the methods for travel away. The generally preferred means of travel is by train and plane, but behind this overall picture there are important sampling area differences. In Kandalaksha, rail travel is totally dominant, whereas respondents in Nikel see travelling by road as more likely. The most dominant response concerning the destination of a conceivable emergency escape is to travel to friends and relatives in Russia or other parts of the FSUS, and this is a relatively stable finding across both the proposed Kolskaya AES and military emergency scenarios and between the different sampling locations.

Chapter 15 Mass Media and Information Aspects of A Radiological Emergency Situation

From the current study, and also as seen in previous studies in Norway and in the actual response to the Chernobyl accident, information gathering is a very important coping strategy given a radiological emergency scenario. Unlike many other disasters, a nuclear accident will often imply a situation where information itself is the carrier of the very threat itself (Poumadére 1991). Burns or acute radiation sickness, instances where victims or observers of victims themselves can observe health effects directly, will not be a widespread phenomenon[1]. One safe conclusion and prediction is that in a nuclear accident situation involving the release of radioactive pollution, the public will also be exposed to an information ambiguity, e.g. Sternglass' sweeping estimate that 500 000 people in Europe would die of cancer because of the Chernobyl accident (Sternglass, 1986). When asked 10 years later, approximately 90 per cent of the public in Norway responded that they had been warned about Chernobyl via the mass media (Tønnessen et al. In prep.). All this emphasises that in such threat scenarios, information and media issues are of essential importance. Hence, some items regarding mass media preferences, confidence and warning preferences were included in the present study. Taking as a point of departure that a vast majority will be informed through the mass media, media preferences and confidence in the steady state is important, i.e. the way the public receive eventual threatening news will be influenced by their media habits, preferences and confidence or trust. Therefore, in order to investigate media-related aspects of a nuclear accident scenario, one must start with the steady state situation. Consequently, the respondents were asked about their media preferences regarding various issues and about their trust in various parts of the mass media. However, before turning to the results a brief description of the mass media situation in the Murmansk region will be given.

[1] As described in chapter 11, many of the radiological emergency scenarios here consider will imply contamination of a level where the resulting doses are in a range where the stochastic and not the deterministic health effect is important.

15.1 The mass media in the Murmansk region

There was strict regulation of the media during the Soviet era, both in terms of the number of newspapers allowed and the control of radio and television. The Communist Party controlled all of the mass media, but with perestroijka and glasnost, this changed. In the early 1990s, there was a peak in the activity of reforming the mass media; old newspapers were reformed, new ones were started and some old ones disappeared. Also alternative radio and TV stations were started but many of them did not manage to survive. Today the official state mass media still exists, but side by side with independent outlets.

Newspapers

One of the first local newspapers in this region was the underground Bolshevik newspaper "Murman" that was published as early as 1907 but came to a halt after only two years. (Also quite early, in 1915, the town of Aleksandrovsk, now Polyarny, had an international telegraph station with connections between Murman – England).

The oldest of the newspapers still in circulation is the Polyarnaya Pravda, started by the Soviet authorities in 1920. Today Polyarnaya Pravda is issued 5 days a week and has a supplement aimed at the younger population segments the "Ya s toboi". The current circulation figures for Polyarnaya Pravda are about 27000. One other newspaper with an historical tradition "pre-perestroijka" is the Ribny Murman, a weekly newspaper that was first issued in 1934. Ribny Murman currently has a circulation of about 15.000 and is reported to contain mostly information related to the fishing industry and the trawler fleet.

The "Komsomolets Zapolyariya" is a weekly newspaper also aimed at younger readers and was founded in 1939 by the Regional Committee of the Young Communist League. Komsomolets Zapolyariya currently has a circulation figure of around 10 000.

Two of the "post-perestroijka" newspapers are the daily Murmansky Vestnik and the weekly Vecherny Murmansk; they both started publishing in 1991. Murmansky Vestnik was founded by the Administration of the Murmansk Region and the Regional Duma, and currently has a circulation figure of about 20 000. Vecherny Murmansk is, as mentioned above a weekly newspaper aimed more at entertainment and popular reading. In addition to those mentioned above many of the towns in the region have their own local newspaper.

Radio and television

With regard to radio and television, the first radio program was broadcast in 1933, and in 1957 the local Murmansk television station was started. The regional broadcasting company of the State Television and Radio Broadcasting Company is called the Murman. The first broadcast by a private broadcasting company was by the TV-XXI Television Company, which went on air in May 1992. The TV-XXI Television Company broadcasts daily for about 14 hours and also has viewers in the Oblast of Karelia. There are numerous local radio stations operating in the area.

Generally speaking when looking at the official figures for total newspaper circulation a quite dramatic reduction in figures can be observed, a reduction that may very well be explained by the increase in newspaper prices, as newspapers in the Soviet era were nearly free of charge. The reduction in circulation figures may indicate that the relative importance of radio and television has increased considerably compared to the newspapers as mass media channels.

15.2 Mass media questions in the current study

Consequently the respondents were asked about their media preferences regarding various issues and to identify their most preferred sources of information concerning: domestic politics, local politics, hazards and risks, environmental problems and culture/entertainment.

From table 15.1, one may conclude that national TV holds a strong position for all issues probed, except for one obvious exception, namely local politics where TV-Murman and newspapers hold the more important position. When it

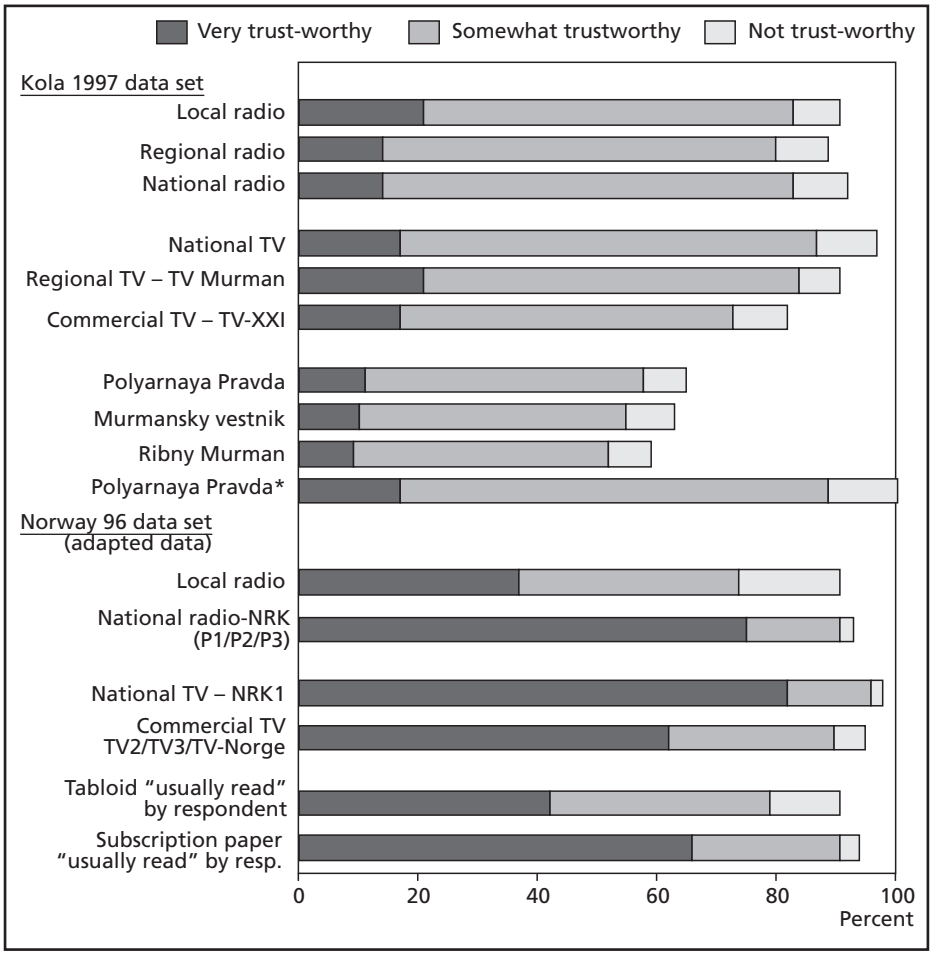
Table 15.1 The respondents' "most preferred source" for five different issues

	National politics	Local politics	"Hazards and risks"	Environmental problems	Culture and entertainment
Local radio	2	19	3	3	1
Reg.ional radio	1	5	1	2	0
National. radio	13	2	9	8	4
National TV	73	6	57	52	71
TV Murman (state)	1	34	4	4	3
TV-XXI (private)	1	11	4	4	7
Newspapers	6	18	17	15	6
Magazines	0	0	1	3	4
Don't know /refused	3	5	4	5	4

comes to hazards and risks and environmental problems the most preferred local source is newspapers. There are some differences between Murmansk city and the other sampling areas so far as TV-Murman and local politics are concerned, i.e. respondents in Murmansk city cite TV-Murman as their most preferred source for local politics, whereas newspapers are the most often mentioned preferred sources for local politics in the other sampling areas. A point more directly related to the content of this report is the finding that newspapers play a relatively more important role in connection to the issues of hazards, risk and environmental problems.

There is no one-to-one relationship between *preferences* regarding different issues and the level of *confidence* in the same media sources.

Figure 15.1 Degree of trust in different mass media sources on the Kola Peninsula, and in a Norwegian reference material



* Freq. distribution for Polyarnaya Pravda excluding missing

TV Murman, a state owned regional TV station, and local radio hold the stronger position of trust. It is interesting to note that national TV (that in table 15.1 dominated as the "most" preferred source for all kind of issues) is here the source seen by most respondents as not trustworthy. This is of course a difference of nearly no percentage points under the heading "not trustworthy", but at the same time the strong position of national TV as the most preferred source cannot easily be explained by the credibility ratings.

A main finding from figure 15.1 is the overall large difference in the trust placed in the mass media in the Kola and Norwegian contexts, although the Norwegian data have been adapted from a five-point scale.

The levels of don't know responses for the specific newspapers and the magazine Murmansky Vesnik has proven troublesome for methodological reasons. As these newspapers and magazine are based in Murmansk city one explanation could be that respondents in the other sampling areas to a larger degree responded "do not know"; this is partly substantiated as the level of don't know in Apatity and Pechenga is indeed higher, ranging from 50-60 %, but the level of "don't know" in Kandalaksha is somewhere in between. However, if we summarise for all these newspapers and look into proportions of "missing" for all three, a pattern emerges where about two out of three respondents that are "missing" for one of the newspapers are missing for all three. Of those "missing" for all three newspapers the respondents outside Murmansk city are proportionally more important.

Another plausible explanation for difference in the "don't know" level is that these items are only available to the respondents as the result of consumption, i.e. maybe those respondents who did not buy these newspapers/magazines found it difficult to respond as to their degree of trustworthiness.

No important gender differences were seen; however looking at age and education level some interesting patterns emerge in the degree of trust. One of the overall more trusted sources, the local radio stations, enjoys an even higher degree of trust among older respondents. More precisely: whereas about one in five respondents in the younger age groups sees local radio as very trustworthy, one in four of the oldest age group responded in the same way. *TV XXI* (a private television company) is clearly most trusted by the younger respondents. For state-owned national television, there are indications of a higher degree of confidence being held among both the oldest and youngest age groups.

There is a tendency that with increasing levels of education the overall level of confidence decreases. The single source with the highest proportion of "very trustworthy" in the respondent group having completed higher education is *Polyarnaya Pravda*. In general, the respondent group with the highest education levels displays the same patterns as the other groups. *TV Murman* and local radio are more often

trusted, and national television and national radio have the highest proportion of "not very trustworthy".

When it comes to different sampling areas, the regional coverage of TV-XXI may be questioned as there is a very much larger proportion of missing response in sampling areas outside Murmansk City. For instance, more than 40% of the respondents in Apatity did not know how to evaluate the trustworthiness of the television channel. However, if one does not take this variance in "missing" into account, the evaluation of trustworthiness is quite similar in the sampling areas. A pattern with a difference in the "missing" responses is also seen for local radio where the respondents in Pechenga rather more often did not reply. One example of a variation in trustworthiness among sampling areas not related to "missing", is TV-Murman, which holds a stronger position in Murmansk City than in the other sampling areas.

To summarise the mass media issues: national television holds a dominant position as the preferred source for the five different issues mentioned. However, for the issues more relevant to the current study (e.g. risks and environmental problems), newspapers have a relatively stronger position than they do for other issues. A discrepancy is observed for national television as far as source preference and confidence ratings are concerned. The state owned regional television station TV-Murman and the local radio hold the strongest position when it comes to confidence ratings. Compared to such ratings observed in a Norwegian context the overall low levels of trust are also compelling.

15.3 Trust in an emergency situation

Russian authorities and agencies with responsibilities related to radiological emergencies

In the survey item for trust reported below there is only one broad item representing the Federal authorities in addition to the military authorities and the Ministry of Civil Defence Emergency Situations and Recovery from Natural Catastrophes of the Russian Federation (for short EMERCOM). One reason for this is the fact that the complete list of different agencies involved is quite large. On a general level one may say that there are something like 7 ministries, 3 State Committees, and in addition some more agencies involved on the federal level. Below a brief outline of some of the complicated patterns and interrelationships of responsibility of the various institutions involved has been given. To make things even more complicated the legislation of the Russian Federation concerning radiation protection, have been and is still in a process of change as new laws or drafts of laws are under devel-

opment[2]. In addition, Russia's former[3] Prime Minister, Sergei Kirienko, made some changes in the government's structure. According to the media, Kiriyenko gave ministers sharper and more specified responsibilities than they had in the old government, where every rank-and-file minister was overseen by at least one Deputy Premier. Kiriyenko therefore cut the number of Deputy Prime Ministers from eight to three, and there is to be no First Deputy Premier. Among those reappointed in the March 1998 change was Sergei Shoigu[4] to Minister for EMERCOM. It is still too early to tell what changes to this sector of the governmental structure the new Prime Minister, Primakov, may bring about.

One way of categorising the various institutions involved is to say that there are some ministries and agencies using nuclear power and radioactive substances, while others supervise, regulate and monitor the activities of different institutions using nuclear power and radioactive substances. Some of these ministries and agencies using nuclear power and radioactive substances are: the Ministry of Defence (the Navy), the State Committee of the Defence Industry (Goskomoboronprom), the Ministry of Transport (Mintrans[5]), Ministry of Construction, and the Ministry of Atomic Energy (Minatom). In addition to responsibility related to electricity generation at nuclear power plants, and nuclear fuel production, Minatom also has a special obligation for co-ordinating the various ministries and agencies.

So far as the regulatory function is concerned the Federal Nuclear and Radiation Safety Authority (GOSATOMNADZOR or GAN) is the state regulatory body that organises and carries out the regulation and supervision of safety in the production, management and utilisation of nuclear energy, nuclear materials, radioactive substances and related materials for both civil and military purposes. GAN was established in 1991, and starting in 1993 it began issuing provisional permits and setting safety requirements for certain types of activities. One recently discussed issue related to this is the permit, as yet ungranted, for reprocessing facilities in Mayak. According to GAN the Mayak Production Association has not been granted

[2] Among the laws under revision are; "On atomic energy use", "On the radiation safety of the population", and "On State policy in the field of radioactive waste management"

[3] (March-September 1998)

[4] Sergei Shoigu was one of the ministers with the longest "ministeral life"; among ministers reapointed in the Kiriyenko cabinet were Foreign Minister Yevgeniy Primakov, Defense Minister Igor Sergeyev and Finance Minister Mikhail Zadornov, Nikolai Aksenenko as railways minister, and Aleksander Tikhonov as education minister while Sergei Stepashin was named Interior Minister. The possible organisational changes, with the August/September cabinet of the former Foreign Minister Primakov, is at the moment of writing too early to tell.

[5] Mintrans is relevant in the context of this report as it is the owner of the icebreaker fleet of M.S.Co., while M.S.Co is the operator.

provisional permits because of problems with the radioactive waste management at the site (Zubkov & Kislov 1995).

Other agencies involved in supervisory functions are: the State Committee for Environmental Protection and Natural Resources of the Russian Federation (GosComPriroda)[6], the Ministry of Health Care and the Medical Industry, the State Committee on Hydrometeorology and Environmental Monitoring of The Russian Federation (ROSHYDROMET) and the State Committee for the Control of Public Health.

GosComPriroda is a federal executive agency governing and co-ordinating the fields of environmental protection, rules for the utilisation of natural resources, and regulations for economic activity involving important environmental impact. GosComPriroda has established territorial agencies that in turn have organised local agencies for environmental protection. An important scientific body related to radiation protection in Russia is the Russian Scientific Commission on Radiation Protection, organised within the GosComPriroda.

The Federal Department of Medicobiological and Extreme Problems (FDMEP) organised under the Ministry of Health Care and the Medical Industry of the Russian Federation (Minzdravmedprom) has taken over functions within the nuclear industry formerly organised as a special medical network under the former Soviet Union Ministry of Health Care. FDMEP consist of public health units and various research institutes. FDMEP provides services for personnel in the nuclear power and nuclear ship building industries as well as for people living in adjacent areas. FDMEP consist of three main departments and has both a Federal Centre for State Public Health Inspection and more local public health units with Centres for State Public Health Inspection of Installations[7].

Until May 1998 the State Committee on Hydrometeorology and Environmental Monitoring of the Russian Federation (ROSHYDROMET) was another federal agency with a supervising function related to ROSHYDROMET's responsibility for environmental monitoring. In May 1998 Roshydromet was incorporated into the State Committee for the Environment (GosComPriroda); for the purpose of this overview Roshydromet will be described as a separate entity in spite of this very recent change in organisational structure. Already in 1961, the Radiation

[6] GoskomPriorda until recently was better known as Minnature and used to be organised as a Ministry not a State Committee. The old name was the Ministry for Environmental Protection and natural resources of the Russian federation (Minnature).

[7] According to Zubkov & Kislov (1995) there is also in addition to the regulatory functions under the Minzdravmedprom an executive body of a State Committee of Public Health Control (Goskomsanepidnazor) with regulatory functions; it is currently not clear to us how the work of this State Committee of Public Health Control interact with the Federal Centres for State Public Health Inspection organised under FDMEP, or if they perhaps are identical units.

Monitoring Services (RMS) had started as a branch of the hydrometerological services. The establishment of this branch at this time was of course related to nuclear test explosions and the needs that had arisen for an institution to detect and monitor radioactive substances released from the bomb tests. Today what used to be termed ROSHYDROMET uses 1460 hydrometerological stations and monitoring posts for radiological monitoring. Around 260 of these stations are located not far from (maximum radius 100 km) radiological hazardous sites. The monitoring stations are organised within Regional Departments of Hydrometeorology and Environmental Monitoring (RDHEMs). In addition to the central Moscow Centre for Hydrometeorology and Environmental Monitoring there are 24 RDHEMs. The Scientific and Industrial Association Typhoon (SPA Typhoon) has the responsibility for the scientific and methodological supervision of the radiological monitoring network of Roshydromet. To optimise the responses of Roshydromet in the case of a nuclear accident, an emergency centre has been established at SPA Typhoon.

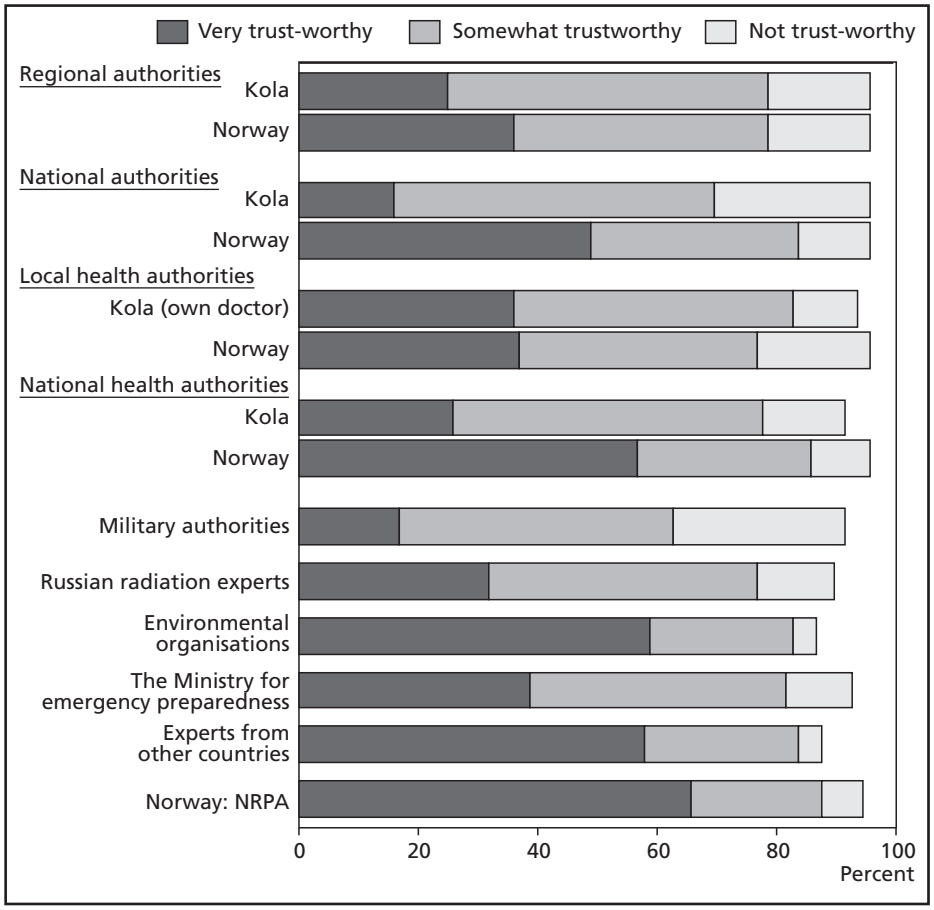
The radiological monitoring of nuclear installations can broadly speaking be divided into two, one part which monitors the various radioactive sources and one monitoring the environment for eventual releases. Monitoring of radioactive sources are performed by the nuclear installations and by departments in GosComPriroda. Monitoring of the radiological situation at the premises of the nuclear installations within the public health zone and within the monitoring zone is the responsibility of the management of the installation. Within the monitoring zone, the radiological situation is monitored at fixed sites by way of surveys carried out by a so-called fast response group. The territorial departments of Roshydromet provide environmental monitoring outside the public health zone, and some fixed Roshydromet stations are placed within the monitoring zones of a nuclear installation. In addition, the territorial departments of Roshydromet run a monitoring program for each nuclear installation located within its territory. If the 100-km zone around a nuclear installation includes another territorial department, the departments involved try to co-ordinate the monitoring program.

The monitoring programs of the various nuclear installations are composed of both continuous and periodic sections. A major part of continuous monitoring is the daily measurement of gamma radiation dose rate (GDR) at all stations and posts within the 100 km of a nuclear installation (more than 1300 posts perform GDR). A major part of the periodic monitoring program is the above mentioned radiation survey performed monthly by a so-called fast response group. The surveys are performed in the vicinity of roads and waterways within 20-km of the nuclear installation. Measurements are made at individual points at some 1-2 km intervals supposedly not less than 5 km from the road, but under difficult conditions as in winter are often made by the side of the road. Snow and vegetation are sampled concurrently with a gamma survey at some 10 to 15 points within a 10-km

zone of the nuclear installations, preferably in all directions from the installation. If increased values are observed the samples are sent to a regional laboratory for isotopic analysis. In addition to the radiological monitoring of fixed points within the Russian federation Roshydromet participates in and arranges special investigations in areas affected by radiation accidents and incidents, and also in areas presumably affected by radioactive waste disposal. Thus Roshydromet played an important role in the joint Russian-Norwegian programme to investigate the radioactive pollution of waste dumping sites in the Kara Sea (JNRC 1994).

To summarise, many of the above mentioned institutions could have been specified in the questionnaire regarding trust in authority sources, but this was seen as too extensive for the resources of the current project as this clearly would imply a larger questionnaire. However, a more simplistic approach was chosen in an

Figure 15.2 Degree of trust in different sources in a nuclear accident situation, including Norwegian refreence material



attempt to survey the degree of confidence in different information sources in a situation involving a nuclear accident. As in the question of trust in different parts of the mass media, the respondents were shown a card with the three levels of confidence.

From figure 15.2 it emerges that many respondents on the Kola Peninsula see environmental organisations and foreign experts as possessing a high degree of trustworthiness. On the other hand, national and military authorities receive a very unfavourable evaluation when it comes to confidence. Among federal authorities, the Ministry for Emergency Situations receives the most favourable evaluation. It is interesting to note that the centre-periphery gradient on the Kola Peninsula is the opposite of what is seen in Norwegian studies. On the Kola Peninsula, both local health personnel and regional authorities receive a more favourable response than their national counterpart, and this is exactly opposite to findings in the Norwegian studies, where central sources are preferred to the local ones (Tønnessen et al. 1995, p. 268).

There is of course a possibility that other important sources have been omitted from the alternatives presented to the respondents, but overall it seems as if the Russian authorities face major challenges in terms of information policies and the confidence they are able to command in a nuclear accident situation. The findings especially highlight the trust problems inherent in a radiological emergency involving a military nuclear installation. The information policies chosen by the Northern Fleet in the recent incidents of 1998 do not point to any improvement in the public's perception of military authorities as reliable information providers[8].

As far as the compelling difference in level of trust in authorities observed on the Kola Peninsula versus the Norwegian context is concerned, it should firstly be noted that the data from the Norwegian material is adapted from a five-point scale. Secondly, the levels of trust in authorities observed in Norway in the RISKPERCOM data set is quite outstanding compared to other European countries (Sjöberg et al. 1998). Thirdly, the various authorities in the former Soviet Union amply demonstrated their unwillingness to openly inform the general public regarding a radiological emergency. The more well known example here is the fact that the Chernobyl accident was only publicly made known after a worker at the Swedish Nuclear Power Plant of Forsmark triggered a detection alarm in the gate on the morning of Monday April 28th as he was entering the NPP area with Chernobyl fallout particles on his clothing.

[8] An example of the current information practices is the handling of an incident that occurred in Zapadnaya Litsa on January 26th, when a pipe broke in the cooling system of an Oscar-II submarine. The incident was denied by the Northern Fleet press centre until the afternoon of January 29th, even though a vice admiral was interviewed regarding this on Murmansk radio on January 28th.

The statistical analysis of variance in confidence ratings and sampling area indicates a moderate tendency for the local health personnel to be accorded higher confidence among respondents in Murmansk City, whereas respondents in Pechenga more often report that the local health personnel are *not trustworthy.*

The analysis also shows some interesting patterns of age effects, although the effects observed are of moderate size. Domestic expert sources such as national authorities and Russian radiation experts have the highest confidence ratings among the youngest age segment (18-29). In addition, both the older and younger segments show less confidence in foreign experts, whereas environmental organisations have lower confidence ratings among the oldest respondents. This finding is quite as expected, but the finding that both the younger and older (as opposed to the mid-range) are more sceptical of foreign experts ought to be noted, although the overall confidence ratings for foreign experts are indeed very favourable.

No strong effects of educational level were observed; there is only a slight tendency for national health authorities more often to be seen as not trustworthy by respondents having completed their higher education. A similar, but weaker tendency concerns confidence shown in Russian radiation experts.

To summarise the confidence in information from various sources in case of a radiological emergency on the Kola Peninsula it ought to be noted that Environmental organisations, foreign experts, the Ministry for Emergency Preparedness (EMERCOM), and local health personnel enjoy more favourable confidence ratings. In an emergency situation involving military installations, the military authorities might be well advised to convey important information through other civilian authorities or organisations in order to counteract the perceived distrust among a large proportion of the population.

15.4 Preferences for warning channels and advice givers in a radiological emergency situation

Two items from the ongoing RISKPERCOM project were used to ask the respondents where they would seek advice in case of a nuclear accident, and what their preferences were regarding the type of channel from whom they would wish to receive a warning sign in an emergency situation.

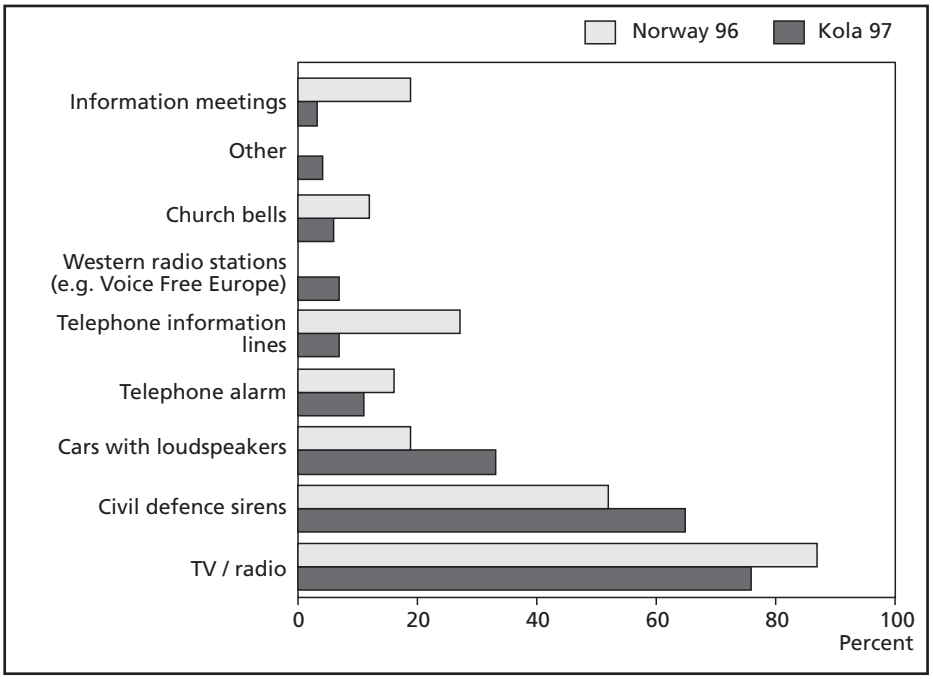
The three most important warning channels for the respondents are TV / Radio, civil defence sirens and cars with loudspeakers. It is noteworthy that the totally dominant position of the mass media in the Norwegian material shows more nuances among respondents on Kola. Put another way, the gap between the most

preferred and second most preferred channel is smaller in the Kola material. It is also quite interesting to note the strong position of the civil defence siren system; this warning channel is even more preferred among the older segments where mass media and civil defence sirens have nearly the same proportion of preference.

The very high level of urbanisation may very well explain the fact that cars with loudspeakers are seen as a dominantly preferred warning channel on the Kola Peninsula. In Norway, where more than 50 % of all municipalities have less than 5000 inhabitants, the task of covering everyone geographically appears to be so ludicrously impossible that the option seems unattractive, whereas the various cities on the Kola Peninsula have a comparatively more limited spread.

On the Kola Peninsula about half of the respondents stated they would seek advice from family and friends, and this alternative together with regional authorities are the only ones more often replied among Kola respondents. In the figure, there are indications of quite clear differences between the different data sets; however, the respondents were asked to check "all that applies" and Norwegian respondents on average gave more responses (3.9 responses versus 2.3). Thus to compare proportions directly will not be meaningful, but ranking the different alternatives within the material can be performed. Nearly twice as many sources are selected in the Norwegian data set, indicating perhaps broader diversity of existing or possible

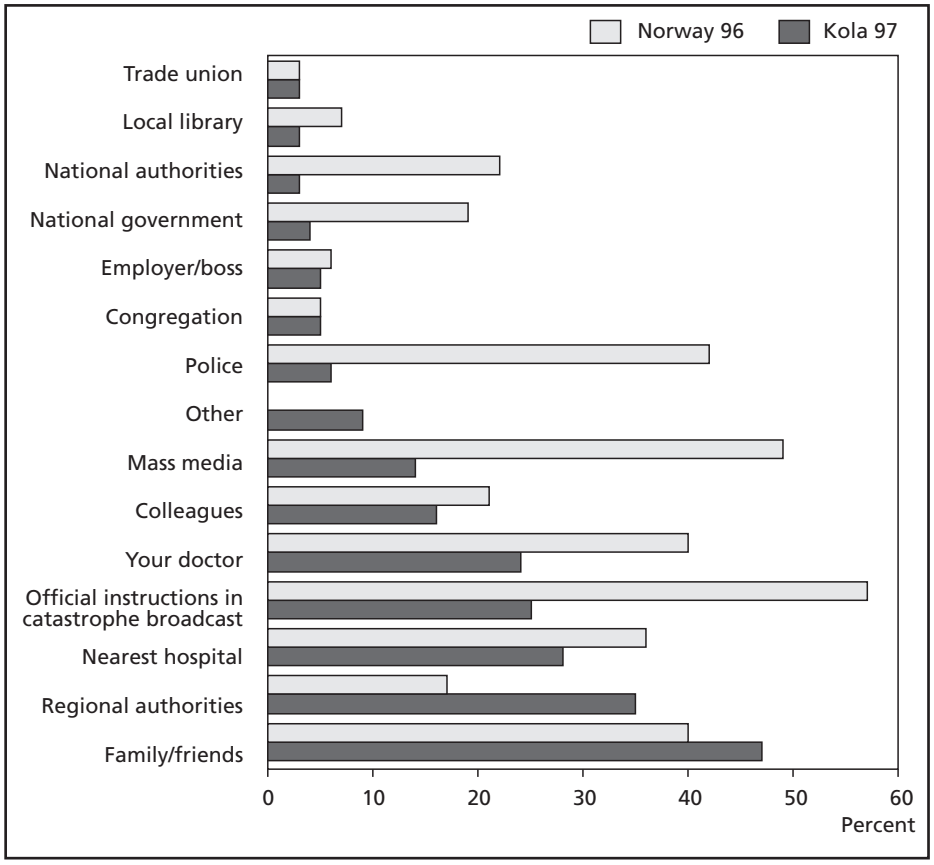
Figure 15.3 Preferred warning channels in a nuclear crisis situation



providers of advice. Family and friends are clearly important for advice in both samples. Striking difference are seen, however, concerning advice offered in official emergency broadcasts, and especially in anticipated use of the mass media and police, upon which Norwegians would heavily rely.

The statistical analysis shows that the regional authorities, although generally enjoying quite a favourable position as providers of advice, clearly are not seen as prophets in their own country[9] i.e. one main effect is that respondents in Murmansk city do not mention them as providers of advice. As an example, 53 percent of the respondents in Pechenga mention regional authorities in this context compared to about 30 percent in Murmansk City. Regardless of this sample variance, the relative frequent mentioning of regional authorities as advice providers is a

Figure 15.4 Advice providers in a nuclear crises situation



[9] As explained earlier in this report the regional authorities of Murmansk Oblast are situated in Murmansk City

finding somewhat in contrasting to the observed confidence ratings of the same regional authorities as an information source (ref. figure 15.2). For local health personnel (the respondent's own doctor) an opposite pattern is found, the confidence ratings are high but the tendency to see them as advice providers is not so often found.

Local health personnel, as represented by the respondent's doctor, holds a stronger position as advice provider among older respondents; about one in five of the youngest respondents (18-29 yrs. of age) mentions their doctor, against about one in three of the older segments.

Official emergency broadcasting holds a stronger source position among the segment of the respondents with higher education.

To summarise the preferences for warning channels and advice providers; TV/radio, civil defence sirens and cars with loudspeakers are the more preferred modes of warning channel, whereas family/friends and regional authorities are seen as the more likely choices for advice. Although the mass media plays an important role as a warning device, they are not seen as a relevant advice provider. The evidence is, as also indicated from the trust ratings, that informal information sources such as friends, family and non-governmental organisations will provide an important basis for the respondent's evaluation of the uncertainties inherent in a radiological emergency situation. The relevant authorities should thus focus on an information strategy for securing interaction with, and input into, such informal information exchange.

Chapter 16 Conclusions

One of the project hypotheses, namely that major economic difficulties are the prime concern of the population on the Kola Peninsula is quite well documented in the present study. The specific mention of radiological emergencies as a personal and general concern is quite rare. The present study documents that compared to a similar Norwegian data set, relatively few respondents mention radiation threat issues in the context of personal concern. The more conventional environmental problems of the region are more frequently mentioned, both as a personal and a general concern, but then more typically among those issues "last mentioned".

However, when interviewers specifically introduce environmental issues to respondents, a more detailed picture of perception of different environmental issues evolves. When asked to rate personal and general risk from 33 different hazard items, nuclear waste and the nuclear threat on the Kola Peninsula both have high mean risk ratings. Interpreting the slightly diverging response patterns of unprompted concern versus mean personal risk ratings, and designing a format to eliminate any questionnaire bias, are methodological challenges. For instance, as discussed in some detail in Chapter 9, one major environmental problem on the Peninsula concerns air pollution and emissions from heavy industry, but still the mean personal risk rating for air pollution is lower than that for *nuclear waste* or for the *nuclear threat on the Kola Peninsula,* whereas air pollution is typically more often mentioned in the open ended response about concerns. Many explanations could be appropriate, for instance that the concept of risk is not one of everyday language, whereas personal concerns are. Independently of the explanation chosen, one also observes patterns of similarity across the response to concerns and personal risk ratings.

If ratings for personal risk embrace another part of the respondents' perception of the environment than do open ended questions it may be important to give considerations to what kind of hazards that are not offered by researchers among the risk items. The French partner of RISKPERCOM has substantiated how many of the concerns often raised in the open ended format are not a part of the risk ratings list (Mays et al. 1997, p. 14).

What then are the more "important" environmental problems, as perceived and interpreted by the respondents? Are they the more conventional problems or the more conspicuous one of radioactive pollution? The findings of this study do not allow a general answer valid for all respondents across gender, education level,

and above all, sampling area. The more distinct finding is that, in harmony with previously unpublished data from Hansen's 1992 study and the previously mentioned study by Smith-Sivertesen and co-workers, inhabitants of the Pechenga sampling area are special in this regard. For respondents in Pechenga the more conventional environmental issues are assigned much more urgent priority than are problems related to radioactivity. The overall pattern for the other sampling area is that of diverging opinions, with a slight indication that conventional environmental problems are considered to be more serious. For instance, about six out of ten of the respondents in the sampling areas of Apatity and Kandalaksha agree with the statement that in their Oblast other pollution issues are more serious than that of radioactive pollution. In Murmansk City, the opinions on the same statement are divided more evenly, and there is a slight tendency among respondents, in the northernmost city district of *Lenin,* in particular males, to perceive the radiological threat as the more serious. Female respondents across the sampling areas are more apt to respond with full agreement with the notion that radioactivity issues are the more important. Although not particularly large, this gender effect corresponds well with gender differences observed in the Norwegian population (Weisæth 1991, Tønnessen et al. 1995).

One may argue that the weighting of different environmental issues is unfortunately also somewhat dependent upon which section of the report is used for the final "verdict". On the one hand, radiological emergencies are hardly mentioned as personal concerns in the open-ended items, and when asked to agree or disagree if other pollution problems are more serious, the majority agrees that other problems are more serious than radioactive pollution. Another trend emerges when looking at the quite large segment of respondents that are responding in a way that indicate involvement with the issues of radiological emergencies. The high mean personal risk ratings for nuclear waste and the nuclear threat on the Kola Peninsula accentuate the impression that nuclear risks are salient for these populations, even though important concerns as expressed in the open ended section are missing from the hazard rating list applied.

However, the focus shifts when the perspective of the current pollution issues is broadened and hypothetical future accidents are taken into consideration. Looking for instance at the statements of probability that a new nuclear accident that affects the Russian Federation may occur, and perceptions regarding the respondents' own district being affected by such an accident, there is strong evidence of perceived vulnerability to future accidents. If another nuclear accident affecting the Russian Federation does occur, nearly half of the respondents think it is very likely that their own district would be affected.

One may tentatively suggest that this perceived vulnerability to future accidents contributes to the fact that, even though a slight majority replied that other environmental problems are more serious, a slightly larger majority prefer foreign aid contributions to be aimed at the issue of radiological pollution.

Reaction patterns

The findings of the perceived likelihood of various reaction patterns confirm one prediction important to the project, i.e. generally the population on the Kola Peninsula is oriented towards active behavioural coping patterns. This is confirmed both at a general level for the respondents usual problem solving approach, and for their preferences for reaction patterns in a radiological emergency.

Three alternatives are judged more likely by a high proportion of respondents: to obtain as much information as possible, getting hold of iodine tablets, and being careful with food & water. Only a troublesome[1] low percentage considers the option of keeping oneself indoors as a likely option. As discussed in Chapter Two, in many radiological emergency situations staying indoors in e.g. a concrete building is a valuable protection that may greatly reduce the dose attained. In a situation of the type that are portrayed in these data, in which a large proportion sees escape as a more likely response, a chaotic situation like that experienced with the Three Mile Island accident may occur in case of an accident. In such conditions the escapes will not be time efficient, and fleeing persons will in fact expose themselves crossing areas of typically high dose-rates. As far as destination and travel format for an eventual escape are concerned, the respondents clearly prefer to go to Russia or other parts of the fomrer Soivet Union, and trains or planes are the most preferred format. The sampling area of Kandalaksha distinguishes itself from the other sampling areas, as a larger proportion there never will consider the reaction alternative of leaving in a radiological emergency.

Going beyond the findings to reflect on radioprotection measures, the relevant authorities might aim at reducing the high "escape" proportion by working harder with information about short term countermeasures related to: iodine tablets, food/water and to take sheltering by keeping indoors. Indications were seen in the factor analysis that the more "functional" alternatives are associated with

[1] To state that a low percentage is "troublesome" will of course be very much depend on the facts of the radiological emergency situation, but in many situations with radioactive fallout those in some minimal distance from "point zero" may reduce their attained doses considerably by staying indoors making the windows and doors dust proof, while waiting for some radioactive cloud to pass over their location, or to wait for a reduction in the dose rate outdoors to occur before a planned transfer to another location with less fallout. The dose acquired is dependent upon the intensity of the ionising radiation (technically termed dose rate) and of course also the time one are exposed.

travelling away. Perhaps by optimising the availability of other, more adaptive coping patterns, the anticipated tendency to "escape" could be reduced.

A non-conforming group in a preparedness measures perspective

The about one out of five respondents, that "not very likely" will follow the authorities advice as best as possible, poses a special challenge from a preparedness measure planning perspective. Some detailed background information and correlation to other variables will be given for this non-conforming group. In this group, some six out of ten are male, more than six out of ten are below 40 years of age, and more than one out of five have finished higher education. Put another way the non-conformant respondents generally are younger males with higher education. This profile in background variables is quite similar to what was found in Norway in 1993, except in Norway a higher income level was more typical attribute than a higher educational level (Tønnessen et al 1995). Correlation to other variables further confirms the distrust in especially national authorities among respondents in this group. They also prefer unofficial sources like friends and family as advice providers. This pattern of distrust is also seen in the confidence ratings they give to various mass media sources, however they prefer newspaper sources more than others for information about environmental problems. As far as trust in information from foreign experts after a nuclear accident are concerned, this authority opposition group confirms to the overall response, thus nearly six out of ten perceive foreign experts as very trustworthy. When it comes to reaction patterns in a radiological emergency, those in the non conformant-group does not either want to consult to neighbours or experts solutions, and in addition, staying indoors, being careful with food ad water or getting hold of iodine tablets are not seen as likely responses. However, travelling away is seen as a more likely response among the non-conformant group, thus further accentuating the preparedness measure relevance of this special group. Clearly, this resourceful non-conforming group of younger males with an active coping style should be properly addressed in the preparedness measures that relevant authorities are working on. One practical implication from this research for relevant authorities could be to develop communication procedures and links to alternative sources. Thus providing means for getting important information through to such critical populations groups via alternative routes without being rejected at the recipient end because of low confidence in the information sender.

Trust in various authorities in a nuclear accident situation is not very high, although quite a few perceive the regional authorities as a possible provider of advice in a radiological emergency. From a more optimistic perspective, one may argue that among the most preferred alternatives in all data sets is that of information

gathering. Hence, authorities by working very actively with various mass media institutions may very well get their advice across in the media. We see indications from the trust shown in the media that by co-operating with a broad range of both state-owned and private mass media institutions one may succeed in reaching out to different segments of the population.

A majority of the Kola respondents sees environmental organisations as very trustworthy in a nuclear accident situation, while in Norway environmental organisations as a sort of "anti-establishment" source enjoy a high level of credibility in particular population segments[2]. On the Kola Peninsula, such NGOs may play a complementary role in providing information and addressing issues relevant to an emergency situation. The relevant authorities may do well to actively use this observed credibility, contacting environmental organisations to ask them to spread the message of importance of e.g. keeping indoors should a radiological emergency be declared.

As far as the main hypotheses[3] of Part II of the project are concerned, these were mainly confirmed by the findings of the current project.

Firstly, already in the spring of 1997, before the recent grave economical crises, economic difficulties were the main personal concern of the respondents. Some six out of ten respondents mentions such problems as their first response to an open ended question about their personal concerns. Furthermore, compared to the proportion mentioning economical difficulties, environmental problems are not mentioned by many as a concern, and the minor four percent share that mentions nuclear threats / radioactive pollution as a concern typically represent the more resourceful respondents. The proportion mentioning nuclear issues is much less, than that found in the Norwegian population (Tønnessen et al., forthcoming).

Secondly, there are as expected clear regional differences in the weighting of the various environmental issues. Respondents in the sampling area of Pechenga especially concerned about conventional pollution, whereas a larger share of respondents in the other sampling areas put more weight on radioactive pollution issues. Very much in agreement with these observed regional differences, there are also differences of opinion among respondents as to what environmental issues foreign authorities should give priority to in their efforts to contribute to the environmental challenges of the region. However, overall a slight majority wants foreign authorities to give priority to radioactivity problems. General environmental attitude

[2] This finding is relevant for the Norwegian 1993 data set, after that time the environmental organisation Bellona has been very active in Norwegian public debate regarding the situation at the Kola Peninsula so this anti establishment source preference for environmental organisations may have changed in Norway.

[3] The main hypotheses are described at the beginning of Chapter 12

questions reveal quite a high level of interest in environmental issues, but a rather low level of active involvement, and quite a grim outlook on the state of the global environment.

Thirdly, the respondents exhibit quite a high level of awareness as far as radiological emergency issues are concerned. More than seven out of ten respondents expect another nuclear accident to occur within the next ten years, a level quite similar to that observed in Norway and Northern-Norway. The rate of respondents on Kola who believe such an accident will affect their own district is high. In line with this one out of four respondents are very much preoccupied with the issues, and more than one out of seven discusses these frequently.

Fourthly, a major hypothesis of the project was related to a population of which a large proportion was without any longstanding roots in the region, and which demonstrated action-oriented problem solving behaviour. In psychological terms, more than four out of ten respondents typically exhibits indications of an active coping style, and will try to influence the situation when facing difficult problems. Already before the interview, some six out of ten respondents had contemplated their own response given the situation of a radiological emergency. From a preparedness measure perspective, those one out of five respondents not very likely to follow the authorities' advice present a special challenge. The many respondents conforming to a typical active coping style, together with the large proportion of immigrants in the region pave the way for the fact that more than one out of three respondents consider travelling away as a very likely response in a radiological emergency. In a situation where the decision has been taken to leave the region, trains or planes are the preferred transportation methods. A hypothesis not confirmed was the expectation of a difference in preferred transportation method given either a Kolskaya AES emergency, or a radiological emergency involving a military installation. The hypothesis that foreign destinations would not come across as very likely endpoints for an eventual escape in radiological emergencies has been amply confirmed. For instance, if one aggregates the figures for the three Nordic countries of Finland, Norway, and Sweden, only a total of some three-percent regard these Nordic countries as a likely destination for a flight. Some may argue that 1-3% of the, regionally speaking, large population still yield many individuals. To this we would counterargue that in such a small observed cell size, the uncertainties involved are very large, thus invalidates such a generalisation. The main conclusion must be that both those that already had escape plans and the general pool of respondents preferred to escape to destinations within areas of the former Soviet Union.

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Appendix 1 Description Of The 1992 And 1997 Living Conditions Surveys Of The Kola Peninsula

The present report is based on data from two different surveys of the population in selected areas of the Kola Peninsula. The survey samples have been drawn independently, thus this is not a panel survey. In this appendix, the sampling distribution, sampling procedures and non-response will be described for both surveys.

1 Sample Allocation And Implementation For The 1992 Survey

The details of this survey have been described earlier in the report "Living Conditions on the Kola Peninsula" by Erik Hansen (Fafo report no. 155, June 1993, pp. 7–11), and only the main features will be referred to here.

1.1 Sampling procedure and distribution

The sampling procedure chosen was a stratified, two-stage random sample, drawn on the basis of electoral lists. The survey population was thereby defined as adult (18 years and older), enfranchised citizens who were registered as voters for the presidential elections in spring 1991.

The strata consisted of the geographical regions selected for study. These were Murmansk city, Severomorsk city and the settlement Nikel in Pechenga municipality. In the first drawing stage a number of electoral districts were drawn using the fixed interval method. Within these electoral districts, respondents were drawn using the fixed interval, random starting point method. Sample distribution is shown in table A.1.

This yielded a net total response rate of approximately 90 per cent, which is extraordinarily high. Part of the high response rate can be attributed to the diligence

Table A.1 Sample distribution for the Kola Peninsula Living Conditions Survey 1992

Stratum	Number of PSUs drawn	Gross sample	Non-response	Deleted	Net sample
Murmansk	20	1484	167	14	1303
Severomorsk	5	387	15	5	367
Nikel	3	199	3	3	193
SUM	28	2070	185	22	1863

of the interviewers, and also to the curiosity generated among the population to this first survey investigating real patterns of living conditions in this region. In 1992, there was still no discernible "survey fatigue" among the population, and the fear of crime had not yet become as widespread as in later periods.

2 Sample Allocation And Implementation For The 1997 Survey

2.1 Stratification

In the design of the 1997 survey, it was the intention of the survey designers to keep the sampling design as closely as possible to its 1992 predecessor, in order to maintain the highest possible degree of comparability. The 1992 survey comprised the areas Murmansk city, Severomorsk and the settlement Nikel, including surrounding rural areas subject to the municipal administration. However, according to a presidential decree enacted in October 1996, Severomorsk and the surrounding areas were declared to be a "closed territorial formation", and hence out of bounds for survey purposes. Instead, the towns of Apatity and Kandalaksha were added as strata, together with Pechenga municipality, comprising the settlement Nikel as well as all other rural areas. In this manner, the survey area came to run in a rough north-south direction, following the main line of settlement on the peninsula, which forms a belt more or less following the main railway line from Kandalaksha Bay on the White Sea to Kola Bay on the Barents Sea.

The survey area as defined by these strata comprises 65 per cent of the population on the peninsula, and in a broad sense, the selected areas can be said to be fairly representative of the settlement types in the region.

2.2 Sampling frames

On the Kola Peninsula, a good sampling frame in the form of a complete and updated vital register or electoral list is not easy to come by. No such lists or registers containing actual names of inhabitants could be made available to the survey designers. Thereby, individual respondents themselves could not be sampled directly at the sample design stage. However, in connection with the elections for local governor and the assembly a description of the delimitation of electoral districts in the form of addresses (street names and house numbers) belonging to each electoral

district (*uchastok*) had been published in local newspapers, and the sample was therefore constructed as a sample of addresses, based on this information. Publicised information on the number of electors in each of these electoral districts was also available, and these districts were therefore applicable for survey purposes as primary sampling units. Based on the information provided on the delineation of the area into electoral districts, together with the information on the number of electors in each district, a representative sample of addresses could be assembled.

2.3 Sampling method

The sampling form chosen was a stratified three-stage, clustered sample. After stratification, described above, sampling was done at the following stages:

First stage: Sampling of PSUs

Electoral districts were used as Primary Sampling Units (PSUs) based on the available information described above. However, the list comprised a minor number of electorate districts with very few electors, sometimes as few as 50 individuals. In order to include only PSUs with a size workable for sampling, all electoral districts comprising fewer than 500 electors were excluded from the selection. This excluded approximately 2 per cent of the population. In Murmansk city, all the PSUs remaining after the removal of the small areas from the list were included, i.e. selected with a probability of inclusion equal to 1. In the other areas, PSUs were selected using the PPS (Probability Proportionate to Size) method of sampling.

Second stage: Selection of households

At the second stage, households were included in the sample through selection of housing units. In each PSU, one address was drawn randomly from the list of addresses. This address, which comprised a street name and a particular house number, formed the starting point for a selection algorithm to be followed by the interviewers as they walked through the PSU. The interviewers would first go to the randomly chosen address indicated for the PSU, identify the lowest numbered housing unit in the lowest numbered or lettered entrance, and conduct the first interview there. The following housing unit was identified by counting a set number of doors to housing units in numerical order (or from left to right) ascending up the stairs, and continuing into the next entrance or house as required, until the pre-set number of households for the PSU was reached. The housing units identified in this manner were to be selected as a respondent household.

Third stage: Selection of individual respondents (RSIs)
In each selected respondent household, one household member was to be selected as individual respondent (Randomly Selected Individual – RSI). After having established contact with the household, the interviewers would identify the household member who was the last to have had his or her birthday, and interview this person. Only this person could be interviewed, and could not be replaced in the case of a refusal or for other reasons for droping out.

2.4 Sample allocation

The sample was allocated to the survey areas in a manner which would give each stratum a sub-sample proportionate to its total weight in the population in the surveyed areas. Sample size by area is given in table A.2.

Table A.2 Sample allocation, the 1997 survey

Stratum	Population	Voters	Nr. of PSUs	Drawn PSUs	Cluster size	Sample
Murmansk	399000	300094	*	134	10	1340
Apatity	73200	54424	27	16	15	240
Kandalaksha	71700	53190	43	16	15	240
Pechenga	48900	37810	30	12	15	180
Total	592800	445518				2000

2.5 Sample implementation

In spite of careful preparation and documentation of the sample as well as monitoring by a survey design representative during the interview phase, some miscommunication did occur over the actual implementation of the sample. As a consequence, the interviewers perceived the number of interviews to be made in each PSU (10 in Murmansk, 15 in the other areas) not as a gross sample, but on the contrary as a net sample. Consequently, they did not stop after having contacted 10, resp. 15 households and allowing for normal drop-out, but continued until 10, resp. 15 interviews were obtained. This manner of sampling is used by some survey organisations, but then mostly in connection with carefully determined quotas of different types of respondents. In a sample design of this type, such a manner of implementation will tend to enhance the bias in the net sample created by drop-outs.

The net sample has therefore been carefully inspected for all possible types of bias using two different methods. Firstly, the sample was compared with available register data for scores on background variables and other characteristics which could influence the integrity and representativity of the sample. Secondly, those

respondents who were "in excess" in each PSU could be removed, and analyses of this reduced sample could be compared to the full body of data. No deviations between the two sets beyond normal statistical margins of error could be detected using either of these control methods. The full sample, containing all interviews conducted by the interviewers was therefore deemed to be useable for analytical purposes.

However, the actual implementation of the sample was used as basis when calculating the inclusion probabilities and adjustment weights for the data set, cf. below.

2.6 Inclusion probabilities and weighting

The calculation of the probabilities of inclusion in the sample formed the basis for the calculation of the expansion weights. These were calculated in the following manner:

Selection probability for PSUs

PSUs were selected for inclusion using PPS (Probability Proportionate to Size) sampling, i.e. the probability of inclusion of a PSU varied according to its proportionate share of the population of voters in the total stratum.

If N(s) is the total number of electors in stratum s, m(s) is the number of selected PSUs in stratum s, and n(s,c) is the number of electors in stratum s, PSU c, the probability of inclusion of PSU c in the sample is equal to:

$$P_1 = \frac{m_s . n_{s,c}}{N_s}$$

Selection probability of households:

If $n^H(s,c)$ is the number of contacted households in stratum s, PSU c, and $N^H(s,c)$ is the calculated total number of households in stratum s, PSU c, based on the average number of electors per household, the probability of inclusion for a household in a given PSU is:

$$P_2 = \frac{n^H_{s,c}}{N^H_{s,c}}$$

The combined inclusion probability for a household is thereby:

$$P_{HH} = P_1 \cdot P_2$$

Selection probability of RSIs

If $n^H(s,c,h,)$ is the number of adults in stratum s, PSU c, household h, the inclusion probability for an individual in a selected household is:

$$P_3 = \frac{1}{n^H_{s,c,h}}$$

The combined selection probability of an RSI is thereby:

$$P_{RSI} = P_1 \cdot P_2 \cdot P_3$$

Based on these inclusion probabilities, expansion weights could be calculated both for households and RSIs.

The expansion weight (W) for a household thereby becomes:

$$W_{HH} = \frac{1}{P_{HH}}$$

Similarly, the expansion weight for RSIs becomes:

$$W_{RSI} = \frac{1}{P_{RSI}}$$

Both these weights can be corrected to account for sampling bias by multiplying by adjustment factors calculated on the basis of register data. The household weights were corrected for the distribution of households of different sizes, and the RSI weights were corrected for age and gender structure of the adult population.

Appendix 2 Comparative materials for part two

A detailed description of the various comparative materials used in Part Two can be found below.

Reference material from Northern Norway

The reference material from Northern Norway that will be used in Part Two comprises telephone interviews with 1600 respondents performed in 2 phases during 1996 in the 3 northernmost counties of Norway, namely Nordland, Troms and Finnmark. The three counties have a total population of about 470 thousand inhabitants as of January 1st 1996 with 45, 25 and 19 municipalities in each county respectively, and respective average of respectively 5360 / 6050 / 4020 inhabitants per municipality. Only 9 municipalities have more than 10 000 inhabitants.

The county of Nordland dominates the population of this part of the country with more than half of the population of Northern Norway. The land area covered by the three counties totals about 107 thousand square kilometres (about 1/3 of Norway's total land area), Finnmark clearly being the largest with a total land area greater than Denmark.

The telephone interviews were carried out in connection with a joint project between SI and NRPA. The interviews were done in two stages with the first phase in January 1996 and the second wave in June 1996. For the purposes of reference material in the present context the timing of the interview will not be utilised, and the two waves will be pooled together. As especially Finnmark and Troms were important for NRPA/SI purposes an over sampling of these counties was undertaken with a total of 600 interviews in each county but only 400 in the county of Nordland (see Haast 1995 for more details). The distribution of interviews between counties from a population representative view should however have been about 820 in Nordland, 518 in Troms and only about 262 in Finmark. Of the 89 municipalities in Northern Norway the interview material covers every one except for three in Nordland namely Træna, (537 inhabitants), Skjerstad (1307 inhabitants) and Røst (726 inhabitants), equivalent to about 1 percent of the population of Nordland County.

For the purposes of being used as reference material in this present context, the data file will be weighted on the basis of population size at the municipality level. Thus in the weighted data file Nordland will have about 51 % of the respondents, Troms about 32 % and Finmark about 16 %. The data file will also be weighted by sex and age distribution within the three counties based on Statistics Norway age categories (SSB 1997) The use of a telephone interview format for such complicated issues is of course problematic. However the topography of this part of Nor-

way makes it very resource demanding to conduct face to face interviews with a representative sample. A timely question relates to respondents without a telephone? From previous research in Norway one knows that young single «just out of the nest» respondents constitute an important subgroup amongst respondents without a telephone (Tønnessen et.al 1995 unpublished data). This research was undertaken before the «mobile phone» revolution, but it is not clear how mobile telephone numbers are aggregated within the random generation of phone numbers currently done in Norway for telephone interviewing purposes. Ordinary household telephone numbers comprises a number series with a prefix that reflects geography (districts) while a mobile phone number does not give any clues about the geographic location of its owner. Thus about 7,5 % of respondents in the 1993 reference material in Norway living in households without a telephone perhaps still lies outside the scope of this Northern Norway material.

Reference Material from Norway 1993

The older reference material from 1993 comes from a nationwide representative sample of 1005 face to face interviews performed by Norwegian Gallup in their OMNIBUS (for more details regarding this see Tønnessen et.al 1995).

Reference material from EUROBAROMETER

When it came to the issue of risk from different industrial installations a modified version of an item used in EUROBAROMETER was chosen (for short EB)17, 22 and 26.

The Euro-Barometer series of surveys was launched in 1974 by the Commission of the European Communities in order to provide a regular monitoring of the social and political attitudes of the public of the nine member states. Euro-Barometers are carried out each spring and fall. For the purposes of reference material, means across EB 17, 22 and 26 will be used. The main theme and date for the three different EB's are as follows; EB 17, April 1982 Energy and the Future, EB 22 Energy Problems and the Atlantic Alliance October 1984, and EB 26 Energy Problems November 1986.

The following text is a statement required when using Eurobarometer data: The data (and tabulations) utilised from this material were made available by the Inter-university Consortium for Political and Social Research (ICPSR). The data for EURO-BAROMETER were originally collected and prepared by Jacques-Rene Rabier, Helene Riffault, and Ronald Inglehart. Neither the collectors of this original data nor the Consortium bear any responsibility for the analysis or interpretations presented here.

Environment and Living Conditions on the Kola Peninsula

The reform period in Russia has not only entailed a series of challenges to social and economic policy, but has also cast new light on the sins of the past. The population has lived through nearly seven years of economic transformation, political turmoil and social upheaval. Nevertheless, in many spheres of life the legacy of the Soviet period continues to influence the lives of people all over Russia. One such sad legacy is the state of the environment in several regions, where people depend on polluting and sometimes dangerous industrial installations for their livelihood.

This report presents the results of a survey covering a representative sample of major population centres on the Kola Peninsula. The report consists of two separate parts. Part I contains an analysis of the living conditions of the Kola population and describes the changes which have occurred in these conditions during the period 1992 - 1997. The report describes demographic factors, employment, income distribution, education, housing, health and migration. Part II of the report is an analysis of the population's knowledge of, perception of, and attitudes to various environmental hazards, with particular focus on radiological emergencies involving nuclear installations of which there are many on the peninsula. The report presents a number of conclusions with implications for disaster preparedness in the case of an accident involving the release of radioactivity to the atmosphere occuring in this region.

The survey described in the report was carried out in April-May 1997 as a cooperative project between The University of Oslo, The Norwegian Radiation Protection Authority, Fafo - Institute of Applied Social Sciences and Murmansk Regional Committee of State Statistics.

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