ECOLOGICAL MIGRANTS IN BELARUS:
Returning Home after Chernobyl?

IOM International Organization for Migration

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TABLE OF CONTENTS

Boxes

Tables

Figures

Annexes

Acronyms

CIS	Commonwealth of Independent States
GCP	"Government Chernobyl Programme" - Government Programme of the Republic of Belarus on Minimizing and Overcoming the Consequences of the Catastrophe at the Chernobyl Nuclear Power Station
GDP	Gross Domestic Product
EC	European Commission
EU	European Union
HDI	Human Development Index
IAEA	International Atomic Energy Agency
ICPR	International Commission on Radiological Protection
IOM	International Organization for Migration
IPHECA	International Programme on the Health Effects of the Chernobyl Accident
OECD	Organization for Economic Cooperation and Development
PPP	Purchasing power parity
TACIS	Name of the EU initiative providing grant support to CIS countries and Mongolia to foster exchange of knowledge and expertise through links and networking
UNDHA	United Nations Department of Humanitarian Affairs
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNHCR	United Nations High Commissioner for Refugees
UNICEF	United Nations Children's Fund
WHO	World Health Organization

EXECUTIVE SUMMARY

Overview

This report presents the results of a feasibility study undertaken with the agreement of Belarus authorities, and fulfills a follow up requirement of the 1996 CIS Regional Conference on Refugees and Migrants. The report reviews Chernobyl-related migration issues in Belarus. The review will help determine its roles for support to the Government of Belarus in strengthening components of the country's medical infrastructure dealing with consequences of the Chernobyl accident, in order to ensure that persons displaced by the accident moving back to affected areas will have improved access to health services.

Findings and recommendations are based on a mission to Belarus, 23 January to 6 February 1997, and subsequent analysis. The analytical framework for the study comprised four parts (section 2). The first reviewed the context in terms of the population, economic transition underway, and state of the present health system of Belarus. The second raised three questions about returning Chernobyl migrants: *Is it safe to return? Does anyone want to return, and if so, under what conditions? What are the demographic and socioeconomic characteristics of the population wishing to return?* The third broadened the study question from *medical* to *health-related* infrastructure to focus on meaningful initiatives. The fourth part proposed criteria for support to displaced Chernobyl migrants returning to their home areas. The criteria are a stepping stone to policy issues that should be considered for international agencies' work in Belarus (section 4).

Findings

As contextual background, Belarus benefits from a well educated population and a GDP per capita greater than the average of Eastern European and CIS countries. It retains some of the manufacturing infrastructure that led it to be called the "assembly line" of the former Soviet Union. Belarus continues to face a difficult economic transition that creates hardships for its population and affects financing and operations of the health system. Displaced Chernobyl migrants are served in the health system along side with the rest of the population. Performance of the health system, in terms of basic mortality and efficiency indicators, compares poorly with western industrialized countries. The Belarus health system is oversupplied with hospital beds and physicians, and needs reform (section 3).

The major findings are

- government plans for mitigating the effects of the Chernobyl accident are extensive and ongoing, account for over 2.5 percent of GDP - almost half the total of health sector expenditures, and include support - in addition to government health sector funding, to health facilities and Chernobyl-affected persons
- no international donor programmes specifically address return migration of persons displaced by the Chernobyl accident
- based on independent international scientific opinion, it can be safe to return to many areas considered contaminated, and numbers of people voluntarily continue to live there and have returned
- some people want to go back but their numbers are unknown
- characteristics of the potential returning population are unknown, so there is no basis for planning to meet health-related infrastructure needs
- informatics resources that would be useful for policy planning and management of return migration and other associated issues are dispersed and inadequate (section 3).

These findings lead to the main conclusion of the study. Support to the Government of Belarus should be based on a clear understanding of the scale of the problem presented by the potential voluntary return of displaced Chernobyl migrants to their home areas. The recommendations following enable this understanding. They also contribute to a positive partnership with the Government of Belarus for addressing real problems, to development of migration-related knowledge useful to international agencies, and to strengthening coordination among agencies working on Chernobyl-related issues. And, they address the immediate medical needs of a special group of some 1500 returnees to areas deemed highly contaminated.

List of recommendations

R 1 *Conduct a well designed project to survey displaced Chernobyl migrants to identify potential numbers of people wishing to return to their home areas, their motivations and conditions under which they would be prepared to return. The survey is to include persons who have voluntarily returned to their home areas.*

R 1.1 *Include in the survey, demographic and household income information useful for developing a profile of the population and the broad characteristics of its health related needs over the next decade*

R 1.3 *Project management and direction should be done by a consulting team. Project execution would be by a Belarus team of experts. A multidisciplinary working group, appointed by and reporting to a high government level, would be mandated to enable and coordinate project design and execution. It should include representatives from the:*

- *Ministries of Emergency Measures and Chernobyl, Finance (Departments of Health Financing and of Chernobyl), Health, Statistics and Analysis*
- *Centre for Medical Technologies, Information Computer System, Health Care and Management and Institutes of Sociology, Urban Planning*
- *Psychological Rehabilitation Centres*
- *Local authorities of a contaminated community*
- *Belarus Academy of Sciences, Institute of Radiological Problems*

Control of project associated procurement and disbursement should be appropriate to the scale of the Project.

R 1.4 *The Project should cover all hardware, software, network and communication costs necessary for participants and working group members to conduct their work effectively.*

R 2 *Project findings should inform and assist the work of agencies developing guidelines and processes for managing nuclear disasters, including the International Atomic Energy Agency, International Commission on Radiological Protection, Radiation Protection Research Action of the European Commission, others as appropriate.*

R 3 *Subject to findings from the project recommended in* **R 1,** *explore with appropriate agencies the feasibility of a joint training project to extend the work of the three Psychological Rehabilitation Centres in Belarus to address needs of potential returnees, and to develop attractive, clear, readable, scientifically grounded, information materials on radiation and return migration that would enable informed decisions by displaced Chernobyl migrants wishing to return to their home areas.*

R 4 *In consultation with the Belarus Delegation of the International Federation of Red Cross and Red Crescent Societies, provide equipment and financing for one year for an appropriately equipped mobile medical team to serve the needs of some 1500 voluntary returnees to areas of higher contamination in Gomel, as suggested at the Ministry of Health.*

R 5 *Undertake a feasibility study to determine the viability of developing a data warehouse to enable central government level policy development, planning and management of Chernobyl migrant needs and associated issues. The Ministries of Finance and Health should be included in the study together with the Ministry of Emergency Measures and Chernobyl Affairs.*

R 6 *Ensure migration representation at joint meetings between the UN Special Coordinator on Chernobyl and Belarus government officials to be held in Minsk in May 1997 to develop a strategy for mitigating the effects of the Chernobyl accident for the next decade.*

INTRODUCTION

Chernobyl-related Population Displacement in Belarus

The Chernobyl accident and its impact

Two successive explosions on April 26, 1986 at the nuclear power plant in Chernobyl, Ukraine blew the roof off one of the reactors and partially destroyed it. The explosions ejected radioactive debris that became the largest recorded short-term release from a source of radioactive materials into the environment. Complex weather conditions persisting after the explosions and the length of time the reactor was open to the atmosphere led to contamination by radioactive deposits of territories in Ukraine, Belarus, the European part of the Russian Federation, and to a lesser extent Scandinavian countries. Graphite and particles of the destroyed reactor were deposited mainly within 40 km of the damaged reactor site, while radioactive products such as tellurium-132 (half-life of 3.2 days), iodine-131 (8 days), the longer lived cesium-137 (about 30 years) were spread over thousands of kilometers. Contamination was greatest in Belarus, principally in the regions (*oblasts*) of Gomel, Mogilev and Brest.

The former USSR government authorized evacuation and relocation of people living in a 30 km "exclusion" zone around the Chernobyl Nuclear Power Plant in the first year after the explosions. By 1990 the government established a legal basis and budget-supported programme of compensated relocation for persons living in contaminated areas. Relocation was mandatory or voluntary, depending on the level of radioactive contamination. Within this framework, Belarus developed a five-year programme for mitigating the effects of the Chernobyl accident on its affected population and received funding from the USSR state budget.

After the collapse of the Soviet Union, Belarus established its own legal basis and continued the programme to mitigate effects of the Chernobyl accident, funded largely through a special Chernobyl tax. Programme activities include extensive measures to decrease radiation exposure dose by decontaminating the physical environment and providing clean food; relocating and compensating residents from territories of surface contamination greater than 5 Ci/km2 (see the glossary, Annex C), and building new housing, schools and health facilities for them, together with associated public utilities of gas, water and roads; providing instrumentation for dosimetry and supporting ongoing radiation monitoring and scientific research; funding additional medical equipment and capital construction for extra in-patient and ambulatory care facilities beyond levels supported by the Ministry of Health; and providing benefits mandated by law to those participating in the initial clean up after the explosions ("liquidators") and to adults and children from territories of highest contamination.

Radiation affected 2.2 million people to varying degrees according to the government (reference *(14)* - Annex A). Under present criteria, 1.84 million people and 23 percent of the country's surface area are considered subjected to radioactive contamination. The population in areas with cesium-137 contamination levels of 1-5 Ci/km2 is subject to periodic examinations and a widespread system of radiation monitoring and control is in place. Thousands of square kilometres of agricultural and forest land are deemed too contaminated for economic use. Fifty-four collective farms were liquidated, nine agricultural industry processing complexes were shut down, and 340 industrial enterprises situated in contaminated zones are functioning at reduced levels, all attributed to the effects of the Chernobyl accident. The government of Belarus estimates total losses and clean up costs will be US$ 235 billion over the period 1986-2015 *(13)*.

Population displacement

In the first year after the explosions, 24,700 persons from 107 settlements were relocated into uncontaminated areas. They were mainly from the Belarus portion of the 30 km exclusion zone. By the beginning of 1996, a total of 131,051 persons from over 400 settlements were relocated. Of these, 84,487 were from areas of surface contamination greater than 15 Ci/km2, the criteria for mandatory relocation. Another 46,564 were from areas with contamination levels 5-15 Ci/km2, entitling them to voluntary relocation with compensation (Table 1). By January 1997, nearly 150,000 persons had been relocated *(1)*. The task of relocation has been essentially completed, according to government officials in Minsk and Mogilev; all who are entitled by law to relocate with compensation and who wish to do so, have been relocated.

TABLE 1
Persons resettled from contaminated territories in Belarus
as of 1 Jan 1996

Territory	Total	Brest	Gomel	Mogilev
priority resettlement >15 Ci/km2	84,487	163	73,142	12,182
right to resettlement 5-15 Ci/km2	46,564	3,825	29,127	12,645
Total	131,051	3,955	102,269	24,827

Source: Ministry of Finance, February 1997

The International Organization for Migration and Chernobyl-related Migration

Belarus has observer status in IOM and participated in the regional conferences on Uncontrolled Migration Across the Baltic Sea (Stockholm, March 1993, January 1994) and the CIS Regional Conference on Refugees and Migrants (Geneva, May 1996). The Stockholm conferences led to a two-year programme of technical cooperation with IOM in collaboration with UNHCR aimed at developing migration management structures in Belarus.

During the technical cooperation, Belarus authorities raised the issue of Chernobyl-related migration. The issue gained prominence at the Geneva CIS Regional Conference where Belarus authorities put forward, as a national priority, the need to assess medical infrastructure in the context of rehabilitation of contaminated areas. Implementation of the Programme of Action that followed up on the Geneva conference led to priority programme elements for Belarus. One of these was *undertaking a feasibility study on possible action to be taken in relation to ecologically contaminated areas in Belarus and the medical infrastructure needed to deal with this challenge (8)*. The feasibility study was intended to lead to a project to support and improve the health status of migrants from contaminated areas and prevent a disorderly return. The purpose of the project would be:

a. *To provide education and counselling to individuals or groups regarding the medical and health implications related to contaminated areas*
b. *To identify and ameliorate gaps in medical education, information, infrastructure, personnel and health service support for migrants or those who might be planning to return to contaminated areas (7).*

IOM supports orderly migration, and its Medical Services unit has expertise in medical research and processing migrants gained over a number of years. Responsibility for addressing the Belarus priority programme related to Chernobyl, therefore, was given to IOM. This report presents the results of a feasibility study undertaken with the agreement of Belarus authorities required as follow up by the 1996 CIS Regional Conference.

Terms of Reference and Study Process

The terms of reference are presented in Box 1.
The study was designed to:

- present a preliminary assessment rather than determine a definitive position given the time and resources available
- focus on displaced Chernobyl migrants wishing to return to their home territories
- determine areas that would benefit from further study,evaluation, assessment or programme intervention.

Box 1 Terms of reference

To undertake an evaluation designed to facilitate the development of proposals, in coordination with local authorities, on strengthening components of the medical infrastructure in Belarus, particularly those dealing with the consequences of the Chernobyl disaster, in order to ensure that displaced persons moving back to affected areas will have improved access to health care services.

Sources: Medical Services, IOM, October 1996

Briefing meetings were held at IOM headquarters in Geneva with the Medical Administrator and other staff prior to traveling to Belarus. In Belarus, meetings were held at number of Ministries and a field trip was taken to clean and contaminated areas in Mogilev. On return to Geneva, a meeting was held with a WHO scientist who edited a major scientific report on health effects of the Chernobyl accident *(27),* and a seminar was given to IOM Medical Services staff on preliminary findings. Meetings held in Belarus are summarized in Box 2. The mission schedule is presented in Annex B.

Box 2 Meetings in Belarus 23 January to 6 February 1997

In Minsk
- **Ministry of Emergency Measures and Chernobyl Affairs**
- **State Agency for Migration**
- **Ministry of Foreign Affairs**
- **UN/UNDP**
- **Centre for Medical Technologies, Information Computer Systems, Health Care Administration and Management**
- **Ministry of Finance**
- **Institute of Urban Planning**
- **Ministry of Health**
- **Institute of Radiological Problems, Academy of Sciences of Belarus**
- **EU TACIS Programme Coordinating Unit**
- **International Federation of the Red Cross and Red Crescent Societies**

In Mogilev
- **Mogilev Oblast Administration**
- **Belarus Scientific and Research Institute of Ecological and Occupational Pathology**
- **Mogilev Diagnostic Centre (and Sasakawa Project)**
- **Pudovnya Village, Drybben Rayon (relocated population)**
- **Slavgorod Rayon Centre (contaminated area)**
- **Village of Gaishyn (contaminated village with two thirds residents relocated)**

ANALYTICAL FRAMEWORK

This section sets out the framework for analysis. First, it overviews the context in which IOM support would be directed at strengthening components of medical infrastructure for displaced Chernobyl migrants returning to their home areas. The contextual has three elements: the population of Belarus, the economic transition underway, and the state of the present health system.

Following the context is a discussion of basic questions about safety and who wants to return. The issue of *medical **vs** health-related* infrastructure is discussed next, to focus on meaningful initiatives. Finally, since there are many international donor and government programmes for Chernobyl-associated issues, criteria for international support are proposed.

Population, Economic and Health System Context

The population and the economic transition

Belarus has a population of 10.26 million (1 January 1996), comparable to Belgium, the Czech Republic, Hungary and Portugal. Its area is 207.6 km2, making Belarus a little smaller than Great Britain and two thirds the size of its western neighbour Poland. The population is 68.9 percent urban, 31.1 percent rural and the age structure is close to that of Europe as a whole. Growth over the past decade was small, about one percent in total. The total fertility rate is 1.386, down from 1.959 in 1990. In 1995 the rate of natural increase in the population became negative (-3.2 per thousand population), the result of a higher crude death rate (13 per thousand) than birth rate (9.8 per thousand).

Box 3 Human Development Index - HDI

The Human Development Index was developed by UNDP to measure human development and track its changes over countries and time. It is based on three indicators: longevity, as measured by life expectancy at birth; educational attainment, as measured by a combination of adult literacy (two thirds weight) and combined primary, secondary and tertiary enrollment ratios (one third weight); and a standard of living, as measured by real GDP per capita (PPP$).

UNDP publishes yearly a Human Development Report and presents an analysis of progress. In the 1996 Report, based on 1993 data, Canada ranked 1st , Belarus ranked 61st, and Niger ranked 174th and last.

Source: Human Development Report 1996, UNDP

Prior to independence in 1991, Belarus was known as the "assembly line" of the former USSR because of its strong manufacturing base. With a 1993 Human Development Index of 0.787 and ranking 61st place out of 174 countries, Belarus is in the top five of medium human development countries. These include Brazil (58th) and Bulgaria (62nd). The HDI ranking for Belarus reflects its high level of literacy and a real GDP per capita (PPP$ 4,244) greater than the Eastern European and CIS country average (PPP$ 4,192).

Impending economic collapse prior to the breakup of the former USSR and transition to independence and a market orientation have taken their toll. GDP declined by 1995 to 63 percent of its 1990 level. The consumer price index soared by 5,037 percent while real personal income collapsed to 56 percent of 1990 levels. The number of people with income below a Minimum Consumer Budget set by government rose from 5 percent to 80 percent. The quality of nutrition, health and life expectancy suffered. Belarus slipped from 40th place in 1991-92 to 61st place in one year in its HDI.

The health sector also felt the impact. Hyperinflation, central and regional financing cuts and shortages of hard currency to purchase imported medications previously available through inter-republican trade, led to the collapse of many public health measures and deterioration of health facilities. Cases of active tuberculosis grew from 29.8 per hundred thousand in 1990 to 42.2 per thousand in 1994. The rate of diphtheria grew ten times, from 0.22 per thousand to 2.23 per thousand. The rate of mortality from infectious and parasitic diseases rose by 27 percent in the period 1990-1995, 33 percent in 1992-1995.

Displaced Chernobyl migrants continue to experience the same hardships and problems with health care as others in Belarus, although liquidators, children of displaced parents and persons resettled on a mandatory basis are partly sheltered. They receive benefits mandated by law which may include free medications, rest, recovery and treatment in specialized facilities and summer camps, and certain costs of transportation to treatment facilities.

Health system organization, financing and performance

Organization

Belarus has an extensive health system whose structure is inherited from the former Soviet era (Table 2). Health care is publicly financed from central and regional government budgets. Nominally, it is available to all residents and free at point of service. The system includes hospitals, *dyspansers*, sanatoria, polyclinics and other medical and dental ambulatory care facilities, and a public health-hygiene-epidemiology service. The latter is responsible for prevention programmes of immunization, control programmes in sanitation, hygiene, water, food and air quality, and laboratory and other analysis.

Delivery components of the health system are supported by medical institutes for training physicians, dentists and pharmacists, and colleges for training nurses, laboratory and imaging technologists and other mid-level health care personnel (Box 4). In addition, there are scientific research institutes conducting clinical, applied and fundamental health-related research. Also supporting health care operations are state enterprises that procure, produce and distribute medications, medical supplies and equipment. Pharmacies outside of health facilities sell over-the-counter drugs.

The health system is strongly centralized and owned by the state. Direction for system organization and delivery of care comes from the Ministry of Health, and funding is provided and controlled from the Department of Health Financing, Ministry of Finance. Regional and local governments include organizational units that mirror those at the central level and include departments of health administration. Thirteen polyclinics and ambulatory care centres, mainly dental facilities, are the only health care facilities operating officially on a self financing basis, charging patients for services. Informal payment by patients for medical services exists and patients occasionally have to find and pay for their own medications for treatment in hospitals and polyclinics.

In addition to the network of health facilities under Ministry of Health jurisdiction, separate health facilities are funded and operated by ministries responsible for military, police, internal security, railway and aviation services, as well as a few facilities developed and funded by state enterprises. All health facilities, except those funded by state enterprises, report on their activities and expenditures to the Ministries of Health and Finance. These parallel health services account for about 5 percent of the acute care beds and three quarters of sanatoria beds. Over 150 recovery homes, recovery hostels and other recovery facilities are under various Ministries and unions. These do not provide medical care and generally are not considered part of the health system. Distinct from them, however, are the specialized *health recovery centres* for persons affected by the Chernobyl accident that are part of the Ministry of Health network.

Box 4 Medical education

Physicians are trained for six years after which they serve one year of internship. During the fifth and sixth years they select a discipline and progressively increase their specialization with courses and clinical training, gaining additional clinical experience during the internship. The Ministry of Health recognizes some 32 specialties, broadly categorized as medical, surgical and public health disciplines. Family Medicine or General Practice, as known in Canada and other western countries, is of great interest, but only emerging.

Nurses are trained at a considerably lower academic and clinical level than in North America, and there are no nursing baccalaureate programmes. Feldshers and midwives are trained at the same college level as nurses. Their training is aimed mainly at preparing them to work in small rural villages in health centres that may or may not have permanent physician staffing, and where they are the first contact care providers.

TABLE 2
Availability and use of health care resources: Belarus 1995 and OECD 1992

Resources and their use	Total 1995	Ministry of Health Network 1995	OECD 1992 of those reporting (minimum of 17)		
			Low	Average	High
Health Care Personnel					
Physicians	**39,018**	**36,852**			
per 1,000	*3.8*	*3.6*	*1.0*	*2.5*	*3.8*
Dentists and Dental Physicians	**5,692**	**5,545**			
per 1,000	*0.6*	*0.5*	*0.2*	*0.6*	*0.9*
Mid-Level Health Care Personnel	**115,596**	**110,005**			
per 1,000	*11.3*	*10.7*			
· **feldshers**	*1.3*				
· **midwives**	*0.8*		*0.9*	*6.7*	*13.7*
· ***nurses***	*7.0*				
· **laboratory, radiology technicians, others**	*2.2*				
In-patient Facilities					
Acute care inpatient care facilities (in hospitals and dyspansers)	**865**	**827**			
Sanatoria	**58**	**23**			
In-patient Care					
Acute Care Beds (in hospitals, dyspansers, and observation-treatment beds in ambulatory clinics)	**127,268**	**120,163**			
per 1,000	*12.4*	*11.7*	*1.9*	*4.6*	*7.4*
Sanatoria beds	**14,223**	**3,495**			
Admissions to Acute Care					
per 100		*24.9*	*6.9*	*16.3*	*24.8*
Average Length of Stay in Acute Care (days)		**15.2**	**6.9**	**15.6**	**50.5**
Patient Days in Acute Care		**38,727,000**			
per capita		*3.8*	*0.8*	*1.4*	*2.2*
Ambulatory Care Facilities					
Physician-based free-standing polyclinics and clinics in hospitals and dyspansers	**1622**	**1528**			
Women's consultative centres and children's polyclinics and clinics, free-standing and in other I nstitutions	**688**	**676**			
Feldsher health centres, free-standing and in other institutions	**1080**	**1009**			
Feldsher midwife stations, free-standing	**2957**	**2917**			
Centres of hygiene and epidemiology	**169**	**151**			
Ambulatory Care					
Total Visits to Physicians		**101,770,000**			
per capita		*10.5*	*1.0*	*6.6*	*17.0*
· **in health facilities**		**83,201,800**			
per capita		*8.0*			
· **at home**		**7,390,000**			
per capita		*0.7*			
· **involving ambulance service**		**11,099,500**			
per capita		*0.4*			
· **involving air transport**		**78,700**			
per capita		*0.0*			
Visits to Dentists and Dental Physicians		**13,178,200**			
per capita		*1.3*			
Visits to Mid-Level Health Care Personnel, independently of a physician, in physician and feldsher-based health stations		**9,270,500**			
per capita		*1.2*			

Source: **Ministry of Finance, Department of Health Financing, February 1997, and** ***(16, 18, 20)***

Care is referred up a line of successively more complex and specialized facilities. Primary care is provided in small health centres-feldsher stations in rural areas and in rural hospitals in larger villages. Mainly primary and some secondary care is provided in polyclinics and rayon hospitals in main rayon centres. Secondary and some tertiary care is provided in polyclinics and oblast hospitals in oblast capitals. Specialized secondary and tertiary care is provided in national hospitals. In-patient and ambulatory care is also provided in *dyspansers*, which are hospitals specializing in a particular discipline: cardiology, dermatology/sexually transmitted disease, oncology, physical medicine/sports medicine, psychiatry/neurology, substance abuse, thyroid disease, tuberculosis, other. Sanatoria provide longer term medical care on an in-patient basis.

Expenditures on health

Belarus spends about 5.2 percent of its GDP on health. This expenditure level is more than 2.5 percentage points below the average for economically developed countries, but likely appropriate under present economic conditions. Taxes raised centrally and by oblasts finance services at the respective levels. One quarter of health expenditures in 1995 were funded centrally, about 70 percent at oblast level. The remaining expenditures were funded under Social Protection (Table 3).

There is an oversupply of in-patient beds and physicians, and utilization levels are high compared to OECD country experience (Table 2). The oversupply can generate as well as respond to demand, an effect recognized in western countries, and lead to higher utilization and higher expenditure levels. Soviet era practices of regular preventive examinations for large numbers of people, routine ultrasound monitoring of low risk obstetrics cases and other practices with poor cost and outcome effectiveness further contribute to inefficiencies in the present health system.

TABLE 3
Expenditures on health care
Belarus 1995

	Expenditure billions of Belarus roubles		Percent of total	Percent of GDP
Health services funded at central level • **central health institutions reporting directly to the Ministry of Health** • **central health institutions under Ministry of Health jurisdiction**	**1069.2** **412.9**	**1482.1**	**24.1**	**1.3**
Health services provided under clinical education activities medical institutes and colleges , funded under Health		**85.9**	**1.4**	
Health services under scientific research by activities of scientific research institutes funded under Health		**34.2**	**0.6**	
Health services funded at oblast level		**4332.3**	**70.6**	**3.7**
Subtotal financed under Health				**5.0**
Financed under Social Protection • **homes for the aged (nursing homes)**		**204.2**	**3.3**	
Total		**6138.7**	**100.0**	**5.2**

Source: **Ministry of Finance, Department of Health Financing, February 1997**
Note: **Total excludes data unavailable on health facilities of the police, military and state enterprises.**

Health system performance

Life expectancy, infant mortality and maternal mortality are three rough indicators of health system performance. On these measures health status in Belarus does not reach western standards and is deteriorating.

Life expectancy at birth in Belarus in 1995 was 68.6 years (74.3 female, 62.9 male), much less than the WHO/EURO target for Europe of 75 years, and down significantly from 71.2 years in 1990, a level that had remained essentially unchanged since 1981. The gender gap in life expectancy is large. At birth, males can expect to live 11.4 years less than females. In comparison, the gender gap for Western European countries is about 6.7 years, life expectancy at birth estimated by WHO over the period 1990-1995 to be 79.7 years for females, 73.0 years for males *(28)*.

The reported infant mortality rate is 13.3 per thousand live births up from 11.9 in 1990, well within the WHO/EURO target of 20 per thousand, but more than twice the rate in Canada (6.2), or Austria (6.1). The probability of children dying by age five is about 2 percent, 2.5 times greater than in Italy, the Netherlands and Spain. The maternal mortality rate is 14 per hundred thousand live births, higher than the WHO/EURO target for Europe of 10.

The Belarus health system needs to strengthen its performance to improve population health. It requires reform to improve efficiency, particularly during the economic transition, and effectiveness, especially to deal rationally with special problems such as those presented by the Chernobyl accident.

Implications for International Agencies

The extent of health system infrastructure, its inadequacies and deterioration under the economic transition present Belarus authorities with ample motivation to seek financing for strengthening medical infrastructure. This has implications for international agencies. The need of returning Chernobyl migrants for medical infrastructure is entangled with the need for extra resources to offset effects of the economic transition and to improve health system effectiveness. Insofar as possible, international agencies must disentangle the issue if they are to provide support. The subsections that follow present discussion to enable this end.

Three Key Questions

Three questions are important for determining the nature and scale of international support to Belarus for strengthening components of medical infrastructure to ensure that displaced Chernobyl migrants moving back to their home areas have improved access to health care.

- ***Is it safe to return?***

  Chernobyl migrants were displaced because their home areas were deemed unsafe. Encouraging their return to unsafe areas cannot be acceptable to international agencies or Belarus authorities. Unless there is reasonable evidence that areas of return now can be considered safe, major international support to strengthen their medical infrastructure is inadvisable and likely would not gain donor support.

- ***Does anyone want to return, and if so, under what conditions?***

  The government of Belarus intends in the longer term to rehabilitate areas affected by the Chernobyl accident. Upon visiting residents of contaminated areas in 1996, the President of Belarus declared that people should be permitted to live where they wish, a statement some officials consider in support of return migration. Intervention programmes supporting return migration are premature, however, without evidence that there are displaced Chernobyl migrants who wish to return to their home areas, and an indication of their possible numbers and preferred areas of return.

Many displaced Chernobyl migrants have established strong family and socioeconomic roots where they relocated. In contrast, community life, housing and basic infrastructure in their contaminated homes areas have typically deteriorated. The conditions for living and working back home may not be adequate. A wish to return, therefore, may be conditional. The conditionalities and their economic consequences need to be understood before developing programmes of support for returnees.

Insight into the numbers of potential returnees, their motivation and conditionalities will clarify for Government of Belarus whether there is a need for intervention programmes, their scale and whether international support is required.

- ***What are the demographic and socioeconomic characteristics of the population wishing to return?***

  The need for strengthening components of medical infrastructure is shaped by the demographic and socioeconomic profile of the returning population. Medical infrastructure requirements are quite different for populations with large numbers of poor or retirement age persons, compared to populations with large numbers of persons economically established, of working and child bearing age. Understanding the present profile also provides information about the evolution of future needs. For example, existence of a large cohort of teenagers about to enter the working and child bearing age in the next five years would affect the type of medical and socioeconomic infrastructure required, and should inform its planning.

  Insight into the demographic and socioeconomic characteristics of the population of potential returnees will help determine the type of medical and other infrastructure needs and response required by the Government of Belarus, and the type of support that could be offered by international agencies.

Conceptual Scope: Components of Medical *vs* Health-related Infrastructure

The study terms of reference refer to components of *medical* infrastructure needs as distinct from *health- related* infrastructure. It is well known that many factors influence health. The availability of *health services* or the subset *medical services* is only one factor. In addition to a person's genetic inheritance, factors that can have much greater influence on population health than the availability of many health or medical services include the following *(4)*.

- ***Living and working conditions***

  Factors supporting health include a thriving economy, meaningful work, adequate incomes, physical safety, positive conditions in schools and workplaces, supportive family and friends, and sound quality parenting in early childhood.

- ***Physical environment***

  A safe, high quality sustainable physical environment supports health. The availability of unpolluted air, uncontaminated water and food supports health.

- ***Personal health practices and coping skills***

  Health promoting lifestyle practices that limit risks by avoiding smoking, limiting alcohol consumption and undertaking regular exercise support health. Behaviours involving good eating habits and safe and healthy sexual practices, as well as factors like effective coping skills, social support and good quality parenting contribute to health.

Stating the problem strictly in terms of the need for *medical* infrastructure unduly limits support to physician-related interventions. This study takes the broader view that includes the above factors that influence health. It considers the need for strengthening *health-related* infrastructure. Housing, employment and economic opportunities, adequate public utilities like water, sewerage and roads, gas are critical elements of the return migration problem. Securing them is a precondition to viable return of displaced Chernobyl migrants.

Criteria for Migration Support to Returning Chernobyl Migrants

The following criteria were set out during the initial meetings with Belarus authorities. By applying them, an international agency can serve a unique role in partnership with Belarus authorities to address real needs, and contribute to coordination, cooperation and efficiency of international assistance efforts in the country.

Internationally supported interventions and programmes for displaced Chernobyl migrants wishing to return to their home areas should:

- be in harmony with the agency's values and mandate
- be credible to donors providing project financing to the agency from a scientific, health policy and health management perspective, and meaningful and acceptable to Belarus authorities
- add value to Belarus as a result of the particular experience and strengths of the international agency
- avoid unnecessary duplication of support provided by other international and humanitarian agencies
- present an integrated approach to migration-related medical and health consequences, through active and open collaboration with related projects financed by Belarus, international donors and humanitarian agencies
- ensure an integrated approach that addresses health related infrastructure needs.

FINDINGS

Government plans for mitigating consequences of the Chernobyl accident on people are extensive and ongoing

Two laws govern government initiatives on Chernobyl-related issues: 1) *On Social Protection of Citizens Affected by the Chernobyl Nuclear Power Plant Catastrophe*, and 2) *On Legal Treatment of Territories Affected by Radiation Contamination as a Result of the Chernobyl Nuclear Power Plant Catastrophe*.

The first law protects the rights and interests of liquidators, and of citizens who took part in the clean up or were affected by accidents and their consequences at other nuclear installations for civil and military purposes, or affected by testing, military training or other works. The second law regulates the territories of Belarus affected by radioactive contamination as a result of the Chernobyl accident. Its purpose is to reduce the effects of the resulting radiation on the population and ecological systems, implement environmental restoration and protection measures, and enable rational use of the environmental, economic and scientific potential of the territories *(13)*.

These laws mandate *The government programme On Minimizing and Overcoming Consequences of the Chernobyl Nuclear Power Plant Catastrophe for 1996-2000* (Government Chernobyl Programme - GCP 1996-2000). Goals for the period are found in Box 5.

The highest priority of the GCP 1996-2000 is to protect and improve the health of residents of contaminated areas. A programme of capital construction will renovate and retrofit buildings in clean areas to establish a national network of health improvement facilities. By the year 2000, the plan is to build 19 *health improvement centres* with a total capacity of 5529 places for clients.

In the priority for residents of contaminated areas, there will be further development of specialized diagnostic and treatment facilities and their provision with contemporary medical equipment. Also planned is further health status monitoring of people affected by mobile medical outreach teams, providing residents with specialized *dyspanser* care, and ensuring their medication needs.

Total Government Programme for Chernobyl expenditures are substantial. In 1995 they accounted for 2.54 percent of the GDP (Table 4). This was nearly half the amount expended on the health sector in the same year (Table 3).

Box 5 Goals of the Government programme on Minimizing and Overcoming Consequences of the Chernobyl Nuclear Power Plant Catastrophe for 1996-2000

- **decrease the total risk of health loss for liquidators resulting from participation in clean up operations**
- **raise the level of medical services for the population and develop specialized ambulatory care-polyclinic facilities in rayons of radioactive contamination**
- **create a national system for improving the health of the affected population, including a network of 24 hour children's rehabilitation-health improvement centres, working with the school system**
- **conduct applied and fundamental research, ensuring scientifically grounded planning and implementation of measures of radiation protection for populations living in chronic low dose exposure conditions, protecting the health of those affected, and in the long run, resolving the problem of rehabilitating contaminated territories**
- **produce agricultural products in rayons of radioactive contamination that meet demands of acceptability**
- **complete relocation of affected persons and provide for them the socioeconomic necessities of life**
- **rehabilitate territories and implement programme measures in the exclusion zone and zones of resettlement**
- **decrease unfavourable ecological, economic and socio-psychological consequences of the catastrophe**
- **implement a system of social protection for persons affected by the catastrophe**
- **fulfill measures for protecting life of populations on contaminated territories according to their socioeconomic and radiological passports**
- **make use of world and international agency experience on consequences of the catastrophe.**

Source: Ministry of Emergency Measures and Chernobyl Affairs, Approved by the Cabinet of Ministers 12 September 1995

TABLE 4
Expenditures on measures to overcome consequences of the Chernobyl Nuclear Power Plant Catastrophe in Belarus, 1995-1997
millions of Belarus roubles

Expenditure category	1995 actual	1996 actual	1997 planned
1. Capital expenditures, of which	1,397,331	1,531,594	1,350,000
1.1 Allocation for development of *health improvement facilities*	166,972	148,084	
2. Measures mandated under the law: *On Social Protection of Citizens Affected by the Chernobyl Nuclear Power Plant Catastrophe*	1,327,435	2,066,748	3,082,830
3. Total for targeted measures	277,531	566,306	550,370
3.1 Measures mandated under the law: *On Legal Treatment of Territories Affected by Radiation Contamination as a Result of the Chernobyl Nuclear Power Plant Catastrophe*, of which	199,545	468,371	467,619
3.1.1 Administration of programmes of activities in the exclusion zone and zones of resettlement	*2,586*	*10,510*	*6,527*
3.1.2 Specialized measures at the APK station	*163,645*	*401,525*	*394,504*
3.1.3 Control of forestry	*4,570*	*8,099*	*8,356*
3.1.4 Maintenance of internal affairs services	*2,500*	*3,950*	*4,028*
3.1.5 Decontamination and burial of contaminated waste	*19,020*	*35,041*	*42,204*
3.1.6 Radiation-ecological monitoring of the environment	*7,224*	*9,246*	*12,000*
3.2 Targeted and scientific research measures	77,986	97,935	82,751
3.2.1 Scientific research programmes	*23,500*	*32,310*	*32.500*
3.2.2 Health care	*42,035*	*36,120*	--
3.2.3 Development of the Chernobyl Register, maintenance of inter-ministry expert committees	--	--	*8,645*
3.2.4 Protection of historic sites	*120*	*175*	*227*
3.2.5 Improvement of the legal and regulatory basis	*184*	*188*	*91*
3.2.6 Training and retraining personnel	*445*	*507*	*897*
3.2.7 International cooperation	*620*	*123*	*1638*
3.2.8 .Provision for information and technology	*159*	*3,419*	*590*
3.2.9 Organization of *health improvement centres,* medical support to the affected population, and maintenance of *centres for psychological rehabilitation*	*9,230*	*22,744*	*33,020*
3.2.10 Reimbursement of transportation costs to commercial organizations distributing clean foods	*1,225*	*1,700*	*2,275*
3.2.11 Fund for assisting resettlers	--	--	*1,048*
3.2.12 Contingency	*468*	*649*	*1,820*
Total	3,002,297	4,164,648	4,983,200
Total as percent of GDP	2.54	2.31	2.21
Additional Chernobyl health related expenditures			
-under Health		120,077	146,500
payments to medical personnel contracted to provide service in contaminated territories		55,077	76,500
grants for free medications for the population affected		65,000	70,000
-under Agriculture		100,000	150,000

Source: Ministry of Finance, Department of Emergency Measures and Chernobyl Financing, February 1997

Actual expenditures for 1996 and planned expenditures for 1997 decline slightly but remain over 2 percent of GDP. At the exchange rate of early February 1997, planned expenditures for 1997 exceed one quarter of a billion US dollars, US$ 22 per capita.

Excluding food, safety and other measures, direct health-related expenditures of the GCP 1996-2000 declined from 7 percent of the total in 1995, to 5 percent in 1996, and to a planned 0.7 percent in 1997 (Table 4, the total of items 1.1, 3.2.2, 3.2.3, 3.2.9). At the high point in 1995, the GCP 1996-2000 contributed an additional 3.6 percent to health sector financing.

Government Chernobyl Programme funding for health is intended to augment overall health sector funding provided in association with the Ministry of Health. The impact of the additional funds is considerable since it is directed mainly to health facilities in affected areas. Many facilities have been upgraded with new equipment that has helped raise the effectiveness of physicians. But the additional funding has also raised concerns about decisions by GCP officials on allocating new equipment and building new capital facilities without adequate consideration of future impacts on the budget. Other concerns are about inappropriate and ineffective allocation of new equipment, particularly in the absence of health specialists in the Ministry of Emergency Measures and Chernobyl Affairs. As a result, from the beginning of 1997, all direct health funding from the GCP is reviewed by the Ministry of Health and its counterpart, the Department of Health Financing, Ministry of Finance.

No international donor programmes specifically address return migration

While there are large numbers of projects supported by donors, covering the spectrum from nuclear engineering to market research, no evidence was found of programmes or projects that specifically address return migration. A number of projects are highlighted in the following list. They may have indirect relationship to return migration and may provide opportunities for future collaboration.

- **International Federation of the Red Cross and Red Crescent Societies:** ***Psychosocial programme for affected communities (interest in cooperation with UNESCO),*** **and** ***primary care mobile outreach teams to remote areas (ongoing).*** The first project is at the interest stage and the second has accumulated useful experience.

- **Tacis:** ***Addressing the clean up and the secondary medical effects of the Chernobyl disaster***. This project under the environment sector covers Belarus, Ukraine and Russia. The European Commission is committed to exploring possible development of a long term plan for the two topics. The first phase of this ECU 1.5 million project would be for project identification. An impact may follow on the rehabilitation of contaminated territories, and hence on return migration.

- **Tacis:** ***Support for Chernobyl Affected Areas.*** Two subprojects at the terms of reference stage are the *Gomel Business Development Agency,* and *Defining and implementing measures to improve and support public information.* This project should be monitored since Gomel is a principal area of return, returnees will face the health related issue of employment, and they require information to understand radiation effects in order to better take control over their lives.

- **UNESCO:** ***Extension of the socio-psychological project to create new rehabilitation centres,*** **and** ***amelioration of the information process for the population (in cooperation with Tacis, the European Community and UNICEF).***

- **UNICEF:** ***Social rehabilitation and information of the population on consequences of the accident.***

- **UNDP:** ***Social and Economic Transition (umbrella project).*** This provides short and medium term advisory services to support the socioeconomic transition, including promotion of enterprise development. In the draft CCP for Belarus 1997-1999, plans are included for *Support to Micro, Small and Medium Enterprises (SME).* The government is noted as wishing to see SME support as part of the rehabilitation of Chernobyl affected areas.

- **WHO:** ***Special action programme to support health care in Belarus,*** **and** ***Country-wide integrated noncommunicable disease intervention programme (CINDI).*** The results of these programs should be monitored. They do not address returning Chernobyl migrants, but they touch on important health topics that could have an impact directions for health reform and on services available to returnees.

Some contaminated areas are habitable

- ***Is it safe to return?***

This question continues to command attention more than ten years after the explosions at Chernobyl. One reason for its recurrence is the attribution of many illnesses to the effects of the Chernobyl accident. The only firm conclusion reached by international studies is that childhood thyroid cancers are attributable to the effects of the Chernobyl accident.

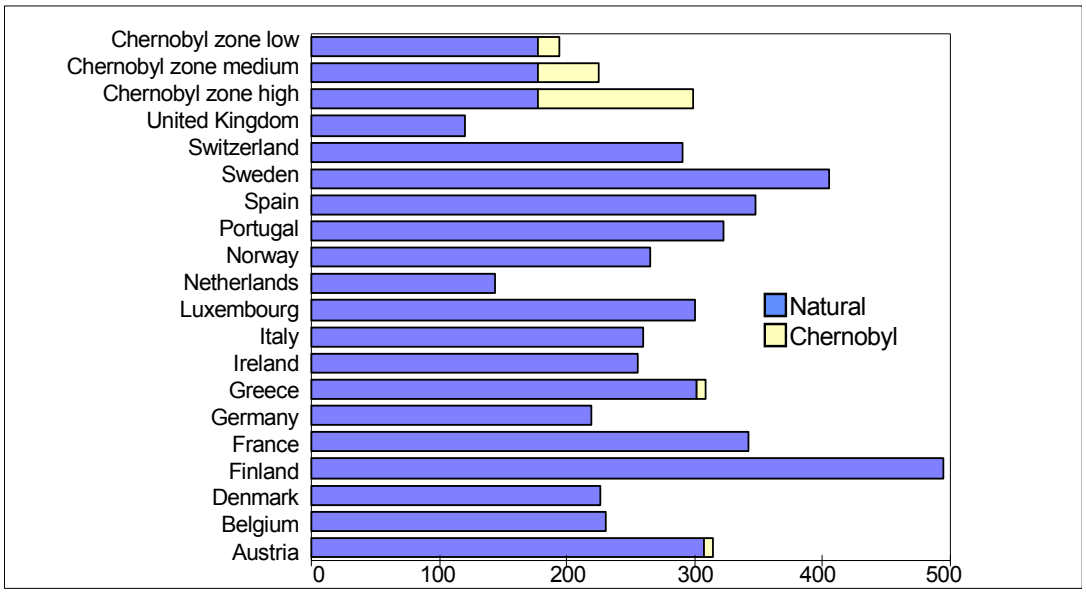
Another reason is that there appears to be no lower limit for safe exposure for humans. Contrasting is the fact that people everywhere are exposed to natural background radiation. Contributions to life time dose in many countries exceeds levels in contaminated areas of Belarus (Figure 1).

A third reason is that many people do not distinguish between two very different phases of the Chernobyl accident. In the first phase, comprising the first few weeks after the accident in 1986, many people were exposed to relatively high levels of radiation, mainly from inhaling and ingesting radioactive material. In particular, the thyroid glands of many young children were quite heavily exposed to radioactive iodine, and many liquidators and people evacuated from the exclusion zone also received relatively high doses in the first phase. Decay of the short half life radioactive elements like iodine-131 dramatically decreased the high dose rates within a few weeks and introduced the second phase. In phase two, many people are exposed to long term relatively low level radiation, mainly from cesium-137. It is these exposures that are compared with natural background radiation in Figure 1 *(6)*.

Some areas are clearly considered habitable. Legally and by choice, people in Belarus live in areas deemed contaminated. The two laws of Belarus governing programmes to mitigate effects of Chernobyl set out acceptable levels of contamination that determine habitable zones. At the beginning of 1996, there were 1,178 settlements in zones of voluntary and mandatory resettlement, in which 323,010 residents were officially registered, 78,743 of them children 17 years or younger. Eighty-seven of the settlements, with 24,426 residents who had chosen to continue living in zones defined as mandatory resettlement *(19)*. As reported earlier, still others have chosen to return but are not necessarily registered.

This report's answer to the question *Is it safe?* is based on three sources. One is the International Atomic Energy Agency which convened an international scientific conference in 1996 that summed up what was known of the consequences of the accident one decade after its event. Another is the World Health Organization which conducted and in 1996 published the research results of the International Programme on the Health Effects of the Chernobyl Accident. The third is the European Commission which conducted a joint research programme with the Belarus, Russian and Ukrainian Ministries on Chernobyl Affairs and held an international conference in 1996 to report on Chernobyl research and its radiological aftermath.

FIGURE 1
Contribution to life time dose in countries of western Europe and in typical areas of the Chernobyl zones (mSv)



Source: International Atomic Energy Agency, 1995

Quotes following from the three sources suggest the answer to *Is it safe?* is a qualified *yes.* The qualification is that the exclusion zone and areas with 'hot spots' of very high levels of radiation should be avoided, and that residents should have access to and eat foods that meet international standards for maximum permitted contamination.

- *There seems little doubt that the sharp increase in the incidence of childhood thyroid cancer was due to radioiodine emmission from the Chernobyl reactor. ...Leukemia incidence does not show a significant increase some 10 years after the accident. There may be good reason to believe that no significant increase above normal incidence will occur in the future. However, the situation should continue to be studied (27).*

- *By far the greatest impact on the population living in the contaminated territories was the mental stress caused by fear of possible future radiation-induced health effects. ...It is apparent that many psycho-somatic health disorders have resulted from these concerns (27).*

- *In general, no food produced by collective farms now exceeds the WHO/FAO Codex Alimentarius levels [set out as maximum permitted contamination levels for foodstuffs moving in international trade, now globally established], although some foods produced by private farmers do exceed these levels (5).*

- *There were two major findings of the study: firstly, the current levels of airborne radioactive material from natural and man made resuspension processes [eg, agricultural practices, traffic, forest fires] are small and give rise to doses that are, in general, small compared to other exposure pathways (ie, external radiation and ingestion of foodstuffs); secondly, the transfer of radioactive material by resuspension from more to less contaminated areas is not significant (2).*

- *The average lifetime dose [due to natural background radiation] in Finland, Sweden, Spain, France, Portugal and Austria is higher than in the contaminated zones. Moreover, if the resettlement policies of the affected states {Belarus, Russian Federation, Ukraine]were adopted in western Europe, then most of Sweden and Finland would have to be resettled elsewhere (6).*

- *By the criteria of the International Basic Safety Standards for Radiation Protection against Ionizing Radiation and for Safety of Radiation Sources, the number of people resettled in Russia and Ukraine is probably five times higher than would be recommended; and in Belarus, about twenty times more people have been or are being resettled than would be warranted (6).*

- *In view of the low risk associated with the present radiation levels in most 'contaminated' areas, the benefits of future efforts to reduce dose still further to the public would be outweighed by the negative economic, social and psychological effects* (5).

- *Full rehabilitation of the exclusion zone is not currently possible owing to: the existence of 'hot spots' of contamination near residential areas; the possibility of local radioactive contamination of groundwater; the hazard associated with possible collapse of the sarcophagus [covering the partially destroyed reactor at the Chernobyl station]; and severe restrictions imposed on diet and lifestyle (5).*

Some people want to go back but their numbers are unknown

- ***Does anyone want to return, and if so, under what conditions?***

There has been no systematic effort to determine the actual or potential scale of return migration by persons displaced by the Chernobyl accident. Anecdotal evidence obtained on this question was from officials and from persons living in relocated and contaminated communities.

Initial reaction of many officials met in Minsk and in Mogilev was surprise that anyone would want to support resettlement from clean to contaminated areas. The typical view was that most displaced people are safer and economically better off relocated, and that their original homes and communities had deteriorated to a level unacceptable for return. Two alternatives for international support were frequently suggested. One was financial support for starting small business ventures by people who voluntarily continued to live in areas from which they could be relocated with compensation (5-15 Ci/km2). The second was to provide financial assistance to hospitals, clinics and physicians in contaminated areas that are facing severe operational difficulties and budget constraints resulting from deteriorating economic conditions.

These reactions were also reflected in the views of relocated Chernobyl migrants met during the field trip to Mogilev. An informal meeting held in the village of Pudovnya, an area settled by relocating a whole village from the contaminated Krasnopolski rayon, complete with one of its small factories, revealed little interest in returning home among displaced Chernobyl migrants. Community representatives indicated that displaced migrants had adapted to their new village. They enjoyed the new homes built for them. They had created new roots. They had intermarried with local residents and children had been born to them in Pudovnya. Their major perceived need was a new hospital in the community. Nevertheless, the deputy major noted one or two families per year returned voluntarily to their contaminated home area. Typically, these were pensioners who wanted to spend their remaining years on the lands of their forefathers.

The situation appeared different in the visited contaminated rayon of Slavgorod and Gaishyn, one of its villages. Slavgorod residents were resettled on an individual and single family basis and dispersed throughout Belarus. The rayon mayor estimated that over half of those relocated would return if basic living conditions could be assured. Based on his experience working in contaminated and clean areas, he hypothesized that people from communities relocated as a unit adapt better to their new environments than people relocated as individuals disconnected from their communities. He attributed the more successful adaptation to the availability and continuity of support systems and a familiar, functioning economic and social fabric. He believed that because individuals and single families dispersed into unfamiliar territories, areas faced social and psychological hardships, given a reasonable opportunity many would prefer to return home.

There is no legal mechanism to prevent people from returning to their home area. Examples exist of people returning in relatively large numbers. Ministry of Health officials reported up to 1500 displaced Chernobyl migrants had voluntarily returned in 1996 to live in their home areas in Gomel oblast in a rayon within 50 kms of Chernobyl. The area they returned to is a zone of forbidden economic activity, contaminated at a level greater than 40 Ci/km2. The Ministry had to provide for minimal medical outreach to serve these returnees in response to appeals on humanitarian grounds from oblast and rayon officials in the area.

Additionally, Ministry of Health officials reported that approximately 100 displaced Chernobyl migrants returned voluntarily to contaminated areas in Mogilev in 1996. The total numbers of voluntary returnees is not known since most have not registered locally and some return only for the spring to fall period. Most were assumed to be old age pensioners. Officials in the Ministry of Emergency Measures and Chernobyl Affairs were aware of these cases, but thought that the number of returnees to Gomel was smaller, the order of 800 persons.

The anecdotal evidence indicates there is a return migration problem to be addressed. Further study is necessary to clarify the scale of the problem and determine whether international support is warranted.

Characteristics of the potential returning population are unknown

- ***What are the demographic and socioeconomic characteristics of the population potentially wishing to return?***

There is no comprehensive demographic and socioeconomic data base on the population displaced by the Chernobyl accident, a subset of which would form the population of potential returnees. While there appears to be no socioeconomic data like household income on Chenobyl migrants, some demographic data is available.

The Chernobyl Register, under the responsibility of the Belarus Centre for Medical Technologies, Information Computer Systems, Health Care Administration and Management in Minsk, provides a valuable but incomplete source of demographic, migration and other data on potential returnees. As of December 23, 1996 it comprised 200,245 records averaging about 1.5 Kbytes each. Estimates are that about 5,000 records are still to be purged as duplicates, the result of merging an updated system with an earlier one. The Register consolidates data from some 150 local registries located at rayon central hospitals and polyclinics in larger centres throughout the country. Local registries capture 200-15,000 records. The Register has data on four categories of people affected by the Chernobyl accident:

- **Group I**: **Liquidators** (78,611 records. These are persons who officially took part in clean up operations after the accident in 1986-87, 1987-89, and in zones of contamination of 15-40 Ci/km2. They comprise the population that received the largest doses of radiation, apart from firemen and a small number of others on the scene immediately after the explosions.)

- **Group II: Persons evacuated from the 30 km exclusion zone** (10,111 records)

- **Group III: Persons resettled from areas with surface radiation greater than 15 Ci/km2** (100,895 records)

- **Group IV: Children born to a parent in Groups I-III** (10,476 records)

A Query By Example facility is available at the Centre to facilitate analysis. (The present system is scheduled for upgrading in 1997 to SQL on a Windows NT platform). The facility was tested to determine the number and age distribution, by five year groups, of displaced Chernobyl migrants living in Pudovnya together with children ever born there to them. The results are presented in summarized form in Table 5 as an example of data available.

It is worth noting that the displaced population structure in the village differs significantly from that of the country as a whole. Compared to Belarus as a whole, in Podubnya the proportion of children is slightly larger (29.1 vs 21.6 percent), persons of child bearing age significantly smaller (38.2 vs 51.1 percent), persons near the retirement age slightly smaller (8.9 vs 10.1) and persons over 65 significantly larger (23.8 vs 17.7). Compared to general population need, Podubnya may face a need for extra seats in schools, less pressure on jobs, and greater need for care of elderly persons.

Not found in the Chernobyl Register is demographic data on more than 46,000 persons who voluntarily resettled with compensation from contaminated areas of 5-15 Ci/km2 (Table 1). Also not captured are people who have returned voluntarily to their home lands.

Examination of other data sources such as the population registry, passport department or address bureau, and Ministry of Finance may contribute to a more comprehensive picture of the potential returnee population.

TABLE 5
Population distribution of Belarus by age group, 1996, and distribution and number of Chernobyl migrants displaced to Pudovnya and their children ever born in Pudovnya, 1997

Age group	Belarus distribution	Pudovnya distribution	
	percent	percent	number in age group
0-14	21.6	29.1	150
15-49	51.1	38.2	197
50-59	10.1	8.9	46
60+	17.7	23.8	123
Totals may not add due to rounding	100	100	516

Source: Belarus Centre for Medical Technologies, Information Computer Systems, Health Care Administration and Management, February 1997

Informatics resources for dealing with Chernobyl migrant issues are dispersed

Computer resources in Belarus are generally inadequate for the country's capabilities and needs, with the exception of resources found in some Institutes and Centres. A number of these have received computer equipment through international donor-supported projects to collect and process specialized data, for example, on thyroid cancers. Some, like the Belarus Centre for Medical Technologies, Information Computer Systems, Health Care Administration and Management have contemporary and sizeable LAN based installations, and data bases like the oncology and Chernobyl registers. Others, like the Institute of Urban Planning, have more modest computer capabilities but data bases with human and physical geography on Chernobyl affected areas, including maps and information about hospitals, schools and other community infrastructure. Notably, the Institute of Power Engineering Problems of the Academy of Sciences of Belarus is the site of a RODOS System installation (**R**eal-time **O**n-line **D**ecisi**O**n **S**upport) for off site management of nuclear accidents, that is being developed under the auspices of the European Commission's Radiation Protection Research Action programme.

Data bases useful to Chernobyl related migration issues are found in Ministries of Finance, Statistics and Analysis, Health and Emergency Measures and Chernobyl, as well as their oblast and local level counterparts. Computer installations supporting the use of the data bases in these organizations tend to be modest, antiquated and multiplatform. More important, the data bases are structured in differing ways and oriented to the functional and process applications of projects and activities of the institutions where they are located. The result is inability to efficiently seek out information useful for policy analysis, planning and management of subject oriented problems like issues concerning Chernobyl migrants.

Policy analysis, planning and management for Chernobyl associated problems, specifically Chernobyl related migrants, could be significantly enabled with the development of a data warehouse.

A data warehouse is a subject-oriented, integrated, standardized, stable collection of data obtained from multiple operational sources and organized in snap shots over time, together with powerful query and analysis tools. The data warehouse gathers and transforms the data into meaningful information that can be accessed and analyzed by users ranging from top level central officials to local officials dealing directly with a Chernobyl migrant. It can contain data that is current, lightly or highly summarized, as well as meta data required by information workers to query the data base at increasingly finer levels of detail, commonly known as "drilling". This permits

posing questions that would otherwise never be addressed because of limitations of time and resources to find, compile and analyze data required to obtain empirically based answers.

Data warehouses differ from other operational and decision support system installations by their subject orientation (ie, Chernobyl migrants), exclusive focus on data modeling and databases, and data integration. Their design can be based on scaleable open platforms and open systems architecture, permitting an initial size and expansion capability as needed. Open standards ensure applications need not be rewritten because of changing platforms and new operating systems, and provide the ability to integrate hardware and software from multiple vendors (see for example http://www.cait.wustl.edu/cait/).

A data warehouse mandated by the highest level of government could be a powerful tool for addressing Chernobyl migration and related issues over the lengthy period of ecological rehabilitation anticipated. The feasibility should be explored of developing one.

POLICY ISSUES

Chernobyl-related migration in Belarus was the result of an environemntal event and presents special challenges. The following policy issues should be considered as agencies formulate their future role in Belarus on Chernobyl-related matters.

Aligning government policy with informed personal choice

An important issue is the extent to which the international agency is, or is perceived to be co-opted to support government policy motivated by economic gain to rehabilitate contaminated areas at the expense of human health or choice. The basis for return migration must be voluntary informed choice, and the role of the agency as an independent international agency must be preserved. Otherwise, the agency risks its reputation supporting activities that might compound present problems faced by displaced Chernobyl migrants. The international agency could play a role in supporting government policy development on return migration and contribute to strengthening the availability of informative materials that enable potential returnees to make informed choices.

Making clear the purpose and extent of international support

Another issue concerns the purpose and extent of international support in relation to government of Belarus obligations. Should it be directed at short term efforts at relieving migration induced pressures? at investing in human and physical capital to create opportunities? at augmenting ongoing operational activity in the face of inadequate government funding? at building new hospitals? Over what period of time, and with what obligations should an agency provide support, particularly if the support is intended to be time-limited but sustainability with government funding cannot be assured under present economic conditions? Is time-limited provision of medications and vaccines to returning Chernobyl migrants a suitable role for an international agency?

Providing support for health infrastructure with health sector reform in mind

Infrastructure can be developed and strengthened to differing standards. Physician and hospital bed supply per capita in Belarus is higher than in most western countries, reflecting its former Soviet system roots (Table 2). The present health system has structural and operational inefficiencies and requires reform *(12, 32)*.

Strengthening health infrastructure to unacceptably high supply standards is problematic. It may not be acceptable to many donors, it supports the continuation of inefficiencies and it may jeopardize government opportunities for introducing reforms.

One must keep aware of international trends in health sector reform. Projects that support strengthening medical infrastructure should be in harmony with major health reform directions internationally. An agency should confirm, prior to formal appeals for funding, the acceptability to donors of various types of infrastructure projects.

Limiting distortions to equity

Support for displaced Chernobyl migrants returning home should not provide unacceptable advantage to them over the rest of the population.

The international agency should work with the government to ensure intervention are designed to limit distortions to equity in the availability of, access to and quality of health services, particularly in local areas where there are permanent residents with whom the returnees must integrate.

Adding migration lessons learned to world knowledge

Lessons learned from Chernobyl related migration should be shared with the world community. They may contribute knowledge that can be generalized for managing ecological as well as other mass migration in other parts of the world. Insights gained on Chernobyl related migration can inform the development of nuclear disaster guidelines and provide a useful human and social dimension to them.

AREAS OF SUPPORT REQUESTED IN BELARUS

Support for persons living in contaminated areas

The consulting terms of reference for this study focused on displaced Chernobyl migrants who wished to return to their home areas. The question of displaced migrants who do not wish to return or those who had never left, therefore, was not addressed. Nevertheless, the most common request from people interviewed in Belarus was for support to health services in contaminated areas to offset the impact of economic difficulties.

List of priority projects from Ministry of Foreign Affairs

A list of priority areas for support was developed by the government and has been presented at meetings with international donors by the Ministry of Foreign Affairs. The list identifies topics that are broadly developmental and research oriented, together with the provision of medical supplies and equipment to hospitals in contaminated regions (Box 6).

Box 6 List of priority projects aimed at the minimization of the medical consequences of the Chernobyl disaster

- **to develop methods for diagnosis, treatment and prevention of diseases for liquidators and other affected population groups**
- **health monitoring of the population groups exposed to small doses of radiation**
- **to analyze the causes of morbidity, mortality and disability caused by general-somatic, neurotic and psycho-somatic illnesses among the liquidators and population exposed to radiation for deriving the influence of non-radiation factors**
- **to design methods of biological dosimetry including retrospective dose assessment**
- **to develop early diagnostic and therapeutic methods for thyroid cancer, in children in the first place, including molecular-biological therapy and methods of cancer prevention**
- **epidemiological research, diagnostics, treatment of thyroid cancer especially in children, other neoplasms as well as genetic disorders**
- **to carry out epidemiological cohort research and examination of liquidators for determining incidence rate of leukosis and solid malignant tumors**
- **medical provision and equipping of hospitals in the affected regions of Gomel, Mogilev and Brest oblasts**

Source: Ministry of Foreign Affairs, Department of International Scientific and Technical Cooperation, February, 1997

Project proposal from the Chernobyl section of the Ministry of Health

A meeting at the Ministry of Health generated a project proposal for mobile, primary care, outreach medical support to the 1500 or so persons who had voluntarily returned to live in their home areas of Gomel where contamination levels are greater than 40 Ci/km2 and economic activity is not permitted. The Ministry was in a difficult position to supply adequate services to them, not only because of financial constraints, but also because the general Ministry position is that the area is unsafe and people should not be living there. The request was for financing a mobile unit equipped with basic monitoring, laboratory and diagnostic equipment and operating support for one to two years for a team comprising one or two physicians, nurses and laboratory technologists. The operating support requested was transitional only, the proposal including the expectation that regular government funding would be found in the future.

Similar support to remote villages is being provided by the Federation of the Red Cross and Red Crescent Societies. The local Red Cross delegation in Minsk indicated that IOM support would be welcomed; coordination and liaison with the Red Cross was requested.

Observations

The IOM policy issues discussed in section 4 apply to the requests outlined in this section. A common understanding reached at the Ministry of Foreign Affairs on priority projects (Box 6) was that IOM could focus on activities that have direct and practical application to the needs of returning Chernobyl migrants. The developmental and research projects topics listed would be more appropriate for funding by other agencies. An example of more practical support was the Ministry of Health proposal for a mobile team to deliver basic services to the 1500 voluntary returnees in Gomel.

RECOMMENDED DIRECTIONS

Support survey research to clarify the problem before developing major interventions

International support to the Government of Belarus should be based on a clear understanding of the scale of the problem presented by the potential voluntary return of displaced Chernobyl migrants to their home areas before embarking on major programs of support. The following recommendations enable this understanding.

Determine the potential scale of migration back to contaminated home areas

R 1 *Conduct a well designed, internationally financed project to survey displaced Chernobyl migrants to identify potential numbers of people wishing to return to their home areas, their motivations and conditions under which they would be prepared to return. The survey is to include persons who have voluntarily returned to their home areas.*

Profile the demographic and economic characteristics of the target population

R 1.1 *Include in the survey, demographic and household income information useful for developing a profile the population and the broad characteristics of its health related needs over the next decade*

Conduct and manage the project with Belarus and foreign experts

R 1.3 *Project management and direction should be by an international consulting team. Project execution would be by a Belarus team of experts. A multidisciplinary working group, appointed by and report to a high government level, would be mandated to enable and coordinate project design and execution. It should include representatives from the*

- *Ministries of Emergency Measures and Chernobyl, Finance (Departments of Health Financing and of Chernobyl), Health, Statistics and Analysis*
- *Centre for Medical Technologies, Information Computer System, Health Care and Management and Institutes of Sociology, Urban Planning*
- *Psychological Rehabilitation Centres*
- *local authorities of a contaminated community*
- *Belarus Academy of Sciences, Institute of Radiological Problems*

Control of project associated procurement and disbursement should be appropriate to the scale of the project according to common international agency practice and standards.

Provide informatics support to the project

R 1.4 *The Project should cover all hardware, software, network and communication costs necessary for participants and working group members to conduct their work effectively.*

Inform world-wide IOM operations and international nuclear accident guidelines

R 2 *world-wide operations, and specifically, the work of agencies developing guidelines and processes for managing nuclear disasters, including the International Atomic Energy Agency, International Commission on Radiological Protection, Radiation Protection Research Action of the European Commission, others as appropriate.*

Explore the feasibility of joint projects in education and counseling with other agencies

R 3 *Subject to findings from the project recommended in* **R 1** *explore with other agencies the feasibility of a joint training project to extend the work of the three Psychological Rehabilitation Centres in Belarus to address needs of potential returnees, and to develop attractive, clear, readable, scientifically grounded, information materials on radiation and return migration that would enable informed decisions by displaced Chernobyl migrants wishing to return to their home areas.*

Strengthen medical programming for migrants who have voluntarily returned

R 4 *In consultation with local and international partners, provide equipment and financing for one year for an appropriately equipped mobile medical team to serve the needs of some 1500 voluntary returnees to areas of higher contamination in Gomel, as suggested at the Ministry of Health.*

Examine the feasibility of a data warehouse for Chernobyl related data bases

R 5 *Undertake a feasibility study to determine the viability of developing a data warehouse to enable central government level policy development, planning and management of Chernobyl migrant needs and associated issues. The Ministries of Finance and Health should be included in the study together with the Ministry of Emergency Measures and Chernobyl Affairs.*

PROSPECTS AND ANTICIPATED BENEFITS AND RISKS

Initial reactions to proposed directions

The major findings and directions of this report were presented in debriefing sessions at the end of the mission to Belarus to the Deputy Minister, Ministry of Emergency Measures and Chernobyl Affairs and to senior officials of the Ministry of Foreign Affairs. The concepts were also tested on representatives met at the Ministries of Finance, Statistics and Analysis and Institutes and Centres visited. In addition, the directions and issues have been presented to IOM staff in a seminar.

There was universal agreement with the directions outlined, given the terms of reference for the study.

Anticipated benefits

Proceeding as recommended will:

- enable the design of an appropriate level of response by Belarus to the problem of return migration by displaced Chrnobyl migrants. They may also improve operations elsewhere and contribute to better management of nuclear accidents;
- medical support for some 1500 migrants who voluntarily have already returned to their homes in areas of higher contamination levels;
- assess the feasibility of developing a data warehouse as a powerful information tool for future Chernobyl migration related planning in Belarus;
- increase expertise on migration and the issue of ecological migrants into focus for these agencies.

Anticipated risks

There are two main risks associated with proceeding as recommended. The first is that the projects proposed may fail in their execution: the survey may be poorly executed, and the equipment and mobile medical units may not fulfill their intended roles. This may be mitigated by careful selection of the consulting team to manage the survey project, and by jointly working out with the Ministry of Health an agreed upon plan of action that includes Ministry monitoring and final reporting on the activities of the mobile unit.

The second risk is that the survey research results will not guarantee the numbers of people that ultimately choose to return to their home areas. This risk is inherent. The mitigating consideration is that the results will inform policy development, which will need to be flexible in any case. Informed policy development by Belarus should lead to a more appropriate and effective response than would otherwise be possible.

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ANNEX B

Persons consulted and schedule

Meetings held during the mission to Belarus departing 19 January returning 8 February 1997

Date, place	Persons consulted
21 January, Geneva, IOM Headquarters	**AM** **1. Loretta Iuri, Assistant Medical Administrator** **1. Jacqueline Weekers, Medical Administrator** **1. Dr Deborah Harding, Medical Officer, Occupational Medicine and Insurance** **1. Joanna Schmitt** **5. PM** **40. Mr Alexander Kapirovsky, Operations Assistant (teleconference to IOM office Minsk)** **40. Jari Pirjola, Head of Office (teleconference to IOM Minsk)** **40. Mr Petteri Vuorimaki, Coordinator CIS and Baltic States**
22 January, IOM Office, Minsk	**PM** **9. Jari Pirjola, Alexander Kapirovsky**
23 January, Minsk	**AM** **10. Igor Rolevich, Deputy Minister, Ministry of Emergency Measures and Chernobyl Affairs** **PM** **11. Dmitri Marach, Deputy Minister, Head of State Migration Service**
24 January, Minsk	**PM** **12. Dr Natalya Drozd, Director, Department of International Humanitarian Cooperation and Human Rights, Ministry of Foreign Affairs**
27 January, Minsk	**13. Pavel Kral, Resident Coordinator United Nations Office in Belarus and Yuriy Misnikov, Action Programs**
28 January, Minsk	**14. Galina Gasjuk, Deputy Minister, Ministry of Statistics and Analysis, and staff**
29 January, Minsk	**AM** **15. Vladimir Vantsevich, Director, Department of International Scientific and Technical Cooperation, Ministry of Foreign Affairs** **PM** **16. Galina Sokolik, Belarus State University** **14. Tatyana Klimova, Institute of Urban Planning, and staff**
30 January, Mogilev	**PM** **18. Anatoly Zahorsky, Head, Mogilev Department of Emergency Measures and Chernobyl and Oleh Kotlyarenko, Deputy Head, Department of Health Care Administration** **18. Vladymir Savchenko, Vice Chairman, Mogilev Oblast Executive Committee** **18. Vladyslav Ostapenko, Director, Belarus Scientific Research Institute of Ecological and Occupational Pathologies** **18. Danyl Kurchynsky, Head, Department of Registration, Chernobyl Register**

31 January	**AM**
Pudovnya Rayon, Mogilev Oblast (resettled)	**22. Vladymir Kononv, Chairman, Drybben Rayon Executive Committee, rayon and kolhoz officials, village residents**
	PM
	23. Valery Brestov, Chairman Slavgorod Rayon Executive Committee
Slavgorod Rayon, Mogilev Oblast (contaminated)	
Gaishyn Village, Slavgorod Rayon (contaminated)	**23. Residents and local representatives**
03 February, Minsk	**AM**
	25. Ivan Zayash, Deputy Minister of Finance and staff
	40. Mr Belsky, Director and Ludmyla Prychodko, Deputy Director, Department of Financing Emergency Measures and Chernobyl, Ministry of Finance
	PM
	27. Svitlana Gorodetskaya, Director Department of Health Financing, Ministry of Finance
04 February, Minsk	**AM**
	28. George Vetcher, Deputy Head Foreign Relations Department and Valentyn Stezhko, Head, Department of Medical Protection from Consequences of the Chernobyl and Emergency Measures, Ministry of Health
	40. Alexey Okeanov, Director, Belarus Centre for Medical Technologies, Information Computer Systems, Health Care Administration and Management
	PM
	30. Vladimir Skurat, Deputy Director, Institute of Radiological Problems, Academy of Sciences of Belarus
	40. Svitlana Gorodetskaya, Director, Department of Health Financing, Ministry of Finance;
05 February, Minsk	**AM**
	41. Natalya Drozd, Ministry of Foreign Affairs and staff
	42. Valentyn Stezhko, Ministry of Health
	43. Fedor Germanovych, Fist Deputy Chief Sanitary Physician, Ministry of Health
	PM
	44. Pavel Kral and Yuriy Misnikov, UN
	45. I Rolevich, Ministry of Emergency Measures and Chernobyl Affairs
	46. Ivan Borisavljevic, Team Leader and Rolf Reichert, Economist, Project Manager, EU TACIS Programme, Coordinating Unit, Belarus
06 February, Minsk	**AM**
	47. Pentti Kotorao, Head of Delegation, International Federation of RedCross and Red Crescent Societies, Delegation in Minsk
07 February, Geneva	**AM**
	48. Dr Gennadi Souchkevitch, Scientist, Office of Global and Integrated Environmental Health, WHO
	PM
	49. Brian Gushulak, Director Medical Services IOM
	50. Seminar to IOM staff

Glossary of radiation terms

1. Radiological units

Summary of Radiological units

Unit	Symbol	Brief Description	Use
Curie	Ci	3.7×10^{10} disintegrations per second	Special unit of activity
Becquerel	Bq	1 disintegration per second	SI unit of activity
Roentgen	R	2.58×10^{-4} C/kg (photons in air)	Special unit of exposure; applies only to gamma and X radiation
Rad	rad	0.01 J/kg (100 ergs/g)	Special dose unit; applies to any radiation
Gray	Gy	1 J/kg	SI unit of dose (equals 100 rads)
Dose Equivalent	H	Dose x Q x any other modifying factors	Radiation protection
Quality Factor	Q	Biological effectiveness related to type of radiation	Radiation protection
Rem	rem	Rad dose x Q x any other modifying factors	Special unit of human dose equivalent
Sievert	Sv	Gy x Q x any other modifying factors	SI unit of human dose equivalent (equals 100 rem

2. Relationship between special and SI units

Activity: 1 Ci = 3.7×10^{10} Bq

Exposure: 1 R = 2.58×10^{-4} C/kg. The special unit for exposure is the Roentgen. There is no SI unit for exposure; it is simply expressed in C/kg.

Dose: 100 rads = 1 Gy

Dose Equivalent: 100 rem = 1 Sv

1 Ci = 3.7×10^{10} Bq = 37 GBq

27 uCi = 1×10^{6} Bq = 1 MBq

1 rad = 0.01 Gy = 10 mGy

1 rem = 0.01 Sv = 10 mSv

3. Glossary of selected radiation safety terms

Absorbed Dose The amount of energy imparted to matter by ionizing radiation per unit mass of irradiated material. The unit of absorbed dose is the rad, which is 100 ergs/gram.

Absorption The phenomenon by which radiation imparts some or all of its energy to any material through which it passes.

Activity The number of nuclear disintegrations occurring in a given quantity of material per unit time.

Acute Exposure The absorption of a relatively large amount of radiation (or intake of radioactive material) over a short period of time.

Acute Health Effects Prompt radiation effects (those that would be observable within a short period of time) for which the severity of the effect varies with the dose, and for which a practical threshold exists.

Background Radiation Ionizing radiation arising from radioactive material other than the one directly under consideration. Background radiation due to cosmic rays and natural radioactivity is always present. There may also be background radiation due to the presence of radioactive substances in other parts of the building, in the building material itself, etc.

Becquerel (Bq) The international (SI) the unit for radioactivity in which the number of disintegrations is equal to one disintegration per second. A charged particle emitted from the nucleus of an atom during radioactive decay.

Chronic Exposure The absorption of radiation (or intake of radioactive materials over a long period of time), ie, over a lifetime.

Contamination, *Radioactive* Deposition of radioactive material in any place where it is not desired, and particularly in any place where its presence may be harmful. The harm caused may be a source of excessive exposure to personnel or the validity of an experiment or a procedure.

Cosmic Radiation Penetrating ionizing radiation , both particulate and electromagnetic, originating in space. Secondary cosmic rays, formed by interactions in the earth's atmosphere, account for about 45 to 50 millirem annually.

Coulomb (C) The meter-kilogram-second unit of electric charge, equal to the quantity of charge transferred in one second by a constant current of one ampere.

Curie (Ci) The quantity of any radioactive material in which the number of disintegrations is 3.7×10^{10} per second.

Decay, *Radioactive* Disintegration of the nucleus of an unstable nuclide by the spontaneous emission of charged particles and/or photons.

Delayed Health Effects Radiation health effects which are manifested long after the relevant exposure. The vast majority are stochastic, that is, the severity is independent of dose and the probability is assumed to be proportional to the dose, without threshold.

Decontamination The reduction or removal of contaminating radioactive material from a structure, area, object, or person. Decontamination may be accomplished by

1. treating the surface to remove or decrease the contamination,
2. letting the material stand so that the radioactivity is decreased as a result of natural decay, and
3. covering the contamination to shield or attenuate the radiation emitted.

Disintegration See decay, radioactive.

Dose or Radiation Dose A generic term that means absorbed dose, dose equivalent, effective dose equivalent, committed dose equivalent, committed effective dose equivalent, or total effective dose equivalent, as defined in other paragraphs of this section.

Dose Equivalent (HT) The product of the absorbed dose in tissue, quality factor, and all other necessary modifying factors at the location of interest. The units of dose equivalent are the rem and the Sievert (Sv). The ICRP defines this as the equivalent dose, which is sometimes used in other countries.

Dose Rate The radiation dose delivered per unit of time. Measured, for example, in rem per hour.

Dosimeter A portable instrument for measuring and registering the total accumulated exposure to ionizing radiation.

Dosimetry The theory and application of the principles and techniques involved in the measurement and recording of radiation doses. Its practical aspect is concerned with the use of various types of radiation instruments with which measurements are made.

Effective Dose Equivalent The sum of the products of the dose equivalent to the organ or tissue and the weighting factors applicable to each of the body organs or tissues that are irradiated.

Electron Volt A unit of energy equivalent to the amount of energy gained by an electron in passing through a potential difference of 1 volt. Abbreviated eV. Radioisotopic energy is typically measured in MeV (million electron volts).

Exposure (1) Being exposed to ionizing radiation or radioactive material. (2) a measure of the ionization produced in air by X or gamma radiation. It is the sum of the electrical charges on all ions of one sign produced in air when all electrons liberated by photons in a volume element of air are completely stopped in air, divided by the mass of air in the volume element. The special unit of exposure is the Roentgen.

External Dose That portion of the dose equivalent received from radiation sources outside the body.

Gray The international (SI) unit of absorbed dose in which the energy deposited is equal to one Joule per kilogram (1 J/kg).

Half-Life, *Biological* Time required for the body to eliminate 50 percent of a dose of any substance by the regular processes of elimination. This time is approximately the same for both stable isotopes and radionuclides of a particular element.

Half-Life, *Effective* Time required for a radioactive nuclide in a system to be diminished by 50 percent as a result of the combined action of radioactive decay and biological elimination.

Effective half-life = (Biological half-life x Radioactive half-life)/(Biological half-life + Radioactive half-life}

Half-Life, *Radioactive* Time required for a radioactive substance to lose 50 percent of its activity by decay. Each radionuclide has a unique half-life.

High Radiation Area An area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 0.1 rem (1 mSv) in one hour at thirty centimeters from the radiation source or from any surface that the radiation penetrates.

Hot Spot The region in a radiation/contamination area in which the level of radiation/contamination is noticeably greater than in neighboring regions in the area.

Intake Quantity of material introduced into the body by inhalation, ingestion or through the skin (absorption, puncture, etc.)

Inverse Square Law The intensity of radiation at any distance from a point source varies inversely as the square of that distance. For example: if the radiation exposure is 100 R/hr at 1 inch from a source, the exposure will be 0.01 R/hr at 100 inches.

Isotopes Nuclides having the same number of protons in their nuclei, and hence having the same atomic number, but differing in the number of neutrons, and therefore in the mass number. Almost identical chemical properties exist between isotopes of a particular element.

Joule The meter-kilogram-second unit of work or energy, equal to the work done by a force of one Newton when its point of application moves through a distance of one meter in the direction of the force.

Monitoring The measurement of radiation levels, concentrations, surface area concentrations or quantities of radioactive material and the use of the results of these measurements to evaluate potential exposures and doses.

Natural Radiation Ionizing radiation, not from manmade sources, arising from radioactive material other than the one directly under consideration. Natural radiation due to cosmic rays, soil, natural radiation in the human body and other sources of natural radioactivity are always present. The levels of the natural radiation vary with location, weather patterns and time to some degree.

Quality Factor (Q) A modifying factor that is used to derive dose equivalent from absorbed dose. It corrects for varying risk potential due to the type of radiation.

Rad The special unit of absorbed dose. One rad is equal to an absorbed dose of 100 ergs/gram or 62.4×10^{6} MeV per gram.

Radiation Area An area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 0.005 rem (0.05 mSv) in one hour at thirty centimeters from the radiation source or from any surface that the radiation penetrates.

Radioisotope A nuclide with an unstable ratio of neutrons to protons placing the nucleus in a state of stress. In an attempt to reorganize to a more stable state, it may undergo various types of rearrangement that involve the release of radiation.

Radiology That branch of medicine dealing with the diagnostic and therapeutic applications of radiant energy, including x-rays and radioisotopes.

Radionuclide A radioactive isotope of an element.

Rem The special unit of dose equivalent. The dose equivalent in rems is numerically equal to the absorbed dose in rads multiplied by the quality factor, distribution factor, and any other necessary modifying factors.

Roentgen ® The quantity of X or gamma radiation such that the associated corpuscular emission per 0.001293 gram of dry air produces, in air, ions carrying one electrostatic unit of quantity of electricity of either sign. Amount of energy is equal to 2.58×10^{-4} coulombs/kg air. The Roentgen is a special unit of exposure.

Sievert The international unit (SI) of dose equivalent (DE, human exposure unit),which is equal to 100 rem. It is obtained by multiplying the number of grays by the quality factor, distribution factor, and any other necessary modifying factors.

Somatic Effects of Radiation Effects of radiation limited to the exposed individual, as distinguished from genetic effects, which may also affect subsequent unexposed generations.

Source Material 1)Uranium or thorium in any combination of uranium and thorium in any physical or chemical form; or 2) ores that contain, by weight, one-twentieth of 1 percent (0.05%), or more, of uranium, thorium, or any combination of uranium and thorium.

Source material does not include special nuclear material.

Terrestrial Radiation The portion of the natural radiation (background) that is emitted by naturally occurring radioactive materials in the earth.

Uptake Quantity of material taken up into the extracellular fluids. It is usually expressed as a fraction of the deposition in the organ from which uptake occurs.

Very High Radiation Area An area accessible to individuals, in which radiation levels could result in an individual receiving an absorbed dose in excess of 500 rads (5 grays) in one hour at one meter from a radiation source or from any surface that the radiation penetrates.

X-rays Penetrating electromagnetic radiation having wave lengths shorter than those of visible light. They are usually produced by bombarding a metallic target with fast electrons in a high vacuum. In nuclear reactions it is customary to refer to photons originating in the nucleus as gamma rays, and those originating in the extra nuclear part of the atom as x-rays. These rays are sometimes called Roentgen rays after their discoverer, WC. Roentgen.

Source: 1. Based on the sections "Radiological Units" and "Glossary" in the "Appendices" of the *Radiation Safety Manual* , ***Office of Radiation, Chemical & BiologicalSafety at Michigan State University,*** Web site *http://www.orcbs.msu.edu/radiation/radiation/radsaf.html*

2. Also see the home Web site at *http://www.orcbs.msu.edu/*

ANNEX D

Consulting engagement "fugitive file" of loose documents (Filed separately with IOM Geneva)

1. Belarus Ministry of Health. March, 1997. "Status of immunization of the population of Belarus in 1996". (Data tables in Russian)

2. Belarus Mapping and Geodesic Enterprise. c 1995. Topographic map of Belarus with data on radiation contamination, and Map of Minsk.

3. Minsk Economic News. February 1997. (Also see http://www.css.minsk.by/)

4. IAEA. 1995. "IAEA: political motivations focus on Chernobyl." *DHA News*: September-October 1995.

5. TACIS. 1996?. "Addressing the clean-up and the secondary medical effects of the Chernobyl disaster." Inter-State Program, p 76. (Project description, on 2 pages)

6. TACIS. 23 August 1996. Table 2. Tacis Inter-state Programme + Nuclear Safety Programme : General overview projects involving Belarus. (Table, 2 pages)

7. UNDP. February 1966. Shortlist of the UN Technical Assistance Projects in Belarus. (Table, 6 pages)

8. UNDP. January 1997. Advisory Note for the Preparation of the Country Cooperation Framework (CCF) for Belarus, 1997-1999. Draft. Not officially edited. UN/UNDP Office in Belarus, Minsk

9. UN-DHA?. December 1996?. "Summary of Chernobyl related current and planned activities of UN agencies and major international organizations (1996-2000)", excerpted from "Updated Information on Chernobyl activities". September 1996. Geneva.

About the consultant

Professional Background
Mr Myroslaw Basil Kohut, MSc, CMC, CHE(CA), CHE(US)

Mr Myroslaw Kohut is a private practice consultant serving clients through *MB KOHUT CONSULTING LTD* based in Surrey, in the Greater Vancouver area, British Columbia, Canada. He is qualified by the Institute of Certified Management Consultants of Canada, the Canadian College of Health Service Executives, and the American College of Healthservice Executives.

Mr Kohut is a graduate of the Universities of Alberta and Toronto in theoretical physics. His interest in health began in the mid-1970s while Chairman of Applied Science and Health, Confederation College, Thunder Bay, Ontario and led to graduate work in the Master's in Health Administration program at University of Alberta during a sabbatical. He joined Alberta Health, a ministry of health where held senior management responsibility for Policy, Planning, and Program Planning in critical care, imaging and laboratory services, mental health, geriatrics and capital planning for health facilities. At Alberta Health he co-developed the ministry's planning and approval process for health facility planning and managed the Proposal and Functional Programming stages of a C$2.5 billion redevelopment programme in the late 1970s.

Since 1980, Mr Kohut has consulted professionally, directing over 60 projects, mainly regional, strategic and policy studies for ministries of health and education, hospital corporations and regional health authorities, and international financing agencies and governments. In Canada the studies include strategic plans for provincial cancer services, long term psychiatric care, environmental health, and rationalization of regional programs of women's, children's and emergency health services. Internationally, he has led projects in Bahamas, Bangladesh, Belarus, Mongolia, Poland, Tajikistan, Ukraine and the US, with some taking him to Sweden and the UK to review policy and planning approaches there.

In 1993, Myroslaw Kohut assessed the health sectors of Belarus and Ukraine for the World Bank. This led to the 1994 World Bank Technical Note "The Belarusian Health Sector", an edited version of his consulting report, and the sections on demography, and assessment of population health status, sector structure and financing in the 1993 World Bank Country Study *Ukraine, The Social Sectors during Transition.* Mr Kohut's experience in other former Soviet economies includes Poland, where he led an on-site team for eight months providing policy and strategic management support to the Ministry of Health, and Mongolia and Tajikistan, where he assessed the health sectors and presented approaches to reform in the context of their economic and governance transitions.

Mr Kohut is recognized for his expertise in health sector assessment and reform. He also consults in digital information technology and telecommunications, an area of growing involvement for him. His health clients include the Aga Khan Foundation, International Organization for Migration, Kaiser Permanente, the World Bank, the Inter-American Development Bank, as well as USAID, CIDA and others. His non-health clients include Sony Pictures Studios, Stentor Resource Centre Inc - the alliance of Canadian telephone companies, and the Vancouver Trade and Convention Centre.

ANNEX F

Acknowledgements

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