MEDICAL AND DEMOGRAPHIC CONSEQUENCES

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I. Before Conversion: The Military-Industrial Complex

The military-industrial complex in Russia had its origins in the shift from a market economy to a command and central control system that occurred in 1927. The reorganization of industry in 1929 destroyed the last remnants of a private economy or private ownership, as well as any semblance of individual legal protection. These changes made the militarization of industry possible, and this militarization had the effect of suppressing non-military economic development. Thus, the military economy became the driving force behind the state economy, with its own set of rules and procedures that bypassed personal economic well-being.[16]

Between the 1930s and 1980s, the Soviet government focused on the development of military production at the expense of civilian production. Although the Soviet government claimed that it accomplished full employment, this was probably an aberration of the methods of accounting used. American researchers have shown that fewer jobs can be created in military industries than is possible for the same expenditure on civilian industries.[17]

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16 V.N. Rassadin, "Military-Industrial Complex as System," *Voprosy Prognozirovania: Institute for Economic Forecasting, RAS, Moscow*, no. 1, 1993, pp. 55-56 (in Russian).

17 "Hearings Before the Committee on the Budget, United States Senate." 95th Congress, *National Defense*, vol. 1, no.28, April 1978, pp. 434-438.

In the Soviet system of national accounting, military industries were not disaggregated from national statistics but were included in national statistics on the machine production, chemical production, and nuclear power industries. By the late 1980s, about 60 percent of machinery manufacture was military-related, while from 80 to 90 percent of all national resources went to forming the military-industrial complex. About 75 percent of all scientific research was also devoted to this end. An important feature of this economic change was the high geographic concentration of military production and research facilities. More than 60 "normative" large cities were constructed, each with a high concentration of military production factories and research facilities. In these cities, the pattern of employment was essentially restricted to these military industries.[18] Some 20 other smaller and medium sized closed cities focused mainly on nuclear technology, and these varied in size from some 13,400 people in Ostrovnoi, located in Murmansk Oblast, to 118,600 in Seversk, located in Tomsk Oblast. In order to attract the most skilled employees to these cities, special conditions were created for them and their families. Material and social well-being were better than in comparable non-military cities. For example, health indicators were better than in comparable non-military cities. In fact, comparisons of infant mortality, birth defects, and rate of infant disease between the 20 special cities and, for example, cities devoted to metallurgy, indicate that these health indicators were primarily related to pollution by nitrogen

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[18] E.E. Kostochkin, *Socio-Economic Characteristics Of Conversion Of Military Industrial Complex In Russia* (Moscow, 1993), p.6 (in Russian).

dioxide and sulfur dioxide emissions from the metallurgical processes, rather than emissions from nuclear plants.[19]

Factories devoted to the production of chemical weapons were located in seven Russian cities: Dzerzhinsk, Volgograd, Berezniki, Novocheboksarsk, Novomoskovsk (Tula Oblast), Chapaevsk, and Kirovo-Chepetsk. More than a million people resided in neighborhoods affected by these enterprises, in which the air became extremely polluted. The first large-scale production of mustard gas was organized in Chapaevsk (Samara Oblast) and in Dzerzhinsk. Altogether, during World War II, 122,000 metric tons of toxic agents were produced in the chemical weapons factories.[20]. The technology used in the production of these toxic agents was the cheapest possible, and there was almost no protection for the factory workers who were exposed to these chemicals, many of whom suffered illnesses resulting directly from their exposure.

The development of Russia's nuclear capability during the post-war arms race also caused environmental deterioration in parts of Russia. This pollution was not connected with nuclear weapons themselves, which were stored safely. Far more dangerous was the radioactive waste material, which was extremely expensive to bury in an appropriate manner. The cost in Russia was more expensive than in the United States, where the cost of deactivating nuclear waste has been estimated at up to $100 billion.[21]

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[19] L.A. Buldakov, S.N. Demin, E.R.Liubchanski, "Analysis of the Influence of Radioactive and Chemical Environmental Factors on the Health of Newborn Infants in the Region Where Nuclear Industry is Located," *Hygiene and Sanitation*, no. 6, 1991, p. 55 (in Russian).

[20] L.A. Fedorov, *Undeclared Chemical War In Russia. Policy Against Ecology* (Moscow, 1995) (in Russian).

[21] *Technology Review*, August/September 1988, p.42.

The first nuclear accident of major proportions occurred in 1957 in Kyshtym, although it was classified as secret until 1989, when it was made public for the first time. Radioactive pollution as a result of the accident covered some 390 settlements in Sverdlovsk Oblast, in which more than 330,000 people were living. Subsequent studies of the effects of this catastrophe have revealed far-reaching health effects on subsequent generations, including rates of birth defects, cancer, and inherited diseases elevated well above normal for this population.[22] Of course, the notorious catastrophe at Chernobyl is a more familiar example of the terrible consequences of such nuclear accidents.

Accurate assessment of the medical and demographic problems associated with the past operations of the Soviet military industrial complex is impossible. Statistics on mortality and morbidity were, for all intents and purposes, never published. Moreover, in many cities with large defense enterprises, such information was the responsibility of special medical offices belonging to the former Third Department of the Ministry of Health Care (also called the Department for Medical and Biological Emergencies), which prevented access to medical statistical data.

II. The Past Decade: Consequences Of Conversion

A. Social Effects

A decade of reform of the military-industrial complex has now passed, and during this time the economy has been converted from a centralized operation, dominated by military and military-related production, to a market system. What are the results of this process?

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[22] The Kystym accident was described in V.Chukanov (ed.) *East-Ural Radioactive Trace* (Ekaterinburg, UrO RAN, 1996) (in Russian).

First, it must be realized that the complexity and scale of the changes in industrial production strategy dominate the process of socio-economic reform that has occurred since 1989 in Russia. Initially, ten governmental organizations were created to finance the process of conversion; altogether some 3,000 conversion projects were initiated.[23] The major elements in the conversion process have been:

(a) an enormous reduction in the output of military-related enterprises, with a concomitant emphasis on developing a market economy;

(b) reorientation of this production capacity, and also the technology base of the military-industrial complex, to a market-based system;

(c) large-scale redistribution of labor to civilian production;

(d) provision of retraining and new employment for personnel formerly engaged in military production, as well as their relocation to new employment sites;

(e) reorganization of the social security system in regions where military factories were previously concentrated.

The first result of this conversion process was "forced" mobility of the personnel involved in the military industries. Before conversion, highly trained workers were attracted to military industries by the relatively high wages, but after perestroika, the emergence of the first private enterprises saw their real and relative salaries drop. Those who stayed in those industries found their wages low, a situation that was

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23 "Lessons Of Restructuring: Conversion Of Defense And High-Technology Industry In 1992-1994 (Review)." *Voprosy Prognozirovania: Institute for Economic Forecasting, RAS, Moscow*, no. 5, 1995, p. 99, (in Russian).

exacerbated by rapid inflation and non-payment. These, together with the absence of an adequate government policy of social welfare, led even more employees to move to more lucrative occupations. This was particularly true of the youngest and most competent professionals, who fled the military industries. By 1993, this flight had largely ceased, leaving in the military industries mostly people who had failed to find other employment because of their age or their personality.

Young professionals are no longer obliged to work where they are assigned. As a result, there is no source of newly trained personnel for the military industries. In fact, the present employees of these enterprises can be characterized with an inverted age pyramid in which the number of personnel is correlated with age; it is virtually impossible to find professionals under 35 years of age in those organizations.

These effects vary geographically. In some parts of Russia, scientific and educational institutions were completely oriented to the needs of the military-industrial complex. For example, in Tomsk, out of a population of 500,000, about 87,000 were employed by state-financed enterprises. Today these workers have no jobs or support. While in the large cities, such as Moscow or St Petersburg, there are good chances of finding a new job, in cities like Tomsk, or others in the northern and northeastern parts of Russia, it is quite impossible.[24]

Although defense conversion originally appeared to be a focal point for socio-economic reform, the social consequences have not worked out as originally intended. Indeed, there are a number of significant negative consequences: increased unemployment, decreased

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24 V.N. Rassadin, "Defense orientation of industrial production," *Voprosy Prognozirovania: Institute for Economic Forecasting, RAS, Moscow*, no. 5, 1995, p. 23, (in Russian).

standard of living, curtailment of social welfare (especially in the health field, where access to medical care is no longer guaranteed, and can be extremely difficult), and exacerbation of environmental problems.

The highest rates of increase in unemployment rates occurred in 1994. For the nation as a whole, the unemployment rate doubled in the period from 1990 to 1997, reaching 9% in 1997. Unemployment in the northern and eastern regions, where most cities were focused on military industries, exceeded the national average, reaching 10-12%.[25] In 1997 the volume of industrial production began to increase, new civilian jobs began to be created, and the national unemployment rate fell. Even so, unemployment remains a significant factor in Russian economic life. According to a poll conducted in 1998 by VTsIOM (All-Russian Center for Public Opinion Studies), 66% of respondents viewed unemployment as the most pressing socio-economic problem for Russia.[26]

Per capita incomes dropped by 41.4% between 1991 and 1996. After an initial collapse in 1992, there was a rise until 1994, but in 1994-1996 further reduction occurred, with real wages dropping by 54.5%. The financial crisis of August 1998 affected every Russian family, and resulted in a further drop in the standard of living. The cost of living doubled in a period of several months, reaching 787 rubles (about $31) according to official statistics, although the actual increase was considerably greater. Official estimates placed the average per capita income at 137% of the cost of living, with pensions at only 51% of the cost of living. In 1998, the average monthly wage of workers in heavy

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[25] B.D. Breev, T.N. Kostenko, A.M. Nanavyan, "Particular Features of Employment Policy During the Transition Period," *Voprosy Prognozirovaniya: Institute for Economic Forecasting, RAS, Moscow,* no. 6, 1998, p. 54 (in Russian).

[26] Breev et al., 1998, p.55.

manufacturing was 946 rubles ($38), while workers in chemical industries received 1174 rubles ($47). In these two industries, employee benefits accounted for 25.4 rubles ($1) and 42.5 rubles ($1.70), respectively.[27]

As a result of the decrease in industrial production, the 1990s have seen environmental pollution undergo a substantial reduction in Russia. In particular, emissions of toxic agents into the atmosphere by industrial sources dropped from 42.5 million metric tons in 1985 to 20.3 million metric tons in 1996.[28] Today the problem of radioactive wastes remains of critical importance. Fifty years of the arms race resulted in the accumulation of huge amounts of radioactive waste materials, and it is extremely difficult to assess the damage to public health caused by these wastes in the regions surrounding their burial sites.

B. Medical and Demographic Consequences of Conversion

The period of 1990-1994 in Russia can be characterized as one of social stress. This stress affected medical and demographic indicators of the population, and the health of the population deteriorated markedly over this period. The most vulnerable sectors of the population, those who were economically marginal and psychologically stressed, suffered most as the situation deteriorated. Rates of occurrence of cardiovascular diseases, alcoholism, and suicide increased markedly. The number of cardiovascular disease cases increased from 10.4% in 1988 to 13.3% in 1995.[29] Every third adult needed some kind of psychological support.[30]

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[27] *Statistical Yearbook*, 1998 (Moscow: Goskomstat of Russia, 1999), p.263.

[28] *Statistical Yearbook*, 1997 (Moscow: Goskomstat of Russia, 1998), p.282.

[29] *Population of Russia*, 1996 (Moscow: Center of Demography and Human Ecology, 1997), p. 96 (in Russian).

Life expectancy reached the lowest point in the whole postwar period (57.4 years for men and 71 for women),[31] while the greatest increase in mortality occurred in the age group of 30 to 60 years.[32] Economic instability appeared to influence the process of family formation, especially among people of marriageable age. As a result, the total fertility rate declined from 1.89 in 1990 to 1.39 in 1994 for women aged 15-49.[33] The total first marriage rate decreased from 1 in 1990 to 0.77 in 1994, and the total divorce rate reached its highest value for two decades in 1994 (0.64 divorces per male and 0.63 per female).[34]

The period 1995-1998 saw a slight improvement in some of these medical-demographic indicators. Several sociological studies indicate that the population is now going through the first stages of adaptation to the changed economic system. A large part of the population has modified its behavior, and has become able to manage their lives independently of state welfare. On the other hand, there remains a group of socially disadvantaged citizens who are unable or unwilling to improve their economic situation. They remain vulnerable to social and economic disturbance and a negative influence on medical and demographic indicators. However, between 1995 and 1998 there was some improvement in certain health indicators: life expectancy increased, reaching 60.9 years for men and 72.9 for women[35] by 1997.

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30 *Population of Russia*, 1997 (Moscow: Center of Demography and Human Ecology, 1998), p. 69 (in Russian).

31 *Population of Russia*, 1997, p. 87.

32 *Population of Russia*, 1997, p. 90.

33 *Population of Russia*, 1997, p. 50.

34 *Population of Russia*, 1997, pp. 38, 47.

35 *Population of Russia*, 1998 (Moscow: Center of Demography and Human Ecology, 1999), p.78 (in Russian).

Fertility, however, continued its decline, with the total fertility rate reaching 1.22,[36] the lowest value since World War II.

The medical-demographic situation in cities that formed the core of the military-industrial complex is revealed by official data and our own research. Special attention should be paid to demographic indicators from the former closed cities, namely those oriented towards nuclear industries. At the present time, these formerly elite cities are experiencing pronounced socio-economic depression as their residents find it harder to adapt to the new conditions than those of cities that did not have special status. Psychological stress associated with the rapid drop in living standards, loss of professional prestige, and changed social ideals (earning a good living instead of forging a defensive shield for the motherland) have apparently led to an increase in male mortality from cardiovascular diseases (relative to the average incidence for Russia).

It is difficult to estimate the total number of cities with large metallurgical and machine-tool complexes that were dedicated to the production of tanks, rockets, different types of guns, antiaircraft devices, ships, etc., but it exceeds several hundred. It is reasonable to assume that deterioration of public health can be found in many centers of the Russian defense industry.

Joint studies by Russian researchers and the Harvard School of Public Health showed the influence of air pollution on the population's health. According to these studies, the increased concentration of pollutants in the air led to an increase in prevalence of cardiovascular and respiratory diseases.[37] Panel studies of children with allergic and

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36 *Population of Russia*, 1998, p.40.

37 B. Katsnelson et al., "Daily Variations of Ambient Air Pollution and Acute Mortality of Population in Ekaterinburg and Nizhnii Tagil Cities, Russia;" in

respiratory symptoms confirmed the correlation between the high concentration of such agents as nitrogen dioxide and particulate matter in the air, and an increase in the frequencies of these disorders.[38]

More than ten uranium mines were located in the former Soviet Union. One was in Lermontov, in the Caucasus, near the famous resort of Piatigorsk. In recent years, information about the level of radon in the city's environment and about the population's state of health has been published for the first time. The effect of increased natural radiation on the population was augmented by the influence of the former professional activities of the employees in uranium processing plants. In addition, radioactive building materials were used in Lermontov. The density of the radon stream from the Earth's surface was about fifteen times the average world value. As a result, the population was exposed to an amount of radiation comparable to that of workers at the uranium processing factories. The consequences of high radiation in Lermontov were terrifying. Between 1958 and 1998, mortality rates increased by a factor of three, and the standardized mortality rates from lung cancer in men were considerably higher than average for Stavropol Krai, where the city is located.[39]

Stores of toxic agents in seven military chemical bases constitute an environmental danger to Russia, which signed but did not ratify the

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"1999 Annual Conference of the ISEE and ISEA: Abstracts," *Epidemiology*, vol. 10, no. 4, July 1999, Suppl., p.45.

[38] L. Privalova, S. Brezgina, B. Katsnelson, S. Kuzmin, S. Voronin, H. Ozkaynak, J. Xue, and J. Spengler, "Ambient Air Pollution, Respiratory Symptoms, and Peak Flow Measurements in Symptomatic and Asymptomatic School Children (Results of A Panel Study in Nizhnii Tagil, Russia;" in "1999, Annual Conference of the ISEE and ISEA: Abstracts," *Epidemiology*, vol. 10, no. 4, July 1999, Suppl., p.53.

[39] S.V. Vereiko, "Radiation And Hygienic Estimation of Working and Living Conditions of the Population of Lermontov" (Moscow, 1998).

convention on the prohibition of the development, production, accumulation, and use of chemical weapons, and their elimination. Medical-demographic data concerning the cities where the military-chemical complexes were located is scanty. Only in recent years has some information on the health of the population of these cities appeared in the media and technical literature. One city where detailed public health studies have been carried out is Chapaevsk, which, like other cities of the military-industrial complex, has experienced high unemployment, rapid reduction in fertility, and increased mortality.

III. Medical and Demographic Indicators in Chapaevsk

Medical-demographic indices in Chapaevsk show substantial deterioration over the past decade. These effects, both long- and short-term, are due mainly to the national socio-economic crisis of the 1990s. Because the economy of Chapaevsk was previously dominated by government-run defense industries, the new socio-economic situation, with its reduced emphasis on the military industry, and increased level of privatization, has had a profound effect on the labor market and population structure.

The population of Chapaevsk decreased by 8,100 during 1990-1997, when, as seen in Table 5.4.1, the rate of natural increase was negative. By the mid-1990s, the birth rate had dropped to its lowest value since World War II.

A major contribution to the drop in the birth rate comes from the aging of the city's population. Chapaevsk has a high proportion of elderly citizens (60 years and older), higher than the average for Russia or for other cities in Samara Oblast. At the same time, of course, the

proportion of younger individuals in the population is decreasing. This aging tendency has become the national norm for Russia (life expectancy also increased in the country as a whole until 1989) along with the trend for families to have no more than one child. These characteristics of aging and decreased fertility are typical of the majority of Russian cities.

TABLE 5.4.1.

Population number, natural increase, and net migration in Chapaevsk, 1989-1997.

	1989	1990	1991	1992	1993	1994	1995	1996	1997
Population (1000s)	98.1				94.7	89.2	86.7	83.9	83.6
Number of births	1011	916	743	686	604	597	617	581	553
Number of deaths	1194	1250	1183	1278	1419	1570	1582	1578	1401
Natural increase	-183	-334	-440	-592	-815	-973	-965	-997	-848
Net migration	-689				358	924	600	384	521

Per 1000 persons

	1989	1990	1991	1992	1993	1994	1995	1996	1997
Number of births	10.4	9.5	7.8	7.2	6.8	6.7	7.1	6.9	6.6
Number of deaths	12.3	13.0	12.4	13.5	15.6	17.6	18.2	18.8	16.8
Natural increase	-1.9	-3.5	-4.6	-6.3	-8.6	-10.9	-11.1	-11.9	-10.1
Net migration	-7.0				3.8	10.4	6.9	4.6	6.2

Data from Chapaevsk Census Department

In Chapaevsk, the last decade has seen new demographic tendencies. First, there was a sharp reduction in births in the first half of the 1990s compared to the late 1980s--a decrease of almost 50%. On the

other hand, mortality rates increased over the same period. By 1994, the number of deaths had increased by 20% compared to 1989. This increase in mortality occurred across all age groups and both sexes (see Table 5.4.2) but was especially high in working-age males. For the age group 40-49, mortality increased by 55% compared to 1990, while the increases were 114% and 66% for the age groups 50-59 and 60-69, respectively. Following a peak in 1995, mortality apparently started to decrease gradually, but there has remained an increasing tendency among the youngest people, men ages 30-39, and women ages 60-69.

TABLE 5.4.2.

Age-specific death rates (number of deaths per 1000 persons)

Men

Year/age	0-29	30-39	40-49	50-59	60-69	70+
1975	0.22	0.76	0.49	2.88	5.09	15.51
1990	0.19	0.68	1.24	1.92	3.71	15.24
1994	0.25	0.73	1.93	4.11	6.16	17.23
1997	0.29	1.04	1.55	2.74	5.14	14.02

Women

Year/age	0-29	30-39	40-49	50-59	60-69	70+
1975	0.09	0.15	0.41	0.84	1.98	10.09
1990	0.11	0.13	0.35	0.74	1.60	8.81
1994	0.08	0.18	0.51	1.00	2.16	12.78
1997	0.10	0.14	0.42	0.93	2.26	10.43

As can be seen in Table 5.4.1, migration to Chapaevsk from other republics of the former U.S.S.R. has had the effect of ameliorating the decrease in population, which would otherwise have been drastic.

The demographic trends just described interact strongly with changes in the labor market. On the one hand, population aging has reduced the number of employment-age people. On the other hand, the unemployment rate is increasing due to the decrease in the demand for labor. These two effects are typical for areas previously dominated by the defense industries. In Chapaevsk, the number of industrial employees decreased by 14,500 to 27,700 between 1989 and 1997. In particular, employees in defense enterprises decreased by two thirds, from 25,400 to 8,700. Downsizing of the defense industry was partially balanced by the development of new small private businesses, which employed 7800 by 1997. By 1997, there were officially 4,400 unemployed residents of Chapaevsk. These unemployed had a very high level of education (61% had university or college degrees). Most of the unemployed were women (52%) and young people under the age of 29 (31%). However, the relatively low official unemployment rate does not reflect the actual employment situation. For example, in 1997 there was a significant component of "hidden" unemployment, where people were forced to work part-time (3,200) or take long unpaid vacations (8,900). The results were lowered living standards and the disruption of traditional relationships between generations within families. These factors have changed the age structure of the work force: the fraction of the work force of employment age dropped from 88.3% in 1989 to 86.5% in 1997, while the fraction of retirees and teenagers working increased to reach 8.7%.

It is reasonable to assume that these changes in the labor market together with inability of the population to adapt to the changed socio-economic conditions affected the entire demographic spectrum. The most noticeable demographic effects have been the reduction of life expectancy and increased mortality due to specific diseases. The mortality rate in Chapaevsk was higher than average for the whole of Samara as well as other cities. By 1995, life expectancy had dropped to 60.7 for males and 74.1 for females. Cardiovascular diseases were the main cause of death (67% for women, 49% for men). From 1989-1997, mortality rates among employment-age men (especially ages 50-59 and 30-39) increased dramatically. The second most important cause of death was accidents and the third was cancer. A comparison of actual and expected mortality rates (the latter is mortality standardized by age for all of Samara Oblast) shows that the ratio is much higher in Chapaevsk than in Samara (see Table 5.4.3).

TABLE 5.4.3.

Observed and expected mortality rate due to cardiovascular disease in Chapaevsk, 1990-1997

Cause	Gender	Deaths		Ratio (3) : (4)		Standardized rate	
		Actual	Expected*	%	CI, 95%	per 100,000 of pop.	CI, 95%
1.	*2.*	*3.*	*4.*	*5.*	*6.*	*7.*	*8.*
cardio-vascular diseases	Men	2553	1532.4	165.4	158.9-172.2	1182.0	1135-1230
	Women	3349	3593.6	93.2	90.0-96.2	665.9	643.1-687.7

* *Age-adjusted death rates for Samara Oblast.*

Direct statistical analysis of the influence of labor market changes on the mortality rate has been difficult because of the absence of specific studies. However, an indirect assessment, based on available statistical data, is possible. Thus, the trend towards an increase in deaths caused by cardiovascular diseases, is compatible with the trend of increasing unemployment. There is a linear correlation between the dynamics of both indices. Deaths due to cancer are much less frequent than those caused by cardiovascular diseases, most probably because in the case of malignant tumors there were better and earlier diagnostics and better treatment.

Nevertheless, male cancer mortality in Chapaevsk is 1.2 times higher than the average in Samara Oblast, 1.3 times higher than the average in Russia, and 1.4 times higher than in the U.S. In fact, the male cancer mortality rate in Chapaevsk is higher than elsewhere in the whole oblast. These deaths were caused mostly by malignant tumors in the digestive tract, the throat, the lungs, bones, and other tissues. The risk of men dying from these forms of cancer in Chapaevsk is accordingly higher: 1.8, 3.3, 1.8, 3.5, 2.7 times, respectively, than for men in the whole Samara region. Chapaevsk women have a higher risk of dying from breast or cervical cancer. Cancer mortality reduces the average male life expectancy by 2.3 years, and for women by 1.9 years. Lung cancer shortens the average male life expectancy by 0.77 year, stomach cancer by 0.28 year, hemoblastoses by 0.17 year. The average woman's life span is 0.29 years shorter in the case of stomach cancer, 0.27 for breast cancer, 0.15 for lung cancer, and 0.11 for hemoblastoses.

The continuous pollution of the environment with dioxins can be clearly detected upon analysis of breast milk and blood. The presence of dioxins in the breast milk of Chapaevsk women is much higher than

other cities in Russia, the United States, Germany, or the Netherlands (Table 5.4.4).

TABLE 5.4.4.

PCDD/PCDF content in human milk, pg/TEQ/g fat

City, country	PCDDs/PCDFs*
Chapaevsk	43.3[40]
15 Russian cities	5-13[41, 42, 43]
Germany	10.0[44]
20 Netherlands cities	23.5[45]
Los Angeles	16.6[46]

**PCDDs/PCDFs — polychlorinated dibenzo-para-dibenzo-dioxins and dibenzofurans.*

40 B. Revich, E. Brodsky and Iu. Sotskov, "Dioxin In Enviromental, Blood, Breast Milk, Cow Milk In Chapaevsk Town," *Dioxin '99: Organohalogen Compounds,* 1999, vol. 44, pp.229 - 232.

41 W.A. Traag and S. Yufit, "The Contamination of Human Milk with PCDD, PCD and PCB in Russia," *Dioxin '97: Organohalogen Compounds,* 1997, vol. 33, pp. 524 - 529.

42 Z.K. Amirova, E.A. Kruglov, E.A. Lozhkina and R.R. Khalilov, "About Level of Dioxins in Breast Milk of Nursing Mothers from Different Cities of Russia," *Bashkirian Chemical Magazine,* vol. 4, no. 4; 1997, pp.70 – 74 (in Russian).

43 A. Schecter, P. Furst, Ch. Furst, W. Groebel, S. Kolesnikov, M. Savchenkov, A. Beim, A. Boldonov, E. Trubitsin and B. Vlasov, "Levels of Dioxins, Dibenzofurans and Other Chlorinated Xenobiotics in Human Milk from the Soviet Union," *Chemosphere,* 1990, vol. 20, no. 7 – 9, pp. 927 - 934.

44 A.K.D. Liem and R.M.C. Theelen, *Dioxins: Chemical Analysis, Exposure and Risk Assessment* (Bilthoven, Netherlands: National Institute of Public Health and Environment, 1997).

45 Ibid.

46 A. Schecter et al., "Levels of Dioxins, Dibenzofurans and Other Chlorinated Xenobiotics in Human Milk from the Soviet Union," *Chemosphere,* 1990, vol. 20, no. 7 – 9, pp. 927 - 934.

Dioxins are considered one of the risk factors for breast cancer, and it is possible that the high degree of contamination of the environment with these chemicals (even with the decrease in military production) has led to an increase in female mortality caused by breast cancer. This issue can be decided conclusively only after detailed case studies.