Adoptive Families Magazine - January/February 1998
www.adoptivefamilies.com

Risks of Radiation Effects in Children Adopted from Russia

Despite reports to the contrary, radiation exposure is in the low to moderate range.

By Carol Wilkinson

As we try to determine the risks involved in taking a child into our lives, we turn to experts for advice. Medical and behavioral experts are widely available. Adoption agencies, pediatricians, psychologists, and other adoptive parents can help us interpret what we find. But where can we go to get information on radiation hazards in Russia and their effects on adopted children? How do you allay fears that a child will be deformed, that he will die of cancer in a few years, that she will never be able to bear "normal" children? What are the risks to parents traveling to a radiation-contaminated area?

Many of the media and World Wide Web reports on radiation exposure in Russia are confusing and frightening. Some consumer protection groups report 30,000 deaths due to the accident at Chornobyl (formerly spelled Chernobyl), while others say only 31 deaths occurred. Reporters go into villages where their monitors measure radiation backgrounds of 100 times normal levels, but local officials invariably say their people are at low risk. Residents claim that children are born with tails and everyone is dying of cancer, but the Russian medical establishment seems to see none of this. Reports indicate that thyroid cancer is increasing in children living near Chornobyl. The experts often disagree with each other. It is no wonder that some families are reluctant to take children from areas suspected to be contaminated.

My husband and I are luckier than most when it comes to understanding radiation in Russia. We are basic research physicists and trained radiation workers at Los Alamos National Laboratory. When we started researching Chelyabinsk, Russia, the hometown of our daughter-to-be, we had access to a large research library and enough background to understand the professional reports. Best of all, we have colleagues who travel to and work at many sites of concern. Since the breakup of the former Soviet Union, the Russian Ministry of Atomic Energy and the U.S. Department of Energy have agreed to share nuclear waste management, cleanup technology, and methods of handling nuclear materials in both countries. Friends who traveled to Chelyabinsk reported that they had spent weeks near the most contaminated spot—stayed in the nearby town, toured the lab sites, eaten the food. They said they had more exposure to radiation on the airplane flights to and from Chelyabinsk than during their visits there. We concluded that neither our daughter nor ourselves were in danger of receiving a significant dose of radiation from the contaminated area, which is 45 miles from her orphanage. After she arrived home, a full-body scan showed that she had absorbed no measurable above-background radiation in the two years she had spent in Chelyabinsk.

Russia and its former states have experienced several incidents that have exposed workers and the public to radiation levels high enough to cause health problems. There

were the 1986 Chornobyl accident, the 1957 Chelyabinsk explosion, and sporadic nuclear tests for nearly 50 years at sites near Semipalatinsk in Kazakhstan and Novaya Zemiya in the Barents and Kara Seas. Radioactive wastes from reactors and fuel processing plants have been dumped, both accidentally and intentionally, into surface waters or injected underground in several areas. The Chelyabinsk weapons site pumped wastes in the 1940s and 1950s that caused radiation sickness and an increased number of cancer cases in downstream residents. Chelyabinsk, Tomsk, and Krasnoyarsk weapons and reactor sites have holding ponds that are still highly contaminated. In some cases, these wastes leak into local waters and pose a threat of future contamination. The Russian nuclear navy has been dumping into the country's seas and coastal waters. Although it has tried to reduce the threat to its citizens, particularly in recent years, Russia has a nuclear legacy from times when dangers of radioactivity were either unknown or ignored. In this article, I will describe the radiation effects from the sites with the largest releases and the most contamination: the Tomsk, Krasnoyarsk, Chelyabinsk, Semipalatinsk, and Chornobyl facilities.

Specific information about how the various releases affect children young enough to be considered for adoption is virtually non-existent. In most cases, the largest doses of radiation occur during and immediately after a release into the environment. It is usually the adults working at the site or those involved in cleanup who receive the highest exposures, not the general population. Children born later may be affected only if genetic effects are passed on. Studies estimating the effects on individuals who were alive at the time of the releases tend to overestimate the effects on children under ten. I have found that the doses affecting today's children in Russia are in the low to moderate range, with few exceptions.

It should be noted that there are considerable variations in the predicted effects, because of various factors. When data are inconclusive, different people may arrive at different estimates of the doses. Because the cancer rates for doses below about 20 Rem have not been adequately measured, there are several standard models for predicting effects. Lack of knowledge or misinterpretation of data can also lead to variations in estimates. Sometimes errors are easy to spot. A radiation measuring instrument, or dose meter, can give misleading results in the hands of an inexperienced person. A meter measurement that radiation in the soil is many times background does not automatically mean that cancer deaths will increase many times over the norm. Some forms of radiation cannot penetrate the soles of your shoes or travel more than a few feet in the air. So, while there may be appreciable radiation in the soil at your feet, there may be virtually none above your knees, and the resulting average dose to the whole body may be quite low. My colleagues tell of seeing reporters showing high or off-scale meter readings during newscasts to demonstrate that officials are lying or downplaying the seriousness of possible exposure. When my colleagues travel to the same places in Russia and use properly calibrated meters, they verify the official reports. In one case, the amount of radiation was equivalent to the natural background level in the area. The reporter's meter must have been on the wrong scale. I have attempted to base my conclusions on reports that come from reputable sources whose assumptions seem to fit the known data.

The estimated dose rates for the majority of recently-born, affected children are in the low, chronic range, below 20 Rem for a lifetime. For these children, an increase in

cancer incidence or other health effects will probably never be detectable. Two sites, Chornobyl and Chelyabinsk, have had the worst contamination of a significant population, and these sites have gathered the best information. Only 1% of the radiation released in the Chornobyl accident remains there today. Consider a child born in 1996 in one of the regions with the highest contamination and who lives in a "strict control" region for sixty years. That child's estimated lifetime, whole-body dose is 5 Rem or less above the naturally occurring dose of 14.4 Rem. The total lifetime dose for this child is the combined sum of natural and fallout-caused lifetime doses, or 19.4 Rem. Note that this is below the estimated lifetime dose of 21.6 Rem for the average citizen of the United States with a similar 60-year lifespan. The exception is the increase in thyroid cancers in children who are more than ten years old today. Short-lived radioactive iodine was released in the Chornobyl accident, and the children living in the contaminated areas received a significant dose to their thyroids. There will probably be several hundred additional cases of thyroid cancer in the several million children who live in the contaminated zones, with most of those occurring in the "strict control" zones. In the ten years since the accident, the rate of thyroid cancer indeed increased, with 800 cases noted by 1995, significantly more than the expected 400. Thyroid cancer responds well to treatment, however, and only three children have died.

In Chelyabinsk and nearby contaminated areas, the majority of exposed children have been receiving low-level doses, and the increase in fatal cancers is not expected to be detectable above normal incidence. Widespread contamination from the 1957 and 1967 accidents has significantly decreased, so the major remaining threat is to the several thousand people living on the Techa River and its flood plain near the Chelaybinsk facility. There is a report indicating that a few hundred children living in the contaminated populated site on the Techa River were receiving 0.5 to 1.0 Rem per year in 1990. This means a maximum lifetime dose of 60 Rem above background dose. For children, this dose can have serious effects. Conservative estimates are that there may be a detectable 0.10 percent per Rem increase in the number of fatal cancers. If 100,000 children received a similar lifetime dose, 6,000 eventual cancer deaths may be added to the expected 17,000. The village in question was evacuated in August 1997, and the inhabitants moved to a less contaminated site. Due to the move, these children will receive a lower lifetime dose than was estimated. Remember, these estimated lifetime doses and risks apply only if a child spends the rest of his or her life in the same area. Any child who is adopted and removed from the area will never have such high accumulated doses.

Contamination near the reactor and fuel processing plants near Tomsk and Krasnoyarsk appears to duplicate the Chelyabinsk situation of extremely contaminated holding ponds on restricted sites, with releases into local surface water. Contamination in rivers immediately downstream of both sites is high. The extent and seriousness of airborne releases have been much less than in the Chelyabinsk case. Such secret military sites are located in areas of very low population density, and dose information is not readily available. Tomsk and Krasnoyarsk have established exclusion and observation zones, and both areas monitor soil and river contamination. In the case of Krasnoyarsk, several studies of the pollution in the Yenisey River have concluded that there is little threat to the population. Outside the exclusion area, the contamination in drinking water is below maximum allowed levels as a result of dilution. For Tomsk, the situation is a

little less stable. Three children and four adults were hospitalized there for radiation sickness in 1990, and this indicates that some children are receiving high doses, even if rarely. Their families supposedly ate wild game that were feeding and drinking near extremely contaminated waste ponds in the poorly-fenced nuclear facility near Tomsk. A 1993 explosion in a fuel reprocessing tank spread a moderate amount of radiation to a nearby village with 200 inhabitants. Local residents were notified, the children of the village were evacuated, and clean food was brought in free of charge, indicating an open and responsible attitude.

The lack of reports of other serious exposure, from either official sources or antinuclear groups, suggests that high-dose exposures are relatively rare. When population density is low, the number of children receiving high or moderate doses is probably low. Significant doses would affect only those living on or very close to the site or on the contaminated shores of the rivers.

Another area of concern is the nuclear weapons test site near Semipalatinsk, which released large amounts of airborne radiation before testing stopped in 1969. Recently, international task forces have surveyed the area and concluded that there is no longer a threat to the public from any remaining fallout. Colleagues who attended a nearby conference in 1994 participated in a field trip to "Ground Zero" at the test site. Those who had access to radiation monitors said the rates were equal to normal background levels.

For the vast majority of adoptable children in Russia, even those living in areas known to be contaminated, detectable effects from radiation are unlikely. Why, then, are there so many reports of serious health problems? Why do so many people think they have ailments caused by radiation? There are indeed documented cases of serious health effects and increased cancers in adult workers and in populations that were exposed to high doses in the past. Children born in recent years have not received high doses. So far, there has been no evidence of inheritable effects being passed on to the children in which you may be interested. Another reason for the perceived increase in illness is the deterioration of health care all over Russia since the breakup of the Soviet Union. Cancer rates were rising before Chornobyl and have continued to rise. The average life span has dropped to 58 years for men, with stroke and heart problems causing most of the deaths.

Industrial and chemical pollution is a serious problem for much of Russia today. International medical teams who examined people living in the Chornobyl fallout zone often encountered pre-existing medical problems requiring immediate intervention in up to 15% of the population. And there is another reason for the increased health problems in areas known or suspected to be radioactively contaminated. Psychological stress from catastrophic events can cause chronic fatigue and digestive tract ailments. Similar responses are seen in victims of natural disasters, such as earthquakes and hurricanes. Stress attributed to accidents involving radiation is enhanced by a lack of understanding of the risks. The reports of poor health in contaminated areas are a mix of real effects from radiation, the poor state of health care in general, and stress-related problems.

The estimated doses for the majority of children receiving radiation exposures in Russia are low, chronic doses. Although we cannot say that there are no consequences, the amount of radiation received by most children is estimated to be below detectable levels for effects such as risk of fatal cancers. The number of children receiving high doses appears to be small.

Genetic effects in children due to exposure of their parents have not been detected and are not expected to occur at detectable rates. Families should not be afraid to travel to Russia because of radiation dangers. They will probably receive more radiation from the high altitude plan flight than from exposures in Russia. The adoptable children in Russia living in radiation contaminated zones are in need of families and should not be rejected on the basis of unlikely negative effects from radiation. Remember, the situation with respect to radiation may not be what it seems. One might have assumed that my daughter, Valya, would benefit in all ways from her adoption. After all, she has gained many things that were missing in her life—adequate food and medical attention, a loving family, and a host of opportunities and material objects. In the move from Chelyabinsk—low altitude, low background radiation—to a Colorado plateau town—high altitude, high naturally occurring radiation—she has, however, also gained an increase in her yearly radiation dose! Please do not hesitate to do another child the same favor!

Perceptions of Risks from Radiation

Human beings have been exposed to ionizing radiation from radioactive sources since the beginning of time. Like sunlight, ionizing radiation is energy traveling through space. It is higher in energy than sunlight, while microwaves, radio, and TV signals are forms of radiation at energies lower than visible light. Like sunlight, too much ionizing radiation is dangerous. It can cause cell damage, burns, cancers, radiation sickness, and death. When harnessed, ionizing radiation can be beneficial, as when it is used for X-rays and for cancer treatments.

The soil, air, and water around us contain naturally occurring radioactive substances. Plants absorb these substances, animals eat the plants, and we eat the plants and animals. The rocks and materials we use for building contain radioactive substances. The earth is also bathed in radiation from the biggest nuclear reactor near us—the sun—and by cosmic rays from outer space. Because we absorb radioactive material from our environment, our bodies themselves are slightly radioactive. Sleeping next to your slightly radioactive spouse increases your yearly dose. Human beings have adapted to a certain background level of radiation whose consequences we can't escape.

If radiation, any radiation, causes cancer and genetic defects, a minimum level of occurrence of these effects is inevitable. When an individual is given a certain dose, the dose is always expressed as the excess above the background level. The average background dose to a resident of the United States is about 360 mRem per year, with an accumulated 25 Rem over a lifetime of 70 years. An mRem is one thousandth of a Rem, a unit of measurement that attempts to take into account the kind of radiation, the amount of radiation, and the sensitivity of the body part receiving the dose. All of these variables ensure that equal doses in Rem result in equal indications of biological damage. The majority of the U.S. background dose comes from the natural sources mentioned above and about 18% comes from man-made sources such as medical X-rays and treatments. About 1% comes from fallout from nuclear testing, bombs and accidents such as those in Russia. There is no difference between the radiation from man-made sources and from natural sources or between the effects of either on human health. Background doses around the U.S. and the world vary greatly. Although the world average is 240 mRem per year, lower than the U.S. average, background doses around the world can range from

a few times lower than the world average to several times higher. Man has adapted to living in all these areas without measurable increase in cancer attributed to radiation.

You can influence the amount of radiation you receive. Tobacco plants take up naturally occurring radioactive substances in the soil and release them into a smoker's lungs when burned. If you are a one-and-a-half-pack-a-day smoker, you may receive an extra 8 Rem per year of radiation delivered directly to the delicate tissues of your lungs. Note that this voluntary dose is more than twenty times the average background levels. If you live near the coal mining areas of Pennsylvania or Illinois or near a coal burning power plant, your yearly dose will be increased due to the natural radiation released from the coal. A large portion of the background dose in the U.S. comes from radon gas produced by our building materials and the soils around us. Time spent above sea level also increases your yearly dose, because there is less atmosphere above you to screen out radiation from space. Thus, anyone who spends a lot of time in airplanes or in the Rocky Mountains receives a higher dose than does a grounded resident of Los Angeles or New York. Pilots and attendants on long flights may soon be classified and monitored as radiation workers, because they can receive as much radiation per year as the maximum allowed yearly dose for workers at nuclear power plants and reactors. The estimated dose for a round-trip flight from Los Angeles to Paris is 4.8 mRem. Dental X-rays are about 10 mRem each. Your personal dose will be somewhat higher or lower than the 360 mRem average, depending upon your environment and lifestyle.

What amount of ionizing radiation is harmful? Scientists have measured the effects in people who received rapidly-acquired, whole-body doses of 100 Rem above background levels. These doses have occurred in atomic bomb blasts and in nuclear accidents. Ionizing radiation damages cells and DNA. If the amount of radiation is high, cells cannot repair themselves, so they die or are permanently damaged. People exposed to rapidly accumulated, or acute, doses above 199 Rem often immediately exhibit clinical symptoms, including temporary radiation sickness. One person in twenty could be expected to develop cancer later in life. Damaging effects increase with increasing dose until death occurs immediately or rapidly after very high exposures.

Below an accumulated lifetime exposure of 100 Rem, radiation-induced effects are harder to distinguish or prove. This is especially true if the dose is accumulated through long-term, or chronic, low-level exposure totaling 20 Rem or less. Past exposure data predicts an associated risk of 1 additional cancer in a population of 10,000 people exposed to 1 Rem. This number is so small (0.1 percent) that it cannot be measured with any certainty against the 33 percent or more naturally occurring cancers in the same population. It is important to note that there are no new diseases or cancers that are caused by exposure to radiation, just possible change in the incident rate of the normally occurring diseases. Even for an additional lifetime exposure of 20 Rem above background, only 20 indistinguishable cases will be added to the 3,300 or more cancers naturally occurring in our sample of 10,000 people. From another perspective, the lifetime accumulated dose from naturally occurring background radiation varies around the world by about 20 Rem, without showing an associated, measurable change in cancer rates.

How do induced effects impact the risks and uses of medical radiation? Medical X-rays and injections of radioactive materials are beneficial if used with caution. Since they are usually confined to a small area of the body and are in the low dose range of

eight to a few hundred mRem per scan, the risks are low, compared to the benefits. Using a fluoroscope to determine your shoe size is a frivolous use of such a tool and is not worth the risk, since repeated exposures could add up to increase in your lifetime dose without any real benefit. Radiation treatments for tumors can involve several hundred Rem applied locally. This dose is in the range of detected effects, such as radiation sickness and increased risk of cancer. The benefit of destroying the cancer that can kill you now versus the increased risk of developing another cancer several years from now is usually clear to the patient facing such a choice.

So, the best action is to take a common-sense approach to limit your exposure to radiation. But before you tell your spouse to sleep in another room, cancel your flight for a skiing trip in the Rocky Mountains, avoid dental X-rays, and move to a brush shelter in the Death Valley low spot, take time to place the overall risks and benefits in perspective. Medical X-rays and nuclear medicine have clear benefits. Living in the Rocky Mountain states may increase your exposure to radiation, but your overall risk of cancer may be much less than if you lived in smog-ridden, sea level cities. Common sense and knowledge are best for dealing with ionizing radiation, which has been a risk factor in the lives of humans since day one. Radiation from man-made sources is a recent and, with few exceptions, a small addition to the natural radiation occurring on earth. See the "Radiation and Health Physics" Web site at: http://www.umich.edu/~radinfo/ for many articles on radiation, risks and benefits, health effects, and exposures around the world.

Dr. Carol Wilkinson, Ph.D, works in the field of accelerator and particle physics at Los Alamos National Laboratory in New Mexico