

## **65. MONITORING OF POTENTIAL HEALTH EFFECTS OF NERVE AGENT DESTRUCTION IN SHCHUCH'YE, KURGAN OBLAST (SOUTHERN URALS), RUSSIAN FEDERATION**

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### **INTRODUCTION**

Russia is the world's largest possessor of chemical weapons. Over 40,000 metric tons of chemical agents are stored today at seven sites. In accordance with the Federal Programme on Chemical Weapons Destruction, decreed on March 21, 1996, and with the Chemical Weapons Convention ratified by the Russian Federation on November 4, 1997, the Russian chemical weapons will be destroyed on site in special destruction facilities.

In Shchuch'ye (Kurgan Region, Southern Urals), the first destruction facility for nerve agents will be built with the support of the American CTR Programme. Approximately 5'450 t of phosphor-organic agents (Sarin, Soman, and VX) in artillery shells and missile warheads will be destroyed with the so-called 'two-stage destruction technology.' In a first step, the toxicity is reduced by mixing organic solvents with the warfare agents; in a second step the process is made irreversible through bituminisation of the salt mass. At the moment final tests are investigating the long-term properties and (non-)toxicity of the bitumen mass. Construction start is scheduled for 2001 and operation start-up for 2008.

Main concerns of the communities living around the stockpile centre on health, state of the environment and emergency preparedness. A ubiquitous believe in all stockpile areas is that the bad state of public health is related to the presence of the chemical weapons. In order to address these concerns and as a baseline to monitor future trends in health, a report on the health status of the population living near the Shchuch'ye chemical weapon storage facility has been prepared in 1997 by a medical group under the leadership of Dr. Tatyana Grozdova (Saratov, Russia). In the same year, the Institute for Social and Preventive Medicine, University of Basel, Switzerland, was requested by Green Cross Switzerland a) to provide advice to the Grozdova group on the assessment and preparation of existing epidemiological data, b) to define gaps of knowledge, c) to support the application of recommendations in two previous reviews of the report (Abelin 1997, Henderson and Joe 1997); and d) to support and advise the group on the development of a long-term health monitoring concept.

### **METHODS**

This advisory report is based on the following materials and methods:

- (1) Personal observations and discussions with persons involved in the project during a visit of Dr. R. Kaiser to Moscow and Shchuch'ye from 23 - 31 January 1998, including public hearings in Shumikha and Chumlyak and visits to hospitals and ambulatories in Shchuch'ye, Chumlyak, Planovye, and Peshanskoye;
- (2) Personal communication with experts in relevant fields; and,
- (3) Review of available international literature (see References).

### **RESULTS AND DISCUSSION**

Shchuch'ye is a town of 10'600 people, located about 1600 km east of Moscow. The administrative area has 2'858 km<sup>2</sup>. Population density is low (10/ km<sup>2</sup>). It is a predominantly agricultural area with some industry in the town of Shchuch'ye. The socio-economic situation has deteriorated in recent years with reduction of incomes and increase of unemployment; today only three enterprises still provide employment.

The largest contribution to air pollution in the Shchuch'ye area stems from 19 coal and fuel operated boiler-houses. The most hazardous combustion substances are lead and its inorganic compounds, vanadium pentoxide, nitrogen oxides, and sulphur. Although limited in number, motor vehicles are also a major source of lead pollution. There is no air-monitoring programme.

The area's water resources are deficient and of poor quality and there are polluted surface and underground water sources. Underground waters are the main source of water supply for the enterprises and the population of the Shchuch'ye area. About 40% of water is delivered through pipes, the remaining 60% stems from open wells. Most of the settlements in the area do not have a centralised water supply and sewage system nor are there water treatment facilities for industrial and household effluents.

The Shchuch'ye area has 90 waste disposal sites (dumps, manure-pits, ash-slag heaps, animal burial grounds, etc.). These sites are operated without any regulatory oversight or environmental monitoring.

Another source of environmental contamination is the Mayak plutonium breeding facility. Its operation has resulted in major radioactive releases into the environment and significant overexposures for thousands of workers and the nearby population. Though the Shchuch'ye area is situated outside of the main contamination plume, medical personnel are concerned about a relationship between a number of lung cancer cases and potential radiation exposure.

The Grozdova report (Grozdova et al 1997) showed little difference in the prevalence of diseases among the residents of Shchuch'ye, Chumlyak, Peschanskoe, and the Kurgan Region. The reviewers of the report, however, challenged the validity of the data for the following reasons:

**a) lack of financial resources:** The operation of hospitals suffers from underfunding, salaries are paid only on a delayed basis, several doctors left the Shchuch'ye area, and patients have to buy and bring medical materials themselves.

**b) limited diagnostic equipment:** Diagnostic equipment is very simple and limited to a rarely used ultrasonographic instrument and a fiberoptic gastroscope.

**c) underuse of health care facilities:** Many people do not use the health care facilities and do not travel to the Shchuch'ye central hospital, even if referred, because of cost. It has been observed that patients come at stages of advanced disease when treatment is hardly successful.

**d) inherent limitations in the health reporting system:** Most people are registered at local nurse stations for medical care. Thirty-seven of these nurse stations are spread over the low populated area. In case of more complicated medical problems patients are referred to the peripheral hospitals or the central hospital in Shchuch'ye. Severe cases are generally treated in Shchuch'ye. A system of mandatory annual health reporting had been established in socialist times. The number of case episodes (for acute diseases, such as temporary respiratory diseases) and patients seen (for chronic diseases) are collected through referral and then compiled in Shchuch'ye for the annual health report. All patient information is written, reported and summarised by hand. The main limitations of health reporting are underestimation of the overall prevalence of diseases and misclassification of diseases due to low diagnostic standards.

One major concern of the population in the Shchuch'ye area is a possible deterioration of the general state of public health after the start-up of the chemical weapon destruction facility. However, monitoring the population for diseases related to releases of nerve agents from the Shchuch'ye facility is not considered to be a useful approach because nothing in the current literature on human and animal studies indicates any long-term health effects associated with low exposures to nerve agents.

Even with an exposure large enough to affect disease rates, detection of changes for rare outcomes would be difficult due to the small population studied and the low level of diagnostics. This can be exemplified by a hypothetical case assuming a radiation exposure in the northern part of the Shchuch'ye area: if the incidence for cancers of the blood and lymphoid system in the Shchuch'ye area doubles from 1996 to 2006, the number of cases would be 10 instead of 5 cases. As a result, there might be concerns about a link between ionising radiation and cancer of the blood and lymphoid system. The magnitude of increase, however, would not considerably differ from the range of 0 to 9 cases that were found within the period from 1988 to 1996. Thus it will not be possible to statistically separate a true increment from expected data variability.

Since exposure levels are expected to be low and effects are unpredictable, the appropriate design for a health investigation is that of occupational monitoring at the chemical weapons destruction facility. First, workers are expected to have the highest - if any - exposure; second, it is feasible to closely monitor and follow-up workers over a long period. A control group should be selected, if possible, from another exposure category within the destruction facility, or from another factory with a profile similar to the destruction facility.

However, an occupational monitoring programme should be an integral part of a general public health concept. Otherwise, the interpretation of occupational surveillance data could be compromised by adverse effects due to poor health conditions

or lack of public health education (e.g. drinking, smoking). Health reporting is a valuable instrument to identify long-term trends in the overall health status of the population and to detect acute disease outbreaks. However, certain standards need to be adopted to improve the quality:

**(1) Diagnostic standards:**

If health care utilisation data are used for reporting it is essential to achieve the same standard of diagnostic equipment, diagnostic criteria and disease coding along the entire way of data collection. Repeated training may help to standardise this process. Although the 10th version of the international classification of diseases (ICD10) is currently being introduced in Russia, the disease classes of the 9th version may be kept until there is some experience with the new structure of ICD10.

**(2) Demographic population data, age standardisation:** Health reports provide us with health indicators such as mortality and morbidity in relation to the size of the population or population groups of different age and sex. Therefore, it is essential for health reporting to have access to annual data on population age groups, further differentiated by sex, and to use age standardisation techniques (direct and indirect) for comparison.

**(3) Presentation as population related rates:** Health reports should show demographic information (total population and age specific groups), birth, mortality and morbidity rates as total numbers and for different age groups (differentiated by sex) and by disease categories. Data sources have to be clearly stated. Missing values should generally be marked as such (e.g. n.a. = not available) and clearly differentiated from zero values.

Last but not least, public health education increases awareness in the population on the relevance of major health threats such as poor living conditions, poor health care and behaviours such as smoking and drinking. It should also help to efficiently prioritise the allocation of limited resources for improving general public health.

## SUMMARY

The low standard of diagnostic equipment, the lack of demographic population baseline data and unexplained variations in morbidity rates indicating incomplete health services data were all identified as major limitations for reliable health reporting. Reliable public health data, however, are a prerequisite to identifying changes in morbidity or mortality patterns in populations.

Potential releases of nerve agents or destruction products into the environment would be low and chronic. Therefore, risk assessment among the total population may not be useful, because the population size is small and, according to current knowledge, it is unlikely that an exposure to nerve agents will play an important role in morbidity processes. The investigation of effects of low levels of nerve agents and their potential degradation products should focus on the occupational setting where exposure would be - if of any significance - the highest. The occupational epidemiological approach includes a) exposure assessment at the destruction facility and the bitumen disposal site, b) health monitoring of workers, and c) the assessment of cofactors of adverse health outcomes.

In general, the sustainable improvement of public health should be a major priority as it is likely that poor living conditions and standards of medical care have a far larger impact on the health status of the population and on limiting life expectancy. Occupational surveillance is considered to be an aspect within this broader scope. Improvement in the quality of health reporting is a prerequisite for receiving reliable data for determining changes in baseline conditions. Continuous and comprehensive public health education is recommended as a vessel to address potential hazards of the destruction facility, to teach actions to take in case of an exposure, and to enhance the general understanding on public health issues including disease prevention and health promotion.

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**KEYWORDS**

Shchuch'ye chemical weapons destruction facility, epidemiology, nerve agent destruction, occupational monitoring, health reporting.