Westfälische Wilhelms-Universität Münster

UKM Universitätsklinikum Münster

www.umweltprobenbank-human.de

The Environmental Specimen Bank for Human Tissues

Umwelt Bundes Amt Für Mensch und Umwelt

The Environmental Specimen Bank for Human Tissues Münster, Germany

The Environmental Specimen Bank For Human Tissues (ESB-Hum) is part of the National Environmental Specimen Bank of the Federal Republic of Germany. It collects environmental samples and human specimens, examines them for environmentally relevant substances and stores them at a low temperature so that they are available at any time in unchanged condition.

The ESB-Hum is funded by the Federal Ministry of the Environment, Nature Conservation and Nuclear Safety under the aegis of the Federal Environmental Agency. Logistically, the ESB-Hum is an integral part of the medical institutions of the University of Münster and has an independent status.

Development

1974

Preliminary studies on deep-freeze storage of human body fluid specimens at the University of Münster

1976 – 1983

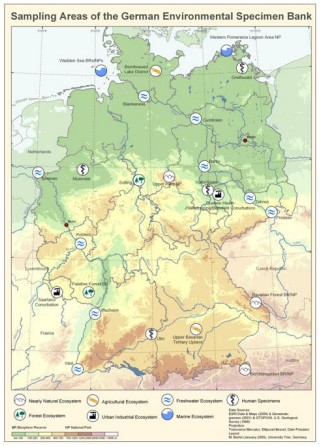
Pilot and test phase of the scientific and technical implementation of an environmental specimen bank

1984

Commencement of permanent research at the Environmental Specimen Bank for Human Tissues

since 1994

Extension to full-time research by commencement of sampling at staggered intervals from potentially polluted (e.g. Halle), moderately polluted (e.g. Münster, Ulm) and relatively unpolluted (e.g. Greifswald) areas of Germany



Objectives of the Environmental Specimen Bank for Human Tissues

Average values measured in blood, urine and human milk reveal the level of human exposure to environmental noxae. Long-term trends can be analyzed by repeated testing of comparable groups of individuals at regular intervals. The detection of these long-term trends in human exposure to harmful substances is important for the development of statutory measures and checking of their success. Concentrations of substances currently recognized as environmental noxae are being monitored continuously, so that correlations with the occurrence of certain diseases can be identified at an early stage.

The long-term storage of collected specimens under reliably stable conditions creates the prerequisites to carry out other tests at a later time or to repeat tests with improved measurement technology after decades have elapsed.

In this way, environmental noxae can be identified retrospectively when these were not yet known or could not yet be analyzed or were not considered significant at the time of specimen collection.

Storage

Since 1980, the Environmental Specimen Bank for Human Tissues at Münster has had at its disposal a walk-in freezer room encompassing 34 m³ which was unique at the time of its inception. With the addition of a second freezer room in 1996, a total of 65 m³ is now available as a central bank for long-term storage of human specimens. By now, about 300,000 single specimens are being stored at -80°C to -85°C with the addition of new specimens every year.

A cooling system with graduated multiple security protection is used to maintain the continuous low temperatures in the freezing rooms. Two deep-cooling generators are employed for each room, where one alone would be sufficient to maintain the necessary temperatures. In the event of a general power failure, the generators can be supplied by an emergency power unit; if this generator fails, liquid nitrogen at a temperature of -196°C can be conveyed directly into the freezing rooms.

Since 2006, the human specimens are stored under stable deep freezing conditions in liquid nitrogen at a

temperature of -150°C in the volatile fraction for the future additional implementation of effect monitoring in the concept of the Environmental Specimen Bank for Human Tissues.

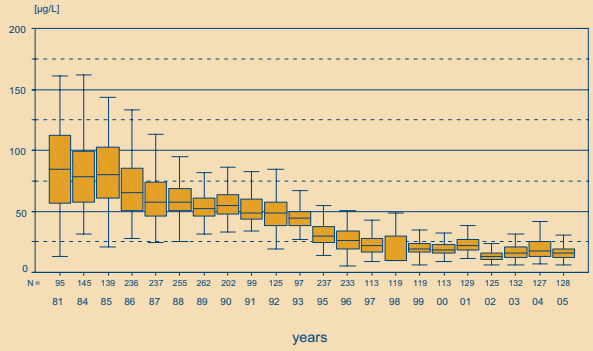
Analyses

Besides the storage of specimens over long periods of time, analysis of harmful substances in human beings is one of the important tasks of the Environmental Specimen Bank for Human Tissues. Using modern equipment, very tiny traces of harmful substances can be detected in blood and/or urine, e.g. heavy metals, pesticides or wood preservatives. The analyses must be very meticulous so as to detect minute alterations in the level of harmful substances in the human body at an early stage.

Results

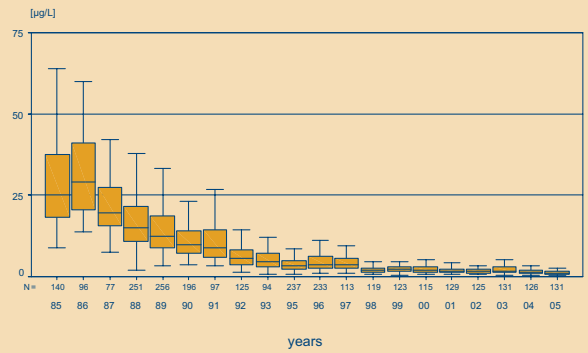
In the monitoring of harmful substances in the human body carried out once a year since 1985, an increase in contamination could not be found for any of the measurable noxae. The concentration of several substances, e.g. arsenic, cadmium and mercury, have mostly remained unchanged. Others showed a clearly perceptible decrease, especially in consequence of statutory regulations and prohibitions.

Lead (Pb) in whole blood



The average lead (Pb) content in the blood fell within 15 years from about 80 ng/ml (1984/1985) to 20 ng/ml (1999/2000) as a direct consequence of the Leaded Petrol Law of 1971, which was most recently amended in 1994. This law has led to a gradual reduction in the lead content of petrol.

Pentachlorophenol (PCP) in blood plasma

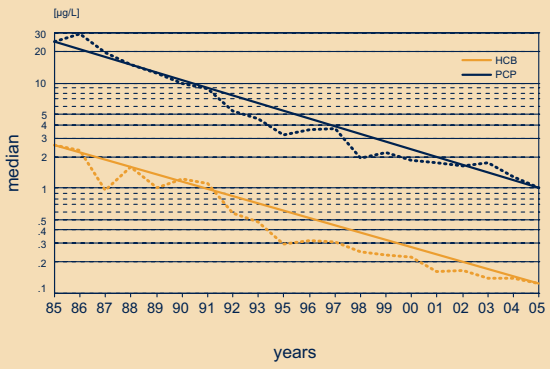


From 1985 to 2005, the contamination of the human body with hexachlorobenzene (HCB) and the wood preservative pentachlorophenol (PCP) fell by more than 90%. In particular, the average HCB content in the blood fell from 2.5 to 0.3 nanograms (thousand millionth of a gram) per milliliter. The PCP level fell on average from 30 nanograms to only 3 nanograms per milliliter blood.

Both substances are chemically related, difficult to degrade and harmful to human health. In the meantime, they have both been banned. HCB was formerly used as a softening agent and as a seed dressing. PCP has a fungicidal effect and was used predominantly as a wood preservative.

Since 1990, the monitoring of the general level of human exposure to environmental noxae has been extended to the new federal states (the former East Germany), where particularly intensive investigations have been conducted. For example, samples were taken in 1995 in Greifswald, Magdeburg, Sauen (Beeskow county) and Halle (Saale). Blood and urine were investigated for harmful substances.

HCB/PCP concentrations in blood plasma



In 1990, the blood samples in the new federal states still contained about 20% more HCB and PCP than samples from the former West Germany.

In 1996/97, comparative studies carried out in the former West and former East Germany no longer showed any differences in contamination levels for the measured noxae: heavy metals, PCP, HCB and polychlorinated biphenyls (PCB). Evidently, the substantial measures taken to eliminate noxae had taken an effect even though the period was a short one for regulating environmental factors.

Further results of scientific and practical significance for prophylactic health protection have arisen from the work of the ESB-Hum: the level of HCB and PCB contamination in blood differs significantly between men and women; on average, women have 20% higher HCB values, but 5% lower PCB values than men. The PCB concentration greatly depends on age. For example, sixty-year-olds (both in the western and in the eastern German states) have three times more PCB in their blood than twenty-year-olds.

Umweltprobenbank des Bundes – Teilbank Humanproben und Datenbank

Prof. Dr. med. Gerhard A. Wiesmüller

Address	Domagkstraße 11, D-48149 Münster
Phone	+49 (0) 251 83-56065
Fax	+49 (0) 251 83-55524
E-Mail	upbhum@uni-muenster.de