

# **Hazardous wastes in the process of managing construction—whose interest is it finally?**

Juha-Pekka Maijala

*Institute of Construction Economics and Management, Tampere University of Technology (TUT), Finland*

## **ABSTRACT**

In existing buildings there might be such equipment and materials, which are classified nowadays as hazardous waste stuff. PCB and mercury are dangerous for the health and the nature. One of the goals in the research *PCB and Mercury in Finnish Building Stock* was to give an estimation of the amount and to make proposals for further actions. The project was a joint research project with TUT Construction Economics and VTT Building and Transport. Collecting PCB and mercury as hazardous waste has risen in importance considering the environmental issues. The more precise procedure in project management in renovation processes was set to be a part of sustainable development in construction branch. Taking care of the waste management in renovation and in demolition works in construction work is important. The reuse of the materials is increasing. Therefore, it is necessary to separate and collect the hazardous waste correctly and according to predefined detailed plans. Also, from the safety point of view, the occupants and workers should be considered during the management process.

## **INDEX TERMS**

Construction; Maintenance; Management; Renovation; Demolition; PCB; Mercury

## **INTRODUCTION**

A new sort of hazardous waste (PCB) in buildings was found in the sealed window sealant (between two glass panes). The necessity to collect PCB and mercury as hazardous waste has risen in importance considering the environmental issues. The more precise procedure in project management in renovation processes was set to be a part of sustainable development in construction branch.

## **METHODS**

The background study was carried out by literature study and was amended with half structured interview technique. Additionally, various registers and statistics of building material were used. In the field study phase, the material samples from existing facilities were collected and analysed in the laboratory. In addition to this, the technical equipment and facilities were fabricated. The final results were reflected through the statistics of the existing building stock and material databases.

## **RESULTS**

The PCB content of the samples taken from, e.g. indoor sealants, glues, sealed windows, was analysed in the laboratory. Mercury was searched by the fabricated technical equipment (HVAC). Mercury can be found, e.g. in electrical switches, measuring equipment (thermometers, manometers), liquid level indicators, as amalgam in water traps (dentist premises) and in fluorescent lamps.

### PCB Findings

As a result of the analyses, the PCB was found in the sealed window sealant (between two glass panes). The amount was about 5000–50 000 mg/kg (0.005–5 wt%). According to national regulations, the material is classified as a hazardous waste, if the contamination is over 50 mg/kg. Few years earlier, PCB contamination was found in sealants between sandwich–facade element seams in external cover. The content of PCB was in the range of 2–40 wt%.

These new findings refer to samples taken from sealed windows that were between the years 1960 and 1974. In samples taken from installations that were built after 1975, PCB was not found. As an estimate, it is possible that the windows in stock at that time were installed within 2–3 years after the manufacturing was over. So, it is likely that sealed windows containing PCB-sealant are not installed after 1977. Using, selling and importing PCB containing products was banned in the end of the 1970s. According to the estimation made, during the years 1960–1980 original installed sealed windows that existed were about 50%. The amount of pure PCB in these windows is about 4000 kg. The annual loss is estimated to be 250–450 kg.

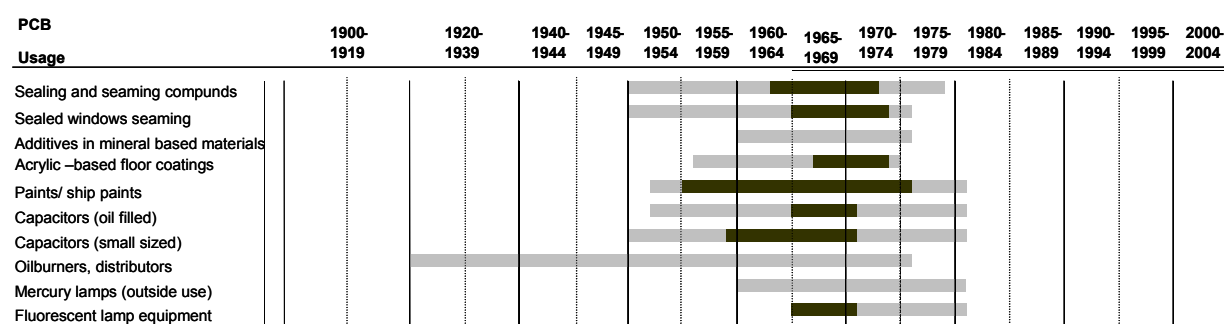


Figure 1 The approximate usage of PCB put in time chart.

### Amount of Mercury

Mercury was found mostly in thermometers in heating rooms, and also in liquid level meters. In two-thirds of the cases mercury was found in heating facilities and the amount varied from one to three thermometers per heating centre. One thermometer contains about 7 g mercury in metallic form. In addition, older style freezers may contain mercury in their light switch system. The amount of mercury collected annually is about 2000 kg. Giving a precise estimation for a loss is difficult, but it is estimated to be about 200–400 kg annually.

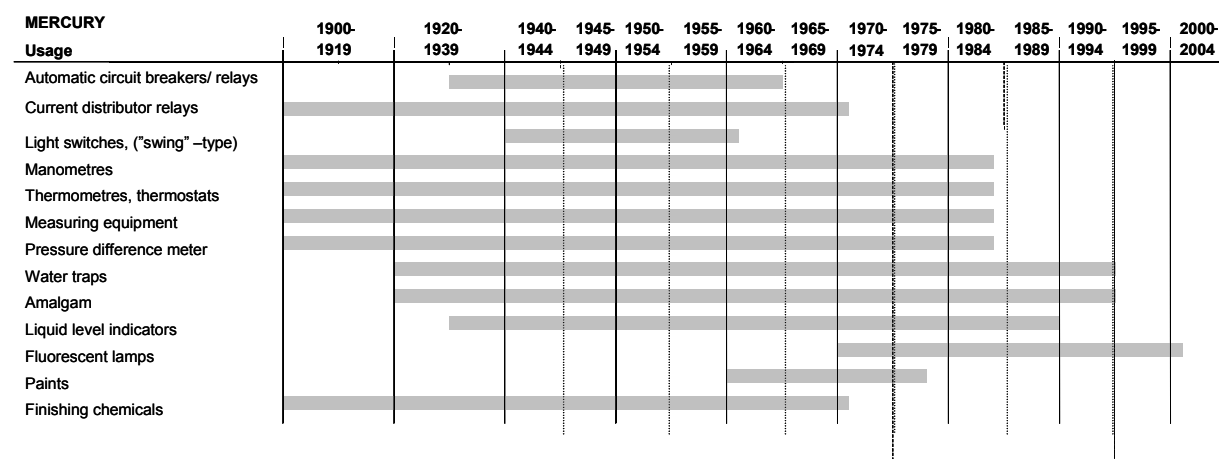


Figure 2 The approximate usage of Mercury put in time chart

## DISCUSSION

Taking care of the waste management in renovation and in demolition works during construction is important. It is difficult for the regulation authorities to cover all works and waste flows in all situations. Therefore, it is necessary to consider at the company level, the importance of the waste management to prevent any uncontrolled waste flows. Some building materials and technical equipment included with the hazardous stuff must be withdrawn from use and must be handled in a proper way. It is a question of informational guidance and influencing the attitudes from a long-term perspective. Perhaps the maximum responsibility lies with the owner, who is responsible for the facility, to provide safe usage, living and working conditions.

### Attitudes and Waste

The materials of the buildings that are intended to be demolished are increasingly being recycled. To separate the hazardous waste from other materials is important. Although for some hazardous wastes, regulations and guidelines are in place, it is still possible that all of the unwanted stuff is not collected correctly. The costs of the separating different types of waste already on site are marginal. So, the result is very much dependent on the attitude and personal commitment to 'eco-efficient thinking' and the level of information. In companies, a new kind of culture, which is adaptable to green issues, has to be cultivated.

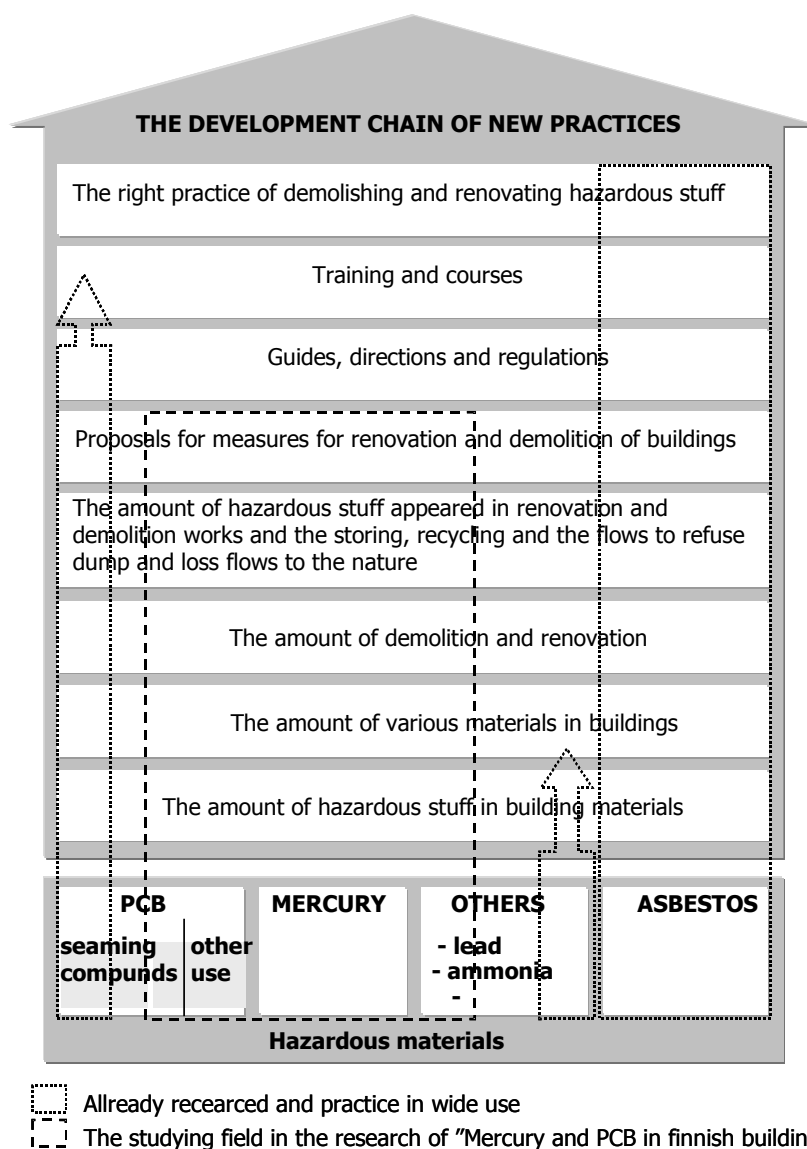
The reuse of the materials when dealing with hazardous wastes is, to some extent, complicated, but not impossible. The amount of one waste unit may be relatively little, but when extended to the scale of whole building stock, the material flow of the hazardous waste becomes quite large. What is significant for both, PCB-containing sealant in sealed windows and metallic mercury in equipment is that they are very easy to collect.

One interesting aspect is that the top quality glass used in windows is not PCB contaminated and can therefore be recycled. The process needs a specialized company to separate the glass from the frame. Through these companies, the material loss flows can be reduced and the material flow from the site can be made more precise and managed easily by contracts.

### Effects in Process

It is becoming increasingly common to sort wastes on the construction sites. It is more important to set up the premises for planning (technical properties, etc.), where the degree and extent of waste management can be defined precisely, at the beginning stages of the project. It is important that the materials containing the hazardous stuff are detected and collected before any demolition or renovation work begins. In case of windows, and material samples in general, the material analyses is the only way to be sure about the contamination. The goal is to avoid loss flows of the waste from the site and get the reusable waste collected in a proper and planned way.

In Figure 3 is described a principal practice of 'Life-Cycle Healthy Building'.



**Figure 3** The handling of hazardous materials in the demolition and renovation works.

### Occupational Safety

The materials should be assembled in compact form and can be collected in units. There should be no direct harm to workers or inhabitants from these hazardous waste classified materials and part of technical equipment. Sufficient protection can be provided with workers' normal personal protection (gloves, possible glasses). Also, the working area does not need to be specially restricted. The importance is to organize the restoration, e.g. for the replaced windows, to keep them untouched till they are transported for further handling. The same principles can be followed with mercury-containing parts in which the mercury is inside a glass cell.

### CONCLUSION AND IMPLICATIONS

As a conclusion, the hazardous stuff containing materials or parts of technical devices must be removed from use and delivered for further handling. Additionally, these materials must be found and their existence documented and replaced or marked, if it is not possible to renew them at once. This is a task and challenge for the owners.

The safety and comfort of residents and employees is to be taken into account throughout the whole project. The renovation period may cause some changes in the residents'

opportunities to normal life. For general guidance, it is important to keep the residents informed of the changes caused by the renovation and of how the work is progressing. The different parties can be taken into consideration when planning the implementation of the renovation.

The sealed windows have been an important commercial article in construction branch in countries where such windows are used, mostly in northern countries. Especially in the Nordic countries the problem of the PCB in windows is similar and requires attention. Some of the windows are exported, thereby making the problem a global one.

To reduce the amount of mercury and PCB in Finnish building stock is a part of a global goal to minimize environmental load caused by the hazardous materials by handling them through proper management in all the stages in the renovation project. The best result can be achieved in cooperation with all the parties involved in the construction project. The goals have to be defined in such a manner as to ensure commitment towards working together to attain targets and gain understanding for sustainable development. For the future, the existence of various kinds of materials in the technical equipment at old premises and in materials used over several decades should be examined more widely and thoroughly to find their properties.

### **ACKNOWLEDGEMENTS**

The author thanks the following organizations for the funding of the research: Ekokem Oy (A company handling hazardous wastes), The Finnish Work Environment Fund, Loimi-Hameen Jätehuolto Oy (A local waste management company), Tekes (National Technology Agency) and the large number of people, who have helped this work with their opinions.

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Author is now a Senior Adviser in Ministry of the Environment, Housing and Building Department, Finland.