Identification of PCB and decontamination of PCB-containing buildings in Norway

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1. INTRODUCTION

In Norway the first regulations for Polychlorinated Biphenyl (PCB) compounds were promulgated in 1980 and revised in 2000. In the last couple of years much attention has been paid to the presence of PCB and its potential impact on health and the environment. A national action plan for building and construction waste was introduced in Norway in February 2001 and one of its main efforts has been to focus on PCB in buildings and building materials.

On the initiative of the Federation of the Norwegian Construction Industry (Byggenæringens Landsforening (BNL)) a Guide containing information about the identification of PCB and the decontamination of buildings and building materials containing PCB has been prepared. The two consulting engineering companies, Techno Consult AS (Norway) and DEMEX Consulting Engineers A/S (Denmark), have participated in the preparation of the Guide, which was issued in December 2001.

2. THE PCB GUIDE

The aim of the Guide has been to collect and communicate existing information about PCB in buildings and building materials. The idea was to create a book of guidelines in a popular language and format. The Guide is primarily aimed at decision-makers, such as owners of buildings. Secondly, much of the information, especially that concerning the practical management/handling of buildings containing PCB, can also be relevant to other parties in the housing and building industry, for example consultants.

The Guide includes aspects such as:

- Criteria for the approval of buildings in relation to PCB
- Descriptions of sampling and methods for analysing samples
- Actual methods for removal or decontamination
- Alternatives for packaging, transport and places of delivery
- Existing knowledge about PCB and industrial relations
- How to describe removal/decontamination in tenders etc.

The figure below gives an overview of the remaining amounts of PCB in Norway (in tonnes of PCB).

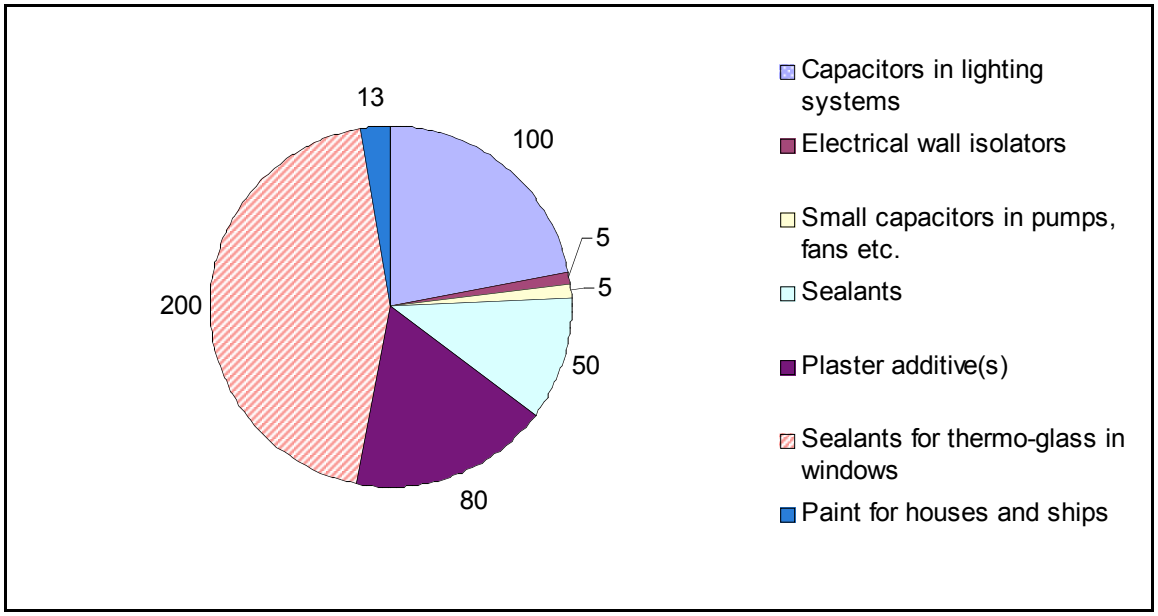

Figure 1 *Remaining PCB in tons in Norway distributed on different building components and materials (per year 2000).*

From the start, one of the main aims of the project has been to ensure that the results of the project are applicable for immediate implementation in the Norwegian building industry. The project therefore included preparation of examples of texts of practical use in connection with offering PCB removal works for tender. This is explained in a little more detail in the following.

3. NEW NORWEGIAN GUIDELINES FOR PCB REMOVAL TENDERS

The description texts are divided into a general part ”BOK 0” extensive general guidelines for the performance of the work, and a specific part ”BOK1” extensive detailed guidelines and requirements for the performance of the work.

Through the preparation of the BOK 0 and BOK 1 texts, emphasis was placed on elaborating the specification texts so that they could immediately be fitted into the normal basis of the specification [tender documents], which are widely circulated in Norway. In Norway almost all building and renovation works are specified with reference to the Norwegian Standard NS.

No proposal for the specification of PCB removal works was found earlier in the Norwegian specification system. Techno Consult and DEMEX have therefore, during the extension of the project, received an application from the Norwegian standardisation board with a view to formally adopting the specification texts in the general Norwegian documentation.

The BOK 0 example contains a grouping of the general requirements placed on the entrepreneur in connection with the performance of PCB removal works. The BOK 0 specifications thus contain:

- health and safety requirements
- references to existing Norwegian legislation
- requirements for the handling and removal of waste
- requirements for the quality assurance of the performance of the work

The example of the BOK 1 text was set up as a ”worst case” example, i.e. a situation taking as a starting point a building that has all known PCB-containing building components. Examples of task specifications are given for the removal of the following building components:

- thermo windows
- additives used in mortar and plaster
- paint
- joint putty
- capacitors in light fittings
- other low voltage equipment containing capacitors
- high voltage capacitors
- high voltage transformers

Through the preparation of the specification text emphasis has been placed on the wording as specific ”requirements” for the performance of the work, such that the specifications can be used directly in a situation involving work offered for tender.

4. FINDINGS IN ADDITIVES IN MORTAR AND PLASTER

In the 1990s PCB was found in facades in larger buildings in western Norway. The source was unknown, but a specific PCB-containing mortar and plaster additive or paint was suspected. Therefore the use of this PCB-containing additive or paint was investigated. This resulted in some new findings about:

- The specific use of a specific PCB-containing mortar and plaster additive
- The use of PCB-containing paint

4.1 Mortar and plaster additive

A Norwegian company in the period 1960-72 on the Norwegian market sold an additive named Borvibet that contained PCB. The most important characteristic was to improve the adhesion of the plaster to walls and floors. Experience is required in order to achieve good results in plastering, but this is something that most non-professionals (for instance “do-it-yourself” builders) do not have. Through the use of the additive, plaster adhered to the underlay as if it had been “glued”. Even an average do-it-yourself builder was able to achieve presentable plaster work. During the project we found no other additives containing PCB. The Borvibet that is sold today does not contain PCB.

The method chosen was to interview people who were active workers in the 1960s. We interviewed, salesmen, entrepreneurs and, in particular, professional bricklayers and craftsmen. In all 22 people were interviewed. Some of them did not know the product at all, but a number of them could give a considerable amount of information about its use. It was evident that the product had been far more widely used than had previously been thought. Most important was the information about whether the entrepreneur or even the individual bricklayer had decided whether or not to use Borvibet. Some entrepreneurs had tended to use Borvibet more often than others. The most desirable characteristic was the improvement in adhesion. Owing to the fact that less water was required the plaster became very hard, and was therefore particularly well-suited for heavily-used floors, for example on stairs or in corridors.

Specific constructions in which the product had been used were:

- concrete floors built in situ, under (and as an additive in) the levelling plaster
- floors in stairs and corridors
- under slate on stairs and floors

- plastering with bricks or tiles in bathrooms or around drinking fountains
- repairs to plastering

4.2 Paint

PCB has been used as an additive ("a softener") in chlorcautchuk paint. This kind of paint was thought to be almost exclusively used by the shipyards on steel ships and steel parts of ships. The chlorcautchuk paint was used from 1952 to 1975. The findings of PCB in facades on buildings led to the suspicion that such paint, and perhaps other types of PCB-containing paint, was also used on buildings. The method used to investigate this possibility was to interview people who were active in "the PCB-period", 1950 to 1980. We interviewed producers, importers, sales personnel, entrepreneurs and professional painters. In all 26 people were interviewed by telephone. Most interviews gave valuable information and led to one or two new persons to contact. We were unable to find any other kind of paint, except the chlorcautchuk paint, which contained PCB. This does not mean, however, that PCB was not used in other kinds of paints. Two specific products were traced and shown not to contain PCB, although one contained asbestos. The most important characteristic of the chlorcautchuk paint was its ability to withstand a wet and slightly acidic environment. In many instances the paint was found to have been used in such environments. PCB-containing chlorcautchuk paint found in an air-raid shelter and on the facade of a residential army building led to the conclusion that painted army concrete constructions should be investigated further in a new study. Other specific uses include farm buildings. An overview is given in the following table.

Table 1 Type of building and corresponding building construction where PCB-containing paint could have been used

Type of building	**Part of building/construction** **Indoors**	**Part of building/construction** **Outdoors**
Cowshed/pigsty	Walls and ceiling	Facades
Outbuildings on farms	-	Facades
Manure basement	Floor, walls, ceiling	-
Bunker on farms	Floor, walls, ceiling	Walls, roof
Building for electrical installations, such as transformers	-	Facades
Army building	Walls in air-raid shelters	Facades
Food industry	In production rooms: Walls and ceiling	-
Schools	Toilets: Walls and floor	-

4.3 Example of PCB in Norwegian hospital buildings

At the same as the PCB Guide was being developed the national hospital in Oslo (Rikshospitalet) was about to be demolished. "The Directorate of Public Construction and Property" (Statsbygg) engaged the authors to check the 16 buildings, comprising a total floor area of 50,000 m^2, for PCB in concrete and plaster. Considerable effort was made to choose the appropriate parts of buildings from which to take the material samples. The new findings about PCB in mortar and plaster, and knowledge about when the buildings were built and/or renovated were essential for the selection of samples. A total of 11 samples was taken from

walls (plaster) and floors (plaster and under slate). The samples were tested for PCB, and two of those taken from the floors proved positive. They contained 15.5 and 19.7 ppm PCB respectively, and were taken from the plastering on floors in two different buildings constructed in 1972 and 1962. They were both concrete buildings in situ. It was assumed that Borvibet had been used on the concrete floor before plastering, or as an additive in the plaster itself. The results of this search for PCB in mortar and plaster at the hospital verified the information from the literature study and the interviews.

The picture below shows part of the floor in the new administration building of the hospital. Samples were taken of the material under the vinyl tiles, which had been used to level off the floor. The result of the analysis revealed that a concentration of 19.7 ppm PCB was found in the material under the tiles.

Figure 1 *Picture of vinyl floor in the new administration building at the hospital (Rikshospitalet) in Oslo where samples were taken and analysed. The material under the vinyl tiles contained PCB in a concentration of 19.7 ppm.*

5. FOCUS ON FUTURE WORK IN RELATION TO PCB

The project showed that the source to PCB found on facades on various buildings in western Norway is not exactly known. Paint, mortar and plaster additives or sealants are the most obvious sources of PCB contamination of the facades. As an example, the source of the PCB contamination of the soil in a kindergarten was likely to be the outer wall of the building next door. The soil has been renewed, but the wall probably still leaks PCB. To remove such

pollution from our environment you first have to find the building with the PCB-containing facades. Depending on the source and construction, effective renovation has to be fulfilled.

5.1 Handling PCB on facades

We have suggested the following procedure for further work in relation to the decontaminate facades containing PCB:

- Buildings that potentially have PCB present in the facades are to be examined. A way to find PCB-containing facades is to make it mandatory to take a few samples of the facade material (mortar/plaster/paint) before starting to renovate the facade. Renovating facades usually starts with jet water washing which leads to waste water to the city's drainage system. The business permit of the facade entrepreneur can be linked to the proof of the harmlessness of the spill water from the jet water washing. This harmlessness can only be obtained by proving that common contamination in this kind of waste water, such as PCB, are not present.
- A number of buildings containing PCB in the facades should be investigated.

- The source of the PCB contamination of the facades should be detected by:
    - Mapping the history of the building
        - When plastered, with what kind of plaster
        - When painted, with what kind of paint
        - Is the paint renewed, and when?
        - Are the windows and/or sealants renewed?
    - Samples of the materials (mortar, plaster, paint, sealants).
- Composition of the results would probably lead to more knowledge about the problem, which will lead to a more precise selection of PCB-contaminated facades in the future.
- Depending on the construction, source and degree of contamination, decide on an effective method of decontamination and renovation.

The advantages would be that the knowledge about the former uses of PCB-containing paints, as shown in Table 1, would become more comprehensive. The renovation of such facades would be safer for the workers and lead to a reduction in the spreading of PCB to the environment. Specific safety measures will only be used where needed, which will lead to a greater cost effectiveness.