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HARMFUL SUBSTANCES USED IN CONSTRUCTION WORK

FROM 1950 TO 1980

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Bachelor's thesis
Spring 2017
Degree program in Civil Engineering
Oulu University of Applied Sciences

ABSTRACT

Oulu University of Applied Sciences
Degree program in Civil Engineering

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Title of thesis: Harmful Substances Used in Construction Work from 1950 to 1980
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Term and year of completion: Spring 2017 Number of pages: *39*

The object of this thesis is to study the health risks of harmful substances in construction materials. The study focuses mostly on materials that were used between the years of 1950 to 1980 and were later found to be harmful.

The materials that were selected for the thesis are PAH compounds, PCB compounds, asbestos, lead and other heavy metals. These materials have all been used in the time period used in the thesis before the health risks of the materials were actually noticed.

The aim of the study is to familiarize readers to the selected materials by gathering a small information pack on them. It contains general information on the materials and how they can affect a person's health. The thesis also features regulations and limits for the substances.

Keywords: PAHs, PCBs, asbestos, heavy metals

TIIVISTELMÄ

Oulun ammattikorkeakoulu
Rakennustekniikan koulutusohjelma

Tekijä: Mikki Greenberg
Opinnäytetyön nimi: Haitallisia aineita rakentamisessa 1950-1980 –luvulla
Työn ohjaaja: Kimmo Illikainen
Työn valmistumislukukausi ja -vuosi: Kevät 2017 Sivumäärä: *39*

Tämän opinnäytetyön aiheena on tutkia ja kertoa terveydelle haitallisista aineista rakennusmateriaaleissa. Työ keskittyy enimmäkseen materiaaleihin, joita on käytetty 1950–1980 -luvuilla rakentamisessa ja jotka on myöhemmin todettu haitallisiksi.

Valikoidut aineet ovat PAH-yhdisteet, PCB-yhdisteet, asbesti, lyijy ja muita raskasmetalleja. Näitä aineita on käytetty kyseisenä aikakautena, kun niiden haittavaikutuksista ei vielä kunnolla tiedetty.

Työn tavoitteena on perehdyttää lukijaa valikoituihin aineisiin keräämällä niistä pienenmuotoinen tietopaketti, jossa ilmenee yleistietoa aineista ja niiden haittavaikutuksista. Työssä tuodaan myös esille määräyksiä ja raja-arvoja, joita aineille on asetettu.

Asiasanat: PAH-yhdisteet, PCB-yhdisteet, asbesti, raskasmetallit

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1 INTRODUCTION

In the 60’s Finland became urbanized and turned into an affluent society. People started migrating to cities when work in the service branch and manufacturing industry became more common. In the early 70’s there was a substantial increase on living standards at roughly the same time there was an energy crisis. In the time span large amounts of building were built and construction started industrializing in the direction of modern construction.

As a basis, information can be found on the materials related to the subject but collecting the information might be a bit patchy. It is easier to find information on certain materials than others. The goal of this thesis work is to make a sort of data packet where information on the materials can be found in one place. The data packet can be useful to someone who does not really have background knowledge on the subject.

In the theoretical section of the thesis the selected materials will be presented more accurately. The selected materials are PAHs, PCBs, asbestos, lead, cadmium, and mercury. These are all materials that appear in Finland and elsewhere but the thesis is based on information associated with laws and regulations in Finland.

The thesis is not meant to give specific instructions on any kind of construction work. It is rather to provide information for someone who works with the selected materials so they can better avoid problems resulting from the materials.

2 ORGANIC MATERIALS

2.1 PAH compounds

PAH compounds or polycyclic aromatic hydrocarbons come from the incomplete burning of organic materials, for example oil and coal. The compound is made up from two or more benzene rings merged together, e.g. a naphthalene (Figure 1). (25.)

Figure 1. Naphthalene (13.)

There are over a hundred different types of PAHs but they are not all as hazardous for the health. The compounds, which are made up of 4-6 hydrocarbon rings, cause the most health issues. An example of this kind of PAH compound is benzo[a]pyrene (figure 2) which is made up of five benzene rings. (9.) (23.)

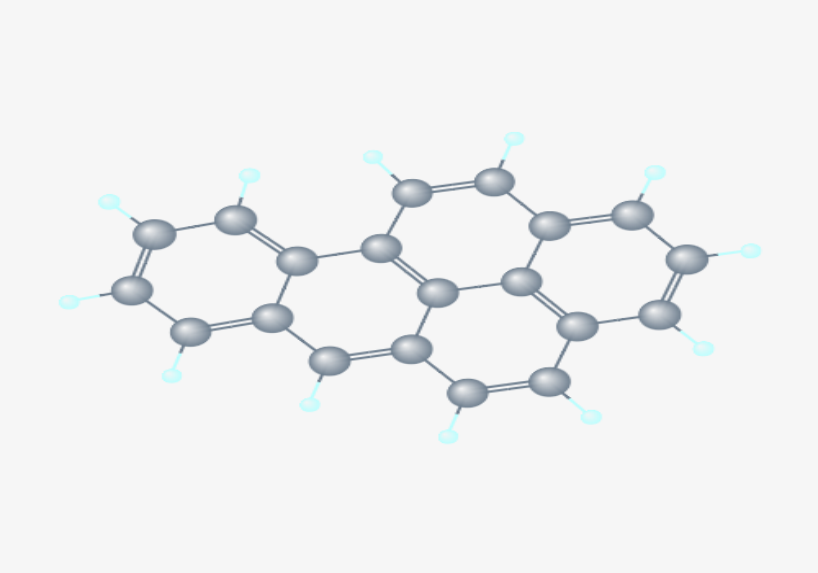

Figure 2. Benzo[a]pyrene(13.)

2.1.1 Use in construction

PAH compounds can be found in some moisture and water insulations and wood preservations. Creosote and bitumen are examples of construction materials in which PAH compounds can be found.

Creosote or coal tar has been used as humidity and water insulation. It can be found in brick seams, basement floor structures as well as masonry floors and intermediate floors among other places. Coal-tar pitch is used as a binder in asphalt products, as a base for coatings and paint and in roofing and paving. It is the residue of distilled coal tar and it also contains large amounts of PAH compounds. (11.)

Bitumen is mostly used in road construction but it is also used in buildings. It is a crucial component in asphalt and it is used as an aggregate in water insulations. When bitumen is heated over 100 °C it releases fumes which let out PAH compounds but it contains noticeably less PAH compounds than creosote. (23.)

- TIMELINE:

These are examples of structures where PAH compounds might be found.

1950:

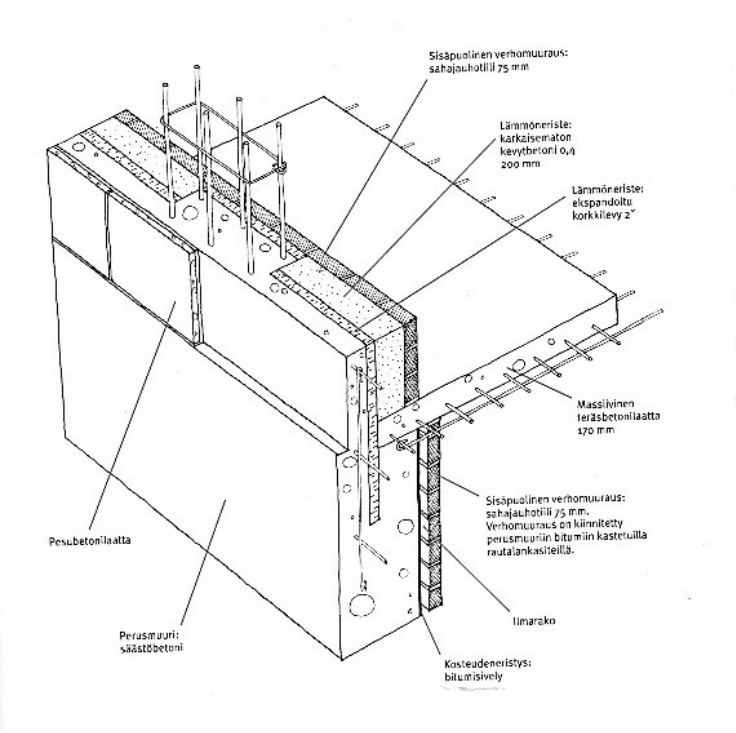

Figure 3. Example house ’52, exterior wall and roof of basement (6, p.127)

The moisture insulation in the structure has a bitumen coat, which may contain PAH compounds (figure 3).

1960:

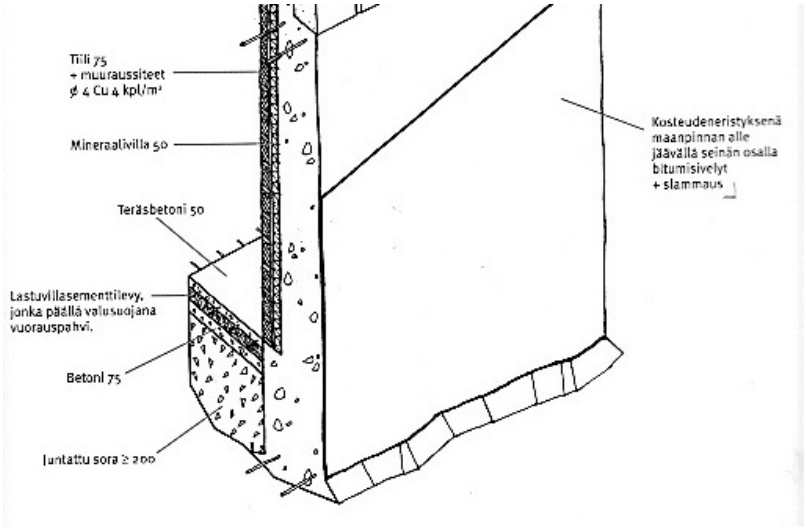

Figure 4. Example house ’63, gable (6, p.197)

The part of the wall that is below the ground surface is coated with bitumen, which may contain PAH compounds (figure 4).

1970:

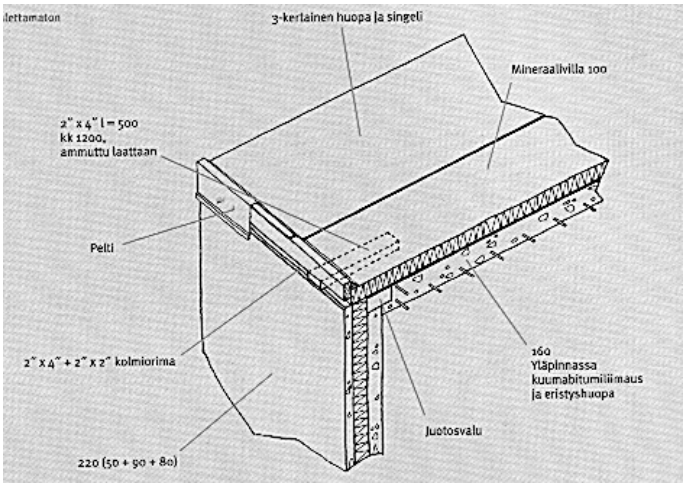

Figure 5. 1970’s unventilated roof (6, p.225)

Hot bitumen glue is used on the upper side of the lightweight aggregate concrete. The glue may contain PAH compounds (figure 5).

2.1.2 Exposure and health risks

PAH compounds are usually in the form of gas attached to dust or other particles in the air. They can drift into humans through the respiratory tract, skin or the gastrointestinal tract.

Some PAH compounds are classified as carcinogenic or cancer inducing substances. They can also cause gene mutations if exposed to them for a long period of time. It can also cause skin irritation and damage the immune system from short- and long-term exposure. (9.)

2.1.3 Limits and use today

The Ministry of Social Affairs and Health has established reference limits for occupational exposure limits in the air at a workplace. The 8-hour occupational exposure limit for naphthalene is 5000 µg/m^3 and for benzo[a]pyrene the limit it 10 µg/m^3. (21.)

For different occupational fields and tasks The Institute of Occupational Health has set recommendations and target levels workplaces should aim at when developing working conditions. Occupational exposure limit and target limits have not been set for any other PAH compounds than naphthalene and benzo[a]pyrene in Finland. (21.)

The use of PAH compounds in construction is nowadays quite restricted. It is mainly used in creosote wood preservatives and bitumen.

Even though PAH compounds are quite constricted in material use the compounds can be found in all surface soils and different types of foods, for example in meat, fish, vegetable and fruit. (11.)

2.2 PCB compounds

PCB compounds or polychlorinated biphenyl form when two combined benzene rings are connected to 1-10 chlorine atoms, e.g. hexacloropiphenyl that contains 6 chlorine atoms (figure 6). There are over 200 different kinds of compounds and 12 of them are particularly toxic.

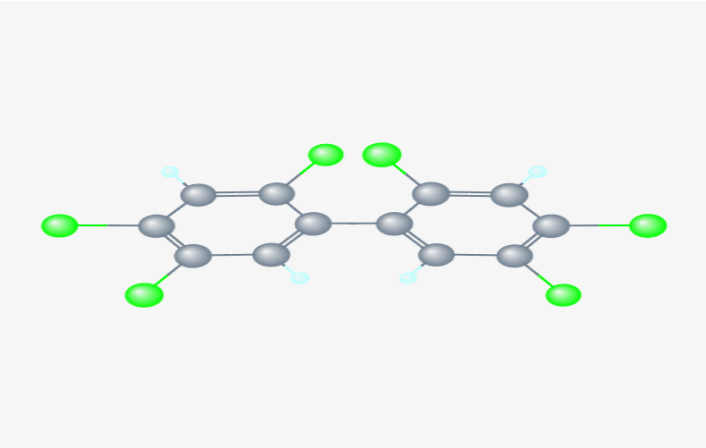

Figure 6. Hexaclorobiphenyl (13.)

PCB compounds are chemically and microbiologically very resistant and for that reason they are very harmful to people and the environment. (12.)

2.2.1 Use in construction

PCB compounds are sustainable, oily, insulate well and are poorly flammable liquids. These properties allow the use of these compounds in many construction materials. PCBs can be found in sealants, glues, insulations and paints, among other things. (24.)

PCB compounds improve the adhesiveness and corrosion resistance in paint for targets where these properties are needed, like industrial buildings. As insulation PCBs can be found in converters, condensers and other hydraulic devices. (24.)

- TIMELINE:

These are examples of structures where PCB compounds might be found.

1950:

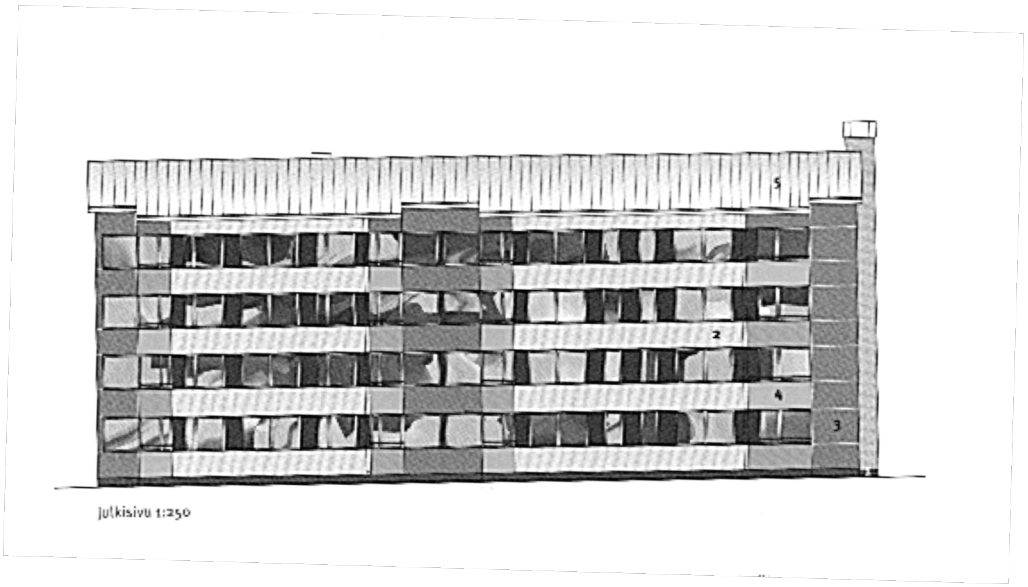

Figure 7. Example house 1959, façade (6, p.137)

The painted façades on these types of buildings may contain PCB compounds (figure 7).

1960:

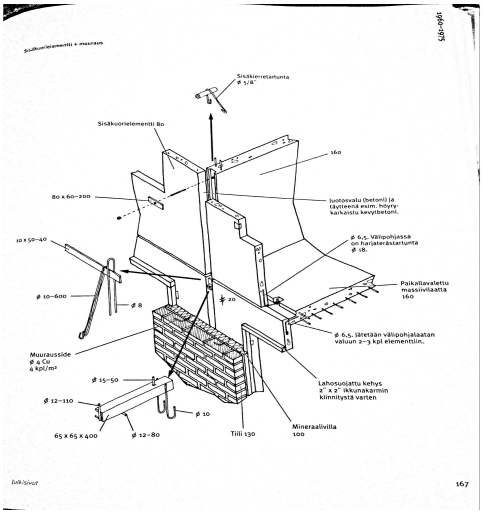

Figure 8. 1960's inner shell element + masonry (6, p.167)

The joint sealing compound in brick linings of 60's buildings may contain PCB compounds (figure 8).

1970:

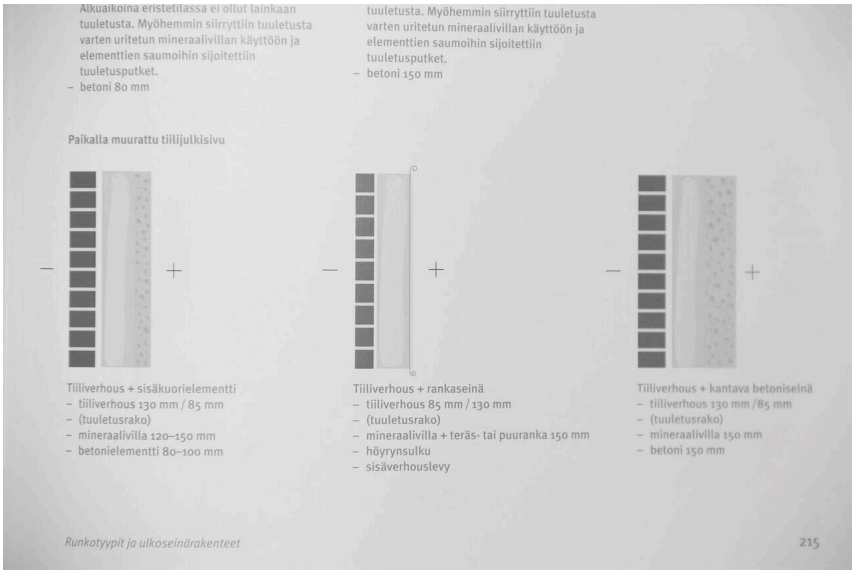

Figure 9. Examples 1970's frame types and exterior wall structures (6, p.215)

In the 70's brick lining became more popular than grey colour and exposed-aggregate concrete. The joint sealing compound used in the brick lining may contain PCB compounds (figure 9).

2.2.2 Exposure and health risks

The most common way to be exposed to PCB compounds is from animal originated foods. They can enter the body through the respiratory tract, through the skin and by being swallowed. PCB compounds mainly have a long-term effect on humans. They accumulate into the adipose tissue and the liver and are slowly excreted by urine, faeces and breast milk. (24.)

PCB compounds have been proven to increase the risk of cancer when exposed to large quantities. Long-term exposure to the substance can cause disorders in development, fertility, the immune system and hormone functioning. (9.)

2.2.3 Limits and use today

The reference limits for PCB compounds set by The Ministry of Social Affairs and Health are announced as both the 8-hour and 15-minute occupational exposure limits. The 8-hour limit is 0.5 mg/m^3 and the 15-minute limit is 1.5 mg/m^3. It is also noted that PCB compounds can absorb through the skin. (18.)

The preparation, importation, sale and extradition of PCB compounds and products that contain PCB compounds have been banned since the beginning of 1990. (19.)

3 ASBESTOS

Asbestos is a general term for several different fibrous silicate minerals. There are various kinds of asbestos minerals, chrysotile (white asbestos), actionlite, anthophyllite, amosite (brown asbestos), crocidolite (blue asbestos) and tremolite. (figure 10) (25.)

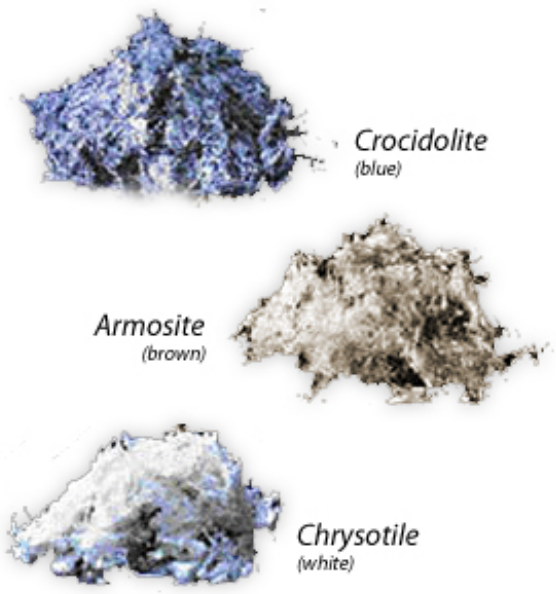

Figure 10. Asbestos (1.)

3.1 Use in construction

Asbestos has been used in most houses and apartment buildings that were built between 1950s and 1980. It can also be found in many different construction materials. (13.)

Asbestos has a very good fire and chemical resistance, which is why it was so popular before the health risks were noticed. It can be found in thermal insulation, asbestos cement products, floor materials and bitumen products. (25.)

- TIMELINE:

These are examples of structures where asbestos might be found.

1950:

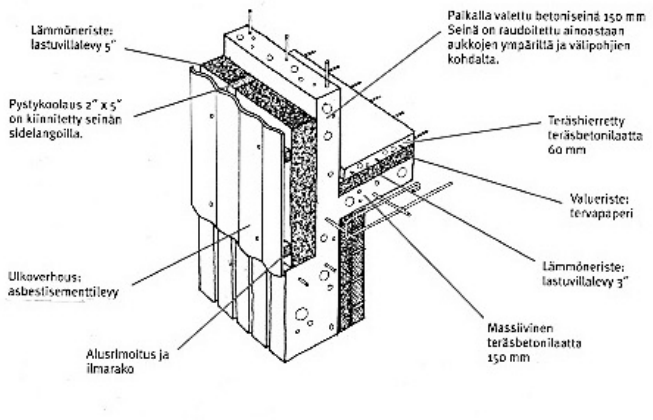

Figure 11. Example house 1959, exterior wall and basement roof (6, p.139)

The external cladding of the structure is made from asbestos-cement sheets (figure 11).

1960:

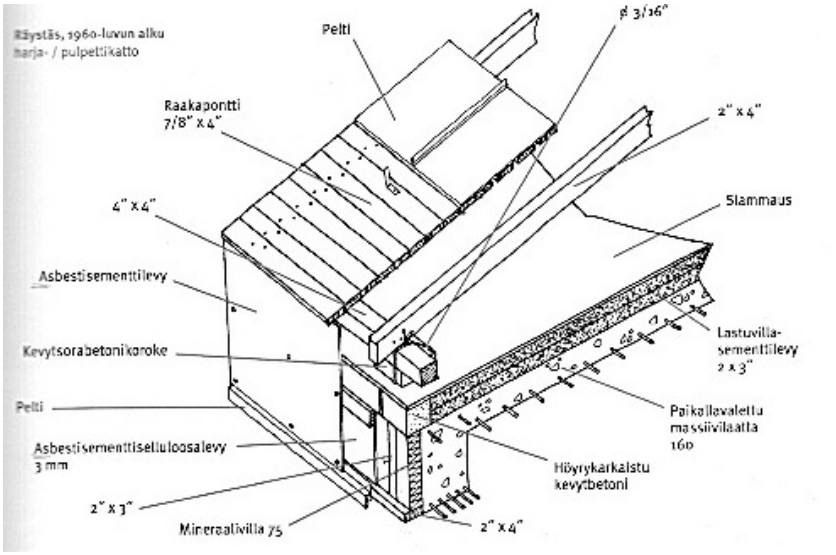

Figure 12. 1960's eaves on a pitched or ridged roof (6, p.175)

The external cladding of the structure is asbestos-cement sheets and there are asbestos-cement cellulose sheets under the external cladding (figure 12).

1970:

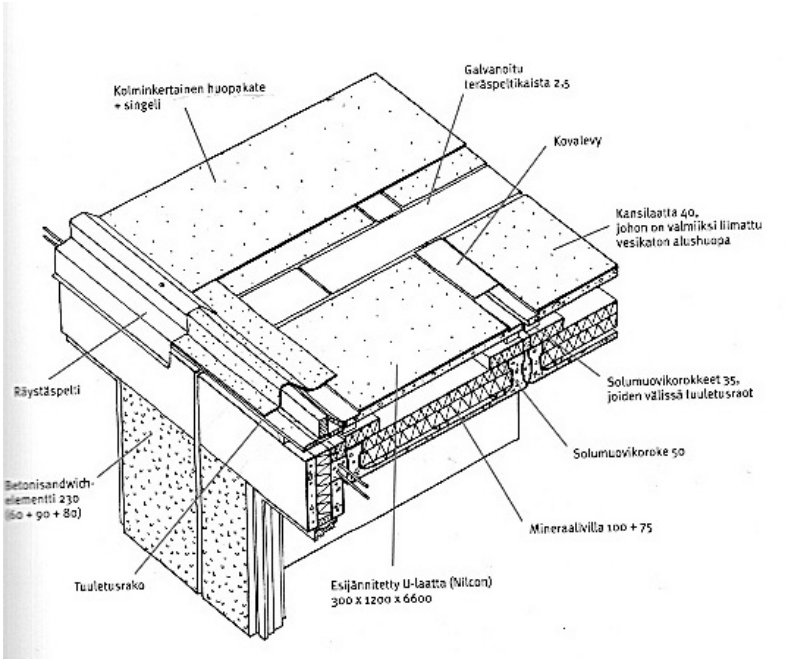

Figure 13. Example house 1975, eave and roof (6, p. 209)

In this type of structure asbestos can be found in insulations among other things. Asbestos can also be found in paints that were used on the concrete surface of exterior walls (figure 13).

3.2 Exposure and health risks

Asbestos as a construction material is not actually harmful to humans but when it wears down or breaks it releases dust, which is harmful when inhaled. When inhaled, asbestos dust contains thin fibres that go into the lungs all the way to the alveoli.

If exposed to asbestos dust it can cause lung diseases. The most common ones are lung cancer, asbestos pneumoconiosis or asbestosis, asbestos plaque burden or pleural changes and mesothelioma, which is a pleural or peritoneal cancer. These diseases do not progress immediately after exposure but develop with time, usually a period of 10-50 years. (11.)(25.)

3.3 Limits and use today

Asbestos is one of several materials for which the Government has regulated specific mandatory limits. The mandatory limit appointed by the Government as the 8-hour occupational exposure limit states that the fibre content must be under 0.1 fibres/cm^3. (21.)

Since 1988 construction products containing asbestos have not been manufactured in Finland. However it was still possible to import these products.

In the beginning of 1993 the preparation and importation of asbestos was banned. The ban against selling and using asbestos became effective in the beginning of 1994. (22.)

4 HEAVY METALS

A metal element is considered a heavy metal when its density is higher than 5 g/cm^3. Heavy metals can naturally be found in bedrock, soil, plants and animals and the metals can be in different forms, for example as minerals, dissolved in water, as ions, as salts or even gases. They can also bind to organic and inorganic molecules or attach to small particles.

Some heavy metals are vital trace elements to people in small quantities but in larger quantities they are toxic. Other heavy metals are harmful or even toxic in very small quantities. The most environmentally harmful heavy metals are mercury, lead and cadmium, which have also been used in construction. (8.)

- TIMELINE:

These are examples of structures where heavy metals might be found.

1950:

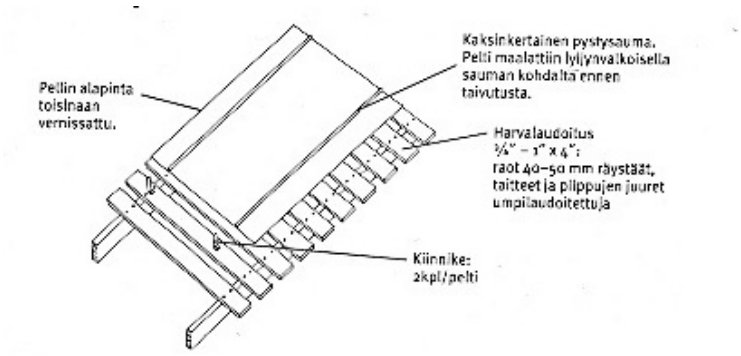

Figure 14. 50's roof (6, p. 107)

The metal on the metal-sheeted roof has been painted with white lead. Other heavy metals may also be found in the paint (figure 14).

1960:

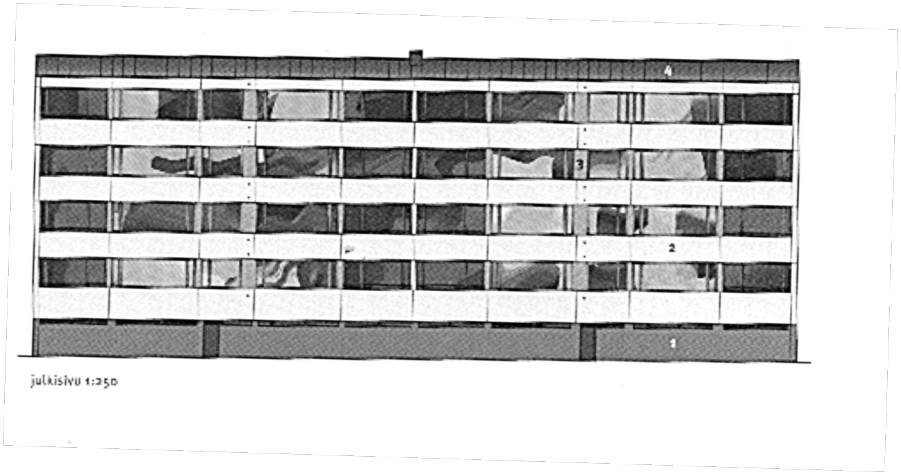

Figure 15. Example house 1963, façade (6, p. 193)

Painted concrete has been used on the façade of this building. The paint may contain heavy metals (figure 15).

1970:

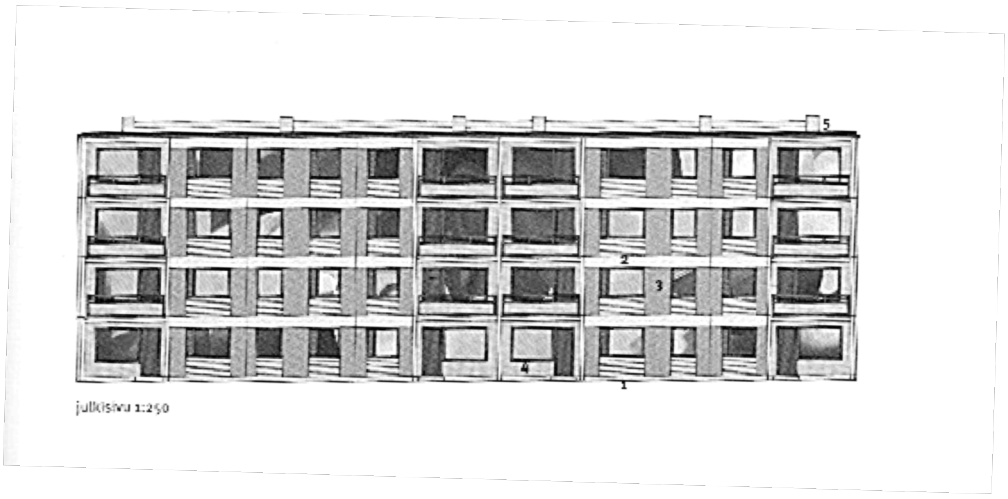

Figure 16. Example house 1975, façade (6, p.205)

In these types of 70's buildings the concrete paint on the façades may contain heavy metals. Heavy metals may also be found in the plastic coating (figure 16).

4.1 Lead

Lead (Pb) is the 82nd element of the periodic table. It belongs to the carbon group and is a bluish silvery grey, soft metal. Lead is rarely found in its element state but as different compounds such as lead sulphate. (8.)

When lead comes in contact with air it oxidizes and quickly forms an alkaline carbonate layer on the surface. Lead and all its compounds are toxic.

4.1.1 Use in construction

Lead is soft which makes it an easily workable metal that has a poor tensile strength. Lead was already used a lot in the classical antiquity, for example in water supply pipes and paints, because large amounts of it were found as a by-product of silver mining.

In this century lead has been used in the joints of stone structures, joints of slate roofs, paints, pipes, flashings etc. (8.)

4.1.2 Exposure and health risks

All lead compounds are toxic but organic compounds are more harmful to people than inorganic compounds. Lead can be absorbed through the skin, by inhalation and by being swallowed. (10.)

The substance may have effect on the blood, bone marrow, the central nervous system, the peripheral nervous system and the kidneys resulting in anaemia,

toxic brain diseases, peripheral nervous system diseases, stomach cramps and kidney failure. It can also be harmful to reproduction and to growth. (8.)

4.1.3 Limits and use today

Lead is also one of the materials for which the Government has appointed mandatory limits. The 8-hour occupational exposure limit is 0.1 mg/m^3.

There is also a border measure set for employees working with lead. If the lead content in the employee's blood is noted to be over 50 mg/dl, at a medical check-up, the employee is not allowed to work somewhere where he/she might be exposed to lead. (21.)

Lead mixtures are all poisonous. For that reason it is sought to reduce the use of lead but because of its good qualities it can still be found in many construction materials. (10.)

4.2 Cadmium

Cadmium (Cd) is the 48th element of the periodic table. It is a silvery white, shiny and extendable substance that is produced mainly as a by-product of zinc. (5.)

Cadmium is electrolytically separated from the zinc and in Finland cadmium is manufactured with a sort of purification solution that makes the cadmium 80 per cent pure. (10.)

4.2.1 Use in construction

Cadmium has a low melting point, malleability, and electrical conductivity. It also has a low corrosion if the surface breaks.

Cadmium is used as an alloy in cadmium coatings, as a stabilizer, in PVC plastic and paints. Cadmium-silver solder makes a very dense and filling junction because cadmium has a very good fluidity. (10.)

4.2.2 Exposure and health risks

Cadmium compounds mostly absorb through the respiratory tract. It can also be absorbed by being swallowed but not through the skin. (5.)

Cadmium stimulates the production of metallothioneins. When cadmium is bound to the metallothioneins, it infiltrates the glomerulus and absorbs into the renal tubular. Cadmium causes more damage to an already damaged kidney than a healthy one. (10.)

A cadmium complex that is attached to an albumin breaks down in the liver and causes liver damage. 75 per cent of cadmium accumulated in the body is in the liver and kidneys but it can also be in the muscles.

4.2.3 Limits and use today

The 8-hour occupational exposure limit, set by The Ministry of Social Affairs and Health, for cadmium is 0.02 mg/m^3. It is also noted that exposure to cadmium can happen through the skin. (21.)

The use of cadmium compounds is banned in many plastics and resins if the mass percentage of the content is higher than 0.1. Cadmium compounds can still be found in many different construction materials, for example in Wood's metal. (10.)

4.3 Mercury

Mercury (Hg) is the 114th element of the periodic table. It is a silvery white metal that is naturally found in soil and bedrock. At room temperature mercury is liquid but it evaporates easily and can spread into the environment through the air. (4.)

In nature inorganic mercury can slowly turn into organic mercury compounds, for example methyl mercury which accumulates into the food chain making food the most significant source of organic mercury. (6.)

Metallic mercury is produced in Finland as a by-product of zinc produce from mercury containing zinc concentrate and is made by calcination. (10.)

4.3.1 Use in construction

Mercury has been used in different construction materials and electrical devices in the past. It was used as colour pigments for different materials, in numerous electric lamps and in thermometers.

In paints mercury was used as a fungicide because of its mildew resistance. It was also used as a red pigment in plastics and rubbers. Compact fluorescent lamps, halide lamps and old thermostats may contain mercury in them but there is a low risk of being affected when the equipment that contains it is undisturbed. (10.)

4.3.2 Exposure and health risks

Metallic mercury absorbs poorly into organisms but organic mercury compounds absorb well. The fumes of metallic mercury absorb well into the body through the respiratory tract and about 80 per cent of mercury that is inhaled absorbs into the body. (10.)

The absorbance of metallic mercury into the gastrointestinal tract is low but depending on the compound about 10 per cent of inorganic mercury compounds can absorb. Through inhalation the absorbance of mercury compounds is lower and slower than metallic mercury because of the solubility of the compounds. Significant amounts of inorganic mercury compounds, particularly bichloride, can even absorb through the skin unlike metallic mercury, which usually has a very low absorbance through the skin. Although it is unusual that metallic mercury absorbs through the skin it is not impossible. (4.)

The side effects of metallic mercury are caused by retention in the body, especially the brain and kidneys. Long term or repetitive exposure to small amounts of mercury can affect the psychomotor activities; the brain and it can weaken the observation skills among other things. Large amount of exposure can cause a significant risk of getting mercury induced nervous system poisoning or kidney damage. (4.)

4.3.3 Limits and use today

The Ministry of Social Affairs and Health has appointed different limit values for the alkyl compounds of mercury than for mercury and its inorganic compounds. The 8-hour occupational exposure limit for the alkyl compound of mercury is 0.01 mg/m^3 and for mercury and its inorganic compounds the limit is 0.02 mg/m^3. However it is noted that they both may react when in contact with skin. (8.)

In Finland they stopped using mercury as a pickling agent in 1992. Mercury is still used in some lamps and indicators nowadays. (10.)

5 RENOVATIONS AND DEMOLITION

Before starting a renovation or demolition in buildings that were built between the years of 1950 and 1980 it is important that the builder has a mapping of harmful substances done on the building. This mapping should be done so the job is done as accurately and safely as possible.

There are specific ways of working with harmful substances and it is very important that the work is done with the right equipment so that no one will get any side effects from the substances. The work is done in accordance with certain standards and with the help of the construction guides (RT cards and Ratu cards) related to the substances. (16.)

5.1 PAH compounds

If PAH compounds are found when doing a mapping of harmful substances the demolition is usually done with a sectioning method because the compounds spread with the dust from the demolition. During renovations it would be good to get rid of all the old materials that contain PAH compounds but it is practically impossible without demolishing the entire building because the compounds absorb into its surrounding materials. (17.)

As an alternative to demolition and a complementary renovation method the structure can be encapsulated with a tight layer of material, for example metal laminate sheets, epoxy coating or any other materials that are proven to have enough diffusion resistance against PAH compounds. (15.)

5.2 PCB compounds

Joint sealants that contain PCB compounds were used a lot in facades and balcony structures from the 50’s to the 70’s. All renovations made on building

that were built between the years of 1958 and 1979 and used elastic joint sealants should be examined for PCB content. (19.)

When examining the content of PCB compounds attention should be paid to the fact that the substance could have spread into surrounding porous materials. If the content of PCB compounds in buildings built between 1957 and 1979 is not inspected before renovation or demolition, the work must be done assuming that the building contains the substance. (15.)

5.3 Asbestos

The asbestos law has been renewed in the beginning of 2016. There is a new law on certain requirements (684/2015) related to asbestos demolition work. The requirements focus on provisions of asbestos work permits and the qualifications of the demolition workers as well as the regulations that must be kept on these subjects. With the Governments new order on the safety of asbestos work (798/2015) the asbestos work procedures are regulated. Also the demolition plans, processes, tools and personal safety equipment service requirements are regulated. (27.)

Only employees who have approved asbestos removal training can do and oversee the demolition work. The qualification requirement of asbestos demolition workers is a vocational degree or an applicable part of it. Practically every building built before 1994 must be ensured that the demountable structures do not contain asbestos because it was used a lot back then. (2.) (27.)

5.4 Lead

Like PCB compounds the mapping, protection and demolition methods for lead are fairly customary. A lot of general instructions and authoritative regulations have been issued on the subject. Lead and PCB compounds practically have the same regulations when it comes to facades and balcony structures.

However lead has been used till the end of the 1980's, which means that the lead content must also be checked in buildings built in the 80's. (15.) (18.)

Since lead as a metal isn't actually harmful it can be recycled. Cutting it by flame cutting or with an angle grinder, amongst other things, should be avoided because harmful particles and fumes may spread into the air. (15.)

5.5 Cadmium and mercury

Cadmium and mercury do not have any specific renovation or demolition guides but knowing that they are harmful substances the work should be accurately and carefully handled. Both substances are also labelled as toxic waste as well as the other substances in this thesis. (4.) (5.)

6 TOXIC WASTE

6.1 PAH compounds

If the total amount of PAH compounds is over 200 mg/kg it is usually delivered to a toxic waste disposal plant. Primarily the environmental authority's instructions are followed when processing the waste. The waste is sorted and kept separately from the other waste.

When delivering the waste the keeper of the dumping area has rules that must be abided to. Also the dumping area must be informed about the waste and the amount of it in advance.

PAH compounds are usually packed into tight and firm packages and it cannot be temporarily stored at the building site. (19.)

6.2 PCB compounds

If the decommissioning waste contains over 50 mg/kg of PCB compounds it is processed as PCB waste. The decommissioning waste is gathered into refuse sacks and the sacks are not allowed to be stored at the work site or directly on the ground. The sacks must be immediately taken to a locked or at least closed waste bin occupied for them. The content of the waste bin must be clearly marked and it is advisable to store the waste in a bin that is also suitable for transportation. (24.)

The waste should be delivered as PCB waste or toxic waste to a toxic waste disposable plant. The waste can also be delivered to a municipal waste management that accepts toxic waste from where the waste is then delivered onward to a toxic waste disposal plant.

Waste containing over 50 mg/kg of PCB compounds must be transported according to the regulations for transport of dangerous goods and a transfer document must be drafted. (19.)

6.3 Asbestos

Waste that comes from asbestos work is packed at the construction site into tight containers or bags. The waste must be packed tightly enough that the dust does not spread from the confined space to other spaces. The waste packages must also be cleaned before being removed from the demolition area. It is important that the packages stay intact when being transported to the dumping area. (20.)

6.4 Heavy metals

Lead, cadmium and mercury can all be toxic waste. It may be problematic if heavy metals end up in demolition waste because they cannot be separated afterwards. Heavy metal waste is always sorted separately from one another and separately from other waste. The metals are delivered to an appropriate toxic waste disposal plant.

Old computers may possibly contain mercury or lead and batteries may contain lead or cadmium. Old or broken electronics and used batteries should always be recycled. They can usually be taken to a recycling centre and old computers and phones can usually be dropped at electronic stores. (16.)

7 SUMMARY CHART

	ORGANIC MATERIALS		ASBESTOS	HEAVY METALS		
YEARS USED	~ 1870-1990	~ 1950-1985	~ 1920-1990	~ 1870-1990/ 2000		
SUBSTANCE	PAH compounds	PCB compounds	Asbestos	Lead	Cadmium	Mercury
USE IN CONSTRUCTION	Moisture insulation Water insulation + Aggregate Bitumen	Sealant Glues Insulation Paints	Insulation Cement Vinyl floors Bitumen	Sealant Paint Pipes Slate roof sealant	Plastic Paint Coatings	Plastic Paint Electric supplies
EXPOSURE	Respiratory tract Skin Gastrointestinal tract	Respiratory tract Skin Swallowed	Inhalation	Skin Inhalation Swallowed	Respiratory tract Swallowed	Mostly: respiratory tract Rarely: gastrointestinal tract, inhalation, skin
HEALTH RISKS	Carcinogenic Gene mutation Skin irritation Damages immune system	Cancer Disorders: Development Fertility Immune system Hormone function	Lung cancer Asbestosis Asbestos plaque burden Pleural changes Mesothelioma	Anaemia Toxic brain diseases Peripheral nervous system diseases Stomach cramps Kidney failure	Liver damage	Affects psychomotor activities Nervous system poisoning Kidney damage

LIMITS	Nafthalene: HTP_{8h} 5000µg/m^3 Benzo[a] pyrene: HTP_{8h} 10µg/m^3	HTP_{15min}: 1.5mg/m^3 HTP_{8h} : 0.5mg/m^3	HTP_{8h} < 0.1 fibres/cm^3	HTP_{8h}: 0.1mg/m^3 Emplyee not allowed to work in any lead exposure if blood content >50mg/dl	HTP_{8h} : 0.02mg/m^3	Alkyl compound: HTP_{8h} 0.01mg/m^3 Inorganic compound: HTP_{8h} 0.02mg/m^3
USE TODAY	Quite restricted Mainly still used in creosote wood and bitumen	Preparation, importation, sale and extradition banned since 1990	Preparation and importation banned since 1993 Sale and use banned since 1994	Use reduced but can still be found in some constructio n materials	Banned in plastics and resins if mass-% over 0.1 Still found in some constructio n materials	As pickling agent stopped in 1992 Still used in some lamps and indicators

8 SUMMARY

The aim of the thesis was to study harmful substances in construction materials of old buildings. Particularly substances found in buildings that were built from 1950 to 1980.

The time period was chosen based on a time when Finland started urbanizing and how construction started industrializing. The biggest challenge was limiting the substances and what information to present on them.

I wish that this thesis could be of use when performing renovations on old buildings. I also hope that the thesis can help construction workers to be more aware of the risks the substances can have on them, the environment and other surroundings.

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