7.4.4.5 Preservation of Wood

This sector (CORINAIR 94 SNAP source category 06 04 06) covers the impregnation with or immersion of timber in organic solvent-based preservatives, creosote and water-based preservatives. Wood preservatives may be supplied for both industrial and domestic use. Most of the information currently available on emissions relates to the industrial use of wood preservatives. Mixing and storing of preservation substances are not included. [cf. 1, 2]

1 Technology Description

Wood is preserved to protect it against fungal and insect attack and also against weathering. Three types of preservatives are used: water-based ones, solvent-based ones and creosote. The estimation of emissions can either be based on the quantity of preservatives consumed or on the quantity of timber treated. Wood preservation is a major industry, with 6 million m$^3$ of timber treated annually in the EU alone. [cf. 1, 2]

The application of the preservative may be carried out via vacuum processes, pressure processes, dipping, spraying or brushing. The vacuum process may vary slightly, depending on the preservative. [cf. 1, 4]

The application efficiency of the vacuum process, dipping and brushing is close to 90 %. Spraying has a much lower efficiency of around 10 %. [3]

1.1 Creosote

Creosote is an oil prepared from coal tar distillation. Approximately 10 % of the creosote used for wood preservation is made up of NMVOC. Creosote is the oldest form of wood preservative and is used for external applications such as telegraph poles and railway sleepers. It is gradually being replaced by water-based preservatives. Creosote may be mixed with petroleum fractions to produce carboliinium. This can be brushed onto the surface of the wood and is mainly for private use. [cf. 1]

In industrial facilities, timber enters a chamber which may be pressurised with air. The chamber is flooded with hot creosote for 1 - 3 hours. After draining, a vacuum is applied to draw off excess creosote. The timber is then left to dry in the open air. [cf. 1]

1.2 Water-Based Preservatives

Water-based preservatives consist of solutions of salts in water. Copper, chromium and arsenic types are the most widely used. These are applied in the same way as creosote. [cf. 1]

1.3 Solvent-Based Preservatives

These consist of approximately 10 % active ingredient and 90 % organic solvent, usually white spirit or other petroleum based hydrocarbons. [cf. 1]

In industrial installations, timber enters a chamber which is subsequently evacuated. The chamber is flooded with preservative and pressurised for 5 to 20 minutes. After draining the chamber, a final vacuum is applied to draw off excess preservative. The timber is left to dry in the open air. [cf. 1]
2 Emission Sources

The main emission source is given by the solvent content of the applied substances. Fugitive and contained emissions can be reduced with the help of abatement equipment. Solvents which remain in the timber after complete drying evaporate over longer periods of time. [cf. 2]

Wood impregnation may be carried out at large plants, where control of emissions may be practical, or smaller plants, where add-on abatement systems could be prohibitively expensive. [cf. 1]

For the impregnation of 1 m³ of wood, an average of 100 kg of creosote is required, traditional creosote containing 20 wt.-% NMVOC [6]. [4] reports a creosote consumption of about 100 – 200 l/m³ redwood splint when the so-called Rüping-method, the most common preservation method, is used. When using other impregnation methods mostly used formerly, such as the Full-cell method, the consumption of creosote is much higher, up to 600 l/m³ redwood splint [4]. Each m³ of wood requires 20 kg of organic solvent-based preservatives, usually white spirit or other petroleum based hydrocarbons, consisting of about 90 % wt.-% NMVOC [5, 7] with the average density of wood being about 1 Mg/m³. The above data relate to the industrial application of wood preservatives. For domestic use, emission factors will be higher.

3 Primary Emission Reduction Measures

Technical Aspects

Emissions can be reduced by good solvent management, enclosing the process wherever possible so that air can be extracted through abatement equipment, and using alternative low-solvent coatings where possible. [cf. 1]

It is assumed that 'good housekeeping' measures might reduce emissions in comparison to the uncontrolled 'bad housekeeping' case by about 20 % [cf. 2].

Fugitive emissions occur throughout the handling, application and drying stages of the processes. Timber impregnation using the closed double vacuum process minimises the fugitive loss. [cf. 1]

Economic Aspects

Information on costs is given in the attached technical data sheet.

4 Secondary Emission Reduction Measures

Technical Aspects

NMVOC emissions result from the evaporation of organic solvents and the volatile components of creosote. These emissions may be fugitive (non captured emissions) or captured and vented via a stack. Stack emissions may be controlled using waste gas cleaning (e. g. carbon adsorption, incineration etc.). [cf. 1]

Secondary measures are only applicable to large facilities, these could be any end-of-pipe technologies as described in the specific chapters on secondary measures (cf. Chapter 9).
Economic Aspects

Information on costs is given in the attached technical data sheet.

5 Side Effects

By the introduction of water-based systems, emission relevance could be moved from air to water. Thus, care should be taken, that water pollution is avoided. Occupationally health problems may be reduced considerably by replacing solvent-based systems.

In the case of incineration, the related combustion emissions have to be accounted for.

6 References


Technical Data Sheet