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Polluted rainwater runoff from waste recovery and recycling companies: Determination of emission levels associated with the best available techniques

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ABSTRACT

Rainwater falling on outdoor storage areas of waste recovery and recycling companies becomes polluted via contact with the stored materials. It contains various pollutants, including heavy metals, polycyclic aromatic hydrocarbons and polychlorinated biphenyls, and is characterized by a highly fluctuating composition and flow rate. This polluted rainwater runoff is legally considered as industrial wastewater, and the polluting substances contained in the rainwater runoff at the point of discharge, are considered as emissions into water. The permitting authorities can set emission limit values (discharge limits) at the point of discharge. Best available techniques are an important reference point for setting emission limit values. In this paper, the emission levels associated with the best available techniques for dealing with polluted rainwater runoff from waste recovery and recycling companies were determined. The determination is based on an analysis of emission data measured at different companies in Flanders. The data show that a significant fraction of the pollution in rainwater runoff is associated with particles. A comparison with literature data provides strong indications that not only leaching, but also atmospheric deposition play an important role in the contamination of rainwater at waste recovery and recycling companies. The prevention of pollution and removal of suspended solids from rainwater runoff to levels below 60 mg/l are considered as best available techniques. The associated emission levels were determined by considering only emission data from plants applying wastewater treatment, and excluding all samples with suspended solid levels >60 mg/l.

The resulting BAT-AEL can be used as a reference point for setting emission limit values for polluted rainwater runoff from waste recovery and recycling companies. Since the BAT-AEL (e.g. 150 μg/l for Cu) are significantly lower than current emission levels (e.g. 300 μg/l as the 90% percentile and 4910 μg/l as the maximum level for Cu), this will result in a significant reduction in emissions into water.

1. Introduction

Rainwater falling on outdoor storage areas of recovery and recycling companies becomes polluted via contact with the stored materials. It contains various pollutants, including (heavy) metals, polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs). It is characterized by a highly fluctuating composition and flow rate. The flow rate depends mainly on the amount of rainfall, while the composition depends both on the amount of rainfall and on the composition and leaching behavior of the materials stored on the site (Blondeel et al., 2014a). As for rainwater runoff in general (Barbosa et al., 2012; Brown and Peake, 2006; Huston et al., 2009; Lamprea and Ruban, 2011; Olivella, 2006; Sabin et al., 2005), atmospheric deposition can also contribute to the contamination of rainwater runoff from the storage area. Atmospheric deposition can be linked to different sources of emissions into the air, such as dust-generating activities or combustion processes, both at the recovery and recycling sites themselves, or in the immediate or wider vicinity.

Abbreviations: BAT, best available techniques; BAT-AEL, emission levels associated with the best available techniques; ELV, emission limit value; IED, Directive 2010/75/EU of the European parliament and of the council of 24 November 2010 on industrial emissions; LNE-AMI, Nature, Energy and Environment Department of the Flemish government, Environmental Inspection Division; LNE-AMV, Nature, Energy and Environment Department of the Flemish government, Environmental Permit Division; PAH, polycyclic aromatic hydrocarbons; PCB, polychlorinated biphenyls; RL, reporting limit; SS, suspended solids; SWG, sector working group; VLAKWA, Flanders Knowledge Center Water; VLAREM, Flemish environmental permit regulation; VMM, Flemish Environmental Agency.

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In Flanders, the polluted rainwater runoff from storage areas at recovery and recycling companies is legally considered as industrial wastewater, and the polluting substances contained in the rainwater runoff at the point of discharge are considered as emissions into water. The permitting authorities can set emission limit values (ELVs, discharge limits) at the point of discharge. To comply with these ELVs, companies have to take measures to prevent pollution and/or to treat the polluted rainwater runoff. Based on leaching tests, Blondeel et al. (2014a) recommended the following actions to prevent pollution of rainwater runoff at scrap recovery and recycling sites: sweeping, separate treatment of electric motor scrap leachate (by connecting an additional oil water separator) and possibly other leachates, leak-proof storage of metal turning scrap and more stringent regulations and controls on the cleaning of (empty) barrels. Chys et al. (2013) and Blondeel et al. (2015) performed lab and pilot-scale tests for the treatment of rainwater runoff in recovery and recycling companies. They reported good removal efficiencies for a number of parameters (suspended solids, metals, PAHs, PCBs) using physicochemical treatment methods such as coagulation/flocculation and/or sand filtration.

Up to now, no sector-specific emission limits values for rainwater runoff from recovery and recycling companies are implemented in Flanders (the Northern part of Belgium). Therefore, the general ELVs in the Flemish VLAREM II regulation apply, or company specific ELVs can be imposed in individual environmental permits.

Within the framework of the European Directive 2010/75/EU on industrial emissions (IED), EU member states are asked to use the best available techniques (BAT) as a reference point for when setting the conditions for environmental permits for certain activities mentioned in Annex I to the directive. This includes, for example, 'treatment in shredders of metal waste, including waste electrical and electronic equipment and end-of-life vehicles and their components, with a capacity exceeding 50 tonnes per day'. In Flanders, the VLAREM regulation also uses the BAT concept as a reference point for environmental permit conditions, not only for activities within the scope of the IED, but also for other types of activities requiring an environmental permit.

Best available techniques are defined in the IED as: "the most effective and advanced stage in the development of activities and their methods of operation which indicates the practical suitability of particular techniques providing the basis for emission limit values and other permit conditions designed to prevent and, where that is not practicable, to reduce emissions and the impact on the environment as a whole:

(a) techniques includes both the technology used and the way in which the installation is designed, built, maintained, operated and decommissioned;
(b) available techniques means those developed on a scale which allows implementation in the relevant industrial sector, under economically and technically viable conditions, taking into consideration the costs and advantages, whether or not the techniques are used or produced inside the Member State in question, as long as they are reasonably accessible to the operator;
(c) best means most effective in achieving a high general level of protection of the environment as a whole".

The IED stipulates that permitting authorities shall set ELVs to that ensure that, under normal operating conditions, emissions do not exceed the BAT-AEL as determined in the BAT conclusions of the European BAT reference documents. European BAT reference documents are the result of an exchange of information organized by the Commission between Member States, the industries concerned, non-governmental organizations promoting environmental protection and the Commission. In Flanders, BAT documents are also produced for activities not covered by the IED or below the capacity threshold set in the IED.

In order to give the permitting authorities in Flanders guidance in setting sector-specific ELVs or imposing company specific ELVs for polluted rainwater runoff from scrap recovery and recycling activities, the emissions associated with the best available techniques (BAT-AEL) are determined.

2. Material and methods

2.1. Emission data and contextual information

The determination of BAT-AEL (see Section 2.3) requires a representative amount of emission data. Data on the composition of rainwater runoff from different recovery and recycling plants in Flanders were obtained from the following sources:

- The Flemish Environmental Agency (VMM): measurements in the period 2009–2013
- The Nature, Energy and Environment Department of the Flemish government, Environmental Inspection Division (LNE-AMI): measurements in the period 2008–2012
- COBEREC (the Belgian Recycling Federation), and individual companies: measurements in the period 2008–2014
- FEBEM (the Belgian Federation of Environmental Companies): measurements in the period 2008–2014
- University of Ghent and VLAKWA, data collected for the REWARE project (Blondeel et al., 2014b).

All samples were grab samples, and measurements were performed using officially approved standard methods (so-called WAC-methods, EMIS, 2015). Since some data were provided anonymously, and since data on the same plant may have been obtained from different sources, the exact number of plants for which data are available is not known, but is higher than 30 plants. The number of samples and the parameters analyzed differ from plant to plant and from source to source. An overview of the total data set is given in Section 3.

As well as emission data, the contextual information was also collected. Information that was available for all data:

- sampling point: Most samples were taken at the point of discharge. A small number of samples (especially those obtained from VMM in 2013) were taken before wastewater was treated
- date of sampling
- presence of a waste water treatment installation, and its configuration.

Information that was provided as far as possible, but not for all data:

- weather conditions (e.g. rainfall intensity, rainfall duration and duration of dry periods before rainfall periods)
- amount and quality of materials stored on the storage area
- storage conditions (e.g. covered storage for some materials)
- general condition of the storage area (e.g. cleanliness, frequency of sweeping).

2.2. Determination of BAT

Methodologies for identifying candidate BAT and selecting BAT at sectoral level have been described in the literature (Cunningham, 2000; Dijkmans, 2000; Geldermann and Rentz, 2004; Georgopoulou et al., 2008; Giner-Santonja et al., 2012; Schoenberger, 2009; Silvo et al., 2002). The four-step methodology