Crop protection products & biocides

on artificial turf fields

Exploratory study on the use of crop protection products and biocides for maintenance of artificial grass sports fields and exploration of the spread to ground and surface water

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Title	Crop protection products and biocides on artificial turf pitches
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Summary

Partly due to their outdoor location, artificial grass fields form a breeding ground for algae and moss.
Regular watering or temporary less playing makes the fields more sensitive. Algae in particular cause slipperiness on hockey fields, tennis courts and korfball fields. Slipperiness increases the chance of injuries. On football fields, there is less nuisance due to the presence of infill and more intensive playing.
The prevention and control of algae and mosses can be carried out mechanically by brushing or sweeping fields. In addition, (chemical) agents are also used. Chemical agents can end up in the groundwater and surface water through leaching and drainage. For the Sports and Cultural Technology Industry Association and STOWA, this is the reason to carry out an exploratory study to gain better insight into the leaching and runoff of chemical agents into the groundwater and surface water.

A literature study was conducted for this exploration. In addition, discussions were held with six municipalities, two sports companies and two hockey clubs spread across the Netherlands. The organisations approached cooperated willingly and provided information on how the fields are maintained and which substances are applied in which dosage and at what times. This information was used to conduct a theoretical analysis in which the possible leaching of harmful substances into groundwater and surface water was explored.

With sufficient preventive maintenance such as dragging, brushing and leaf blowing, problems with algae, moss and weeds are minimized. The edge strips of artificial grass fields can be maintained without chemicals, provided that they are brushed and cleaned frequently enough with suitable equipment. A number of municipalities have been working chemical-free for several years and use hot water, for example, to combat weeds on the edge strips. Some of the interviewees occasionally use Roundup (glyphosate), cleaning vinegar or salt.

Almost all interviewees use chemical agents on semi-water fields and water fields (hockey fields that are regularly sprayed) to prevent algae nuisance. The agents are mainly applied to the field with the sprinkler system or with a spray boom (a tractor with a liquid tank).
One municipality also treats the artificial grass football fields and a sand-filled hockey field with an agent against algae. Since, according to the interviewees, the 'perfect' agent has not yet been invented, sports field managers remain interested in new environmentally friendly and effective agents for tackling algae. One of the interviewed hockey clubs has stopped chemical control and is experimenting with an artificial grass robot, which is brushed frequently.

The active ingredients of the chemical agents used are salt, hydrogen peroxide, DDAC, DPGME and ADBAC. Exploratory calculations show that these substances probably leach in low concentrations due to instability, strong binding with the soil or rapid decomposition. The expected concentrations are usually lower than drinking water standards and/or other indicative values.
An exception is an enzyme-based agent with the active substance DGPME, which can cause a relatively high concentration in groundwater and surface water if the dosage is too high.

Of the products used, one biocide, called BioGuard based on the active substance ADBAC, is legally approved for use on semi-water and water artificial grass sports fields (hockey fields) to combat algae. The other substances are therefore not permitted. One municipality interviewed uses Algae-Des (works on the basis of the active substance DDAC) to combat algae on artificial grass fields. According to the instructions for use, this agent may not be used on artificial grass. According to the approval, the algae agent is intended for combating bacteria, fungi and algae in recirculating cooling water systems.
Hydrogen peroxide is also not legally permitted as a means of combating algae on artificial grass.
It does appear that a water board has given a municipality written permission for the use of hydrogen peroxide on hockey fields. Salt and Biomix ATM Vitaal (based on enzymes and the active substance DPGME) are also not permitted as a means to combat algae on artificial grass fields.

This report therefore identifies a number of aspects that require attention. Firstly, it is recommended to provide clarity to all associations and managers in the legislation and regulations for the use of agents on artificial grass fields to combat algae and moss. It is also recommended to conduct further research into the effectiveness and costs of permitted agents and (chemical-free) maintenance measures. The knowledge and experience obtained will have to be shared to enable field managers to make a switch. Finally, more insight into the effect of cleaning agents, for example those based on enzymes, is desirable.

By focusing on bundling knowledge and sharing knowledge and information about techniques for combating and preventing algae and moss, the desired situation can be worked towards. It is recommended to tackle this as the Sports and Culture Technology Industry Association with STOWA and to do this in collaboration with the Knowledge Network Biocides facilitated by the RIVM.

1 Introduction

1.1 Background and problem description

Artificial grass sports fields

In the Netherlands there are approximately 15,000 hectares of 'outdoor sports floor' of which approximately 7,000 hectares are football grass, 5,000 hectares are golf grass and 2,200 to 2,500 hectares are artificial grass for other sports. The remainder (approximately 500 hectares) consists mainly of tennis courts and fields for smaller sports in the Netherlands such as baseball, softball and jeu de boules (Bos, 2015).

In the Netherlands, the surface area of artificial turf fields has increased significantly in recent years.

Artificial turf fields are mainly used for outdoor sports such as hockey, korfball, tennis and football.

In the Netherlands there are now approximately 2,000 artificial grass football fields (Balemans, 2017) and 900 hockey fields (Mies, 2017). Based on the maximum dimensions of these fields, this concerns a total of approximately 1,800 hectares of football artificial grass and approximately 450 hectares of hockey artificial grass.

Artificial grass fields are constructed from a (very) permeable construction and are almost always equipped with a drainage system. The advantage of an artificial grass field is that the number of playing hours can be greatly increased. Artificial grass fields, just like natural grass fields, require maintenance in order to continue to meet the sports technical requirements and to ensure the safety of the players (preventing injuries).

Algae, mosses and weeds

Due to the combination of light, moisture and nutrition, artificial grass fields form a breeding ground for algae and moss. Especially on hockey fields and especially the semi-water fields and water fields, which are irrigated before playing, are sensitive to algae and moss growth. On these fields, an artificial environment is created with sufficient nutrients, moisture and light with the unintended effect of stimulating algae growth. Algae cause slipperiness on the field and this increases the risk of injuries for athletes. Other negative effects are the risk of reduced permeability (water stagnation), diseases/infections (bacteria and abrasions), stench and dirty clothing.

Weeds and mosses are mainly found in the last meter of the run-off strip of artificial grass fields because there is no playing surface and, on average, less intensive maintenance is carried out compared to the playing field.

Maintenance: mechanical and chemical control of algae, moss and weeds

Since the advent of artificial grass fields, various machines have been developed (and are still being developed) that can be used for maintenance. Chemical agents are also used to combat weeds, mosses and algae. These agents can end up in the groundwater and surface water via the permeable construction and drainage. Chemical agents require approval: an approved crop protection agent must be used against weeds and an approved biocide against algae. The use of non-approved chemical substances is not permitted.

Chemical-free techniques such as brushing, treatment with hot water, steam, or heat are permitted.

Towards environmentally friendly and sustainable maintenance of artificial grass

The sports sector strives for further sustainability of the maintenance of sports fields. The Sports and Cultural Technology Industry Association (BSNC) has therefore set out the sector's ambitions to minimise the use of crop protection products in the Green Deal Sports Fields

(Staatscourant, 2016). The Green Deal was signed by the ministries of Economic Affairs (EZ) and Infrastructure and the Environment (IenM), BSNC, NOC*NSF (Netherlands Olympic Committee/Netherlands Sports Federation), golf alliance, Cumela Nederland, Association of Gardeners and Landscapers (VHG) and Association of Sports and Municipalities (VSG). The Green Deal only concerns crop protection products.
Formally, biocides fall outside the scope of the Green Deal.

1.2 Purpose

The aim of this exploratory study is to gain initial insight into the use of resources and the emission of chemical substances into groundwater and surface water as a result of chemical control of weeds, algae and moss on artificial turf pitches, based on literature study, expert judgement and interviews.

1.3 Research questions

The research questions to be answered in this exploratory study are:

1. What chemicals are used on artificial turf fields to control weeds, moss and algae?
2. Which crop protection products and biocides are permitted on artificial turf pitches to control weeds, moss and algae?
3. What are the substance properties of crop protection products and biocides used on artificial grass fields? Can these substances leach out based on these substance properties?
4. To what extent are residues measured in groundwater and surface water and how does this relate to other substances?
5. If not found in groundwater and surface water, what can be said about leaching to groundwater and surface water based on substance properties and in relation to substances found in groundwater and surface water?

1.4 Method

The following method was used to answer the research questions:

- Literature study
- Interviews with ten administrators/municipalities
- Qualitative analysis of environmental impacts
  - Assessment of the leaching and run-off relevant substance properties of the active substances of
  - the agents used on artificial turf fields.
  - Making exploratory calculations for annual average leaching concentrations.
  - Comparing the active substances of the products used on artificial turf fields with the substances found in ground and surface water.

1.5 Delimitation

This research is an exploratory problem analysis based on a desk study. The research focuses on artificial grass sports fields and specifically on the maintenance measures aimed at combating weeds, mosses and algae. The assessment of the possible impact of infill materials (such as rubber, plastic, cork) on the groundwater and surface water and an assessment of the cost-effectiveness of the maintenance measures fall outside the scope of this research.

The qualitative analysis of the environmental effects focuses on calculating the leaching to groundwater and/or to drainage means and therefore not on toxicity effects for surface water or groundwater.

Calculated concentrations are tested against general standards.
Emissions of crop protection products and biocides to soil and waterbed and any human effects have not been considered in this study.
Carrying out monitoring by, for example, sampling and analysing ground and surface water also falls outside the scope of this exploratory study.

1.6 Reading guide

After the introduction (chapter 1), chapter 2 presents the results of the literature study, after which chapter 3 summarizes the results of the interviews. Chapter 4 describes the environmental effects of the maintenance measures. Finally, chapter 5 presents the conclusions with the answers to the research questions and the recommendations.

2 Literature study

2.1 Admissions

As of 31 March 2016, an amendment to the Crop Protection Products and Biocides Decree came into effect. As a result, professional users are prohibited from using crop protection products on a paved surface outside of agriculture and horticulture. However, a number of exceptions have been made to this regulation, including sports fields for organised outdoor sports, as far as the playable part of the terrain is concerned, including a limited zone around it that is necessary for practising the sport (source: Crop Protection Products and Biocides Decree). A survey by the Netherlands Food and Consumer Product Safety Authority shows that municipalities and contractors make use of this in practice (Netherlands Food and Consumer Product Safety Authority, 2017).

The Ctgb database contains several products for algae control.
The Bio-Guard product (approval number 14112N) based on the active substance ADBAC is the only biocide that may be used on artificial grass according to the instructions for use to combat algae in semi-water and water artificial grass sports fields during periods when they are not being used. When used on artificial grass fields, the product may only be applied manually or via a small field sprayer with a maximum spray boom height of 30 cm above the field or a shielded sprayer. It is not permitted to administer this product via the irrigation system (Ctgb, 2015).

Crop protection product or biocide?

A plant protection product is an active substance or preparation containing one or more active substances, intended or used for (Ctgb, 2017):

- protect plants or plant products against all harmful organisms or the to prevent its operation;
- to influence the life processes of plants, except where nutrients are involved;
- to store vegetable products;
- kill unwanted plants; or
- to destroy parts of plants or to slow down or prevent unwanted plant growth to come.

Biocides are all substances or mixtures that consist of one or more active substances or contain or generate those substances. They are intended to destroy, repel, render harmless or prevent the effects of harmful or unwanted organisms (Ctgb, 2017).
The active substance in a biocide can be a so-called natural oil or extract, a chemical substance or a micro-organism, a virus or a fungus (Ctgb, 2017).

However, if a product manufacturer does not state in the claim of a product that the product destroys, repels, renders harmless or prevents the effects of harmful or unwanted organisms, then the product does not legally fall under a biocide and no legal approval under this legislation is required. For example, it is then a cleaning or cleaning agent. Hydrogen peroxide is also a biocide and approved in Europe as an active substance. It also has other applications and is therefore under

more registered under REACH. The REACH regulation (Registration, Evaluation, Authorisation and Restriction of Chemicals) provides a comprehensive legal framework for the production and use of chemicals in Europe. Enzyme-based products, such as Biomix and KG Reiniger, are described as cleaning agents with the effect of removing dirt and deposits, for example.

Agents and products that are not approved as biocides may not be used for biocidal applications. The use of such agents and products is prohibited under the Wgb (Crop Protection Products and Biocides Act) and will be punished if found by the inspection services.
This also applies to the user who does not comply with the regulations associated with the permit.
Inspection services are the Netherlands Food and Water Authority, the SZW Inspectorate, the Environment and Transport Inspectorate, the Health Care Inspectorate and the State Supervision of Mines. The water boards are designated as supervisors for water-related violations in the Wgb. For conducting tests for research or development purposes, the Wgb offers the Ctgb the possibility of issuing a test exemption (Unie van Waterschappen, 2017).

One of the municipalities interviewed has written permission from the water board for the use of hydrogen peroxide to combat algae on hockey fields. Based on the safety data sheet, the water board has assessed that there is no risk of a (long-term) negative influence on the water quality, provided that the product is used in the described manner.

During the execution of this research, a document was published on 1 August 2017 that provides guidance for determining the boundary between cleaning agents and disinfectants (biocides) (ILT, 2017).
If a substance must be classified as a biocide, this substance may only be placed on the market in the Netherlands with an authorisation based on the Plant Protection Products and Biocides Act (Wgb) and the European Biocides Regulation1 , also known as the Biocides Products Regulation, abbreviated as BPR.

In addition to the requirements of the Environmental Management Act, cleaning agents must also meet the requirements of the Environmental Management Detergents Decree. There is no approval system for cleaning agents. Cleaning agents that are intended as biocides must meet the requirements of the Wgb. Based on the BPR, a product that is 'intended' to combat harmful organisms is a biocide.
The decision tree drawn up in the guideline can be used to determine whether a product (substance or mixture) in the form in which it is supplied is a biocide and will depend on the answer to the question whether it is 'intended' to combat harmful organisms (killing micro-organisms). The intended use as a biocide can be evident from an explicit claim, but also from other facts and circumstances. When agents are used on artificial grass fields with the aim of combating nuisance caused by algae, this is therefore a biocide.

The above means that products that are intended to combat algae are biocides. Substances that are intended to combat weeds or mosses are crop protection products. For all substances that are biocides or crop protection products, it applies that they may only be used if they have been approved by the Ctgb for the relevant use. If the product does not have approval for the relevant use, then there is a violation. In addition, the product must be used according to the instructions for use. If the user does not do this, then he is in violation (Unie van Waterschappen, 2017).

1 Regulation (EU) No 528/2012 of the European Parliament and of the Council of 22 May 2012 concerning the making available on the market and use of biocidal products.

2.2 Chemistry on artificial turf fields

2.2.1 (semi)scientific literature Netherlands

Smidt and Spijker (2010) found no scientific literature on crop protection on artificial grass or gravel in a literature study on the use of crop protection products and biocides on sports fields. No scientific data were found that related to the control of algae, mosses and weeds on artificial grass fields.

Combating algae

In 2013, De Goeij and Van 't Land conducted research for a graduation assignment on keeping hockey fields free of algae. They indicate that, in order to keep algae problems under control, many clubs use a chemical agent to kill algae. The agents are applied by many clubs via the irrigation system. The advantage of this is that the agent can be applied at night.
This is important for a number of agents, because it breaks down faster in sunlight. It is possible to choose to spray a number of agents mechanically on the fields. The advantage of this is that the agent can be applied more accurately and places that are sensitive to algae can receive extra attention.
(De Goeij and Van 't Land, 2013). There are various products on the market for combating algae. The active ingredients in the various products often appear to be the same, although the concentration differs. The active ingredients are often disinfectants. These products are effective because they affect multiple processes of the algae at the same time. The disadvantage of this, however, is that the side effects that the products can have on the environment are more difficult to determine.
It is not clear from the students' report which other means are used to make the comparison.
In order to burden the environment as little as possible, it is important that the agents used are fast-acting. In addition, these agents must be broken down quickly so that no accumulation of pesticides can occur in the environment. In addition to the active substances, adjuvants have been added to the various agents. These adjuvants can be added so that the agent takes effect faster or to further optimize the effect of the agent. In addition, there are various adjuvants that ensure that an agent is broken down less quickly so that it can do its work for longer (De Goeij and van 't Land, 2013).
It is not clear from the students' report whether these are wishes from an environmental hygiene point of view or whether they concern resources that are used in practice.
The students compared different means to kill algae and found large differences in the amounts of the active substances. This is because there are different means that are for professional use and other means for the private market (De Goeij and Van 't Land, 2013) or because sometimes it concerns concentrates that first have to be diluted.

The students mention covering and using UV light as alternative options to combat algae.
By covering the field, light and water cannot reach the algae, causing them to dry out and die sooner. However, covering the fields is difficult to achieve because the surfaces are large. In addition, the period that the fields are covered will be too short due to the high degree of play, which means that the effects will be minor (De Goeij and Van 't Land, 2013).
The other method mentioned for combating algae is the use of UV-C radiation.
UV-C radiation has a disinfecting effect. However, there are disadvantages to combating algae with UV-C radiation. Due to the shadow effect of the fibres in the mat, it is not possible to illuminate the algae all the way down to the bottom of the mat. Another disadvantage is that UV-C radiation has a weathering effect on plastics. The plastics will discolour and age more quickly. The speed at which ageing occurs on artificial grass sports fields due to UV-C radiation has not been sufficiently tested (De Goeij and Van 't Land, 2013). Recently, UV light has been used on natural grass sports fields to combat fungi (Kuenen,

2017). It is not known whether this method is also effective for combating algae.
Wit and Verduin (2013) indicate that managers can make algae on artificial grass as difficult as possible by varying the control factors per type/kind of algae. Control factors are the salt content, adjusting the water source, acidity, covering, steaming and drying out.

Weed and moss control

There are various types of chemical agents (crop protection agents) on the market for the control of weeds and moss. In contrast to the control of algae, where the active substance is the same in almost all agents (biocides), there is a large difference in the type of active substance for the control of weeds and moss.
The most common agents used to control weeds and moss are (De Goeij and Van 't Land, 2013):
• Inorganic compounds (iron
sulphate) • Quaternary ammonium compounds
• Glyphosate

Alternative weed and moss control can be carried out by hot water or steam. With these forms of control, the above-ground parts of the plants are heated strongly. With these methods, the roots of the plants do not die off. This allows them to start growing again after a while.
For weed control on paved surfaces, covering or using vinegar are also mentioned. However, these methods do have disadvantages. The plastic makes covered paved surfaces difficult to walk on and vinegar causes stench nuisance (De Goeij and Van 't Land, 2013).

In a study into the environmental impact of crop protection products on sports fields in the municipality of Utrecht (original source reference: Smidt et al. 2007), the municipality of Utrecht indicated that it only uses herbicides along the edges of artificial turf fields to prevent weeds from growing in (Smidt and Spijker, 2010).

2.2.2 International scientific literature

Sharma et al. (2016) indicate that a good maintenance plan for artificial grass fields should be drawn up and that weeds, mosses and algae should be chemically or mechanically tackled monthly. The article does not mention any agents or concentrations. Cheng et al. (2014) describe that no chemical agents are required for the maintenance of artificial grass fields (unlike natural grass fields) and that there is no soil or groundwater contamination.
McLeod (2008) indicates that there is no validated data in the literature on the maintenance of artificial grass on which maintenance measures can be based. McLeod indicates that hockey fields suffer from algae and that this can be prevented by using algaecides. The product Bayer Dimanin Spezial (active ingredient: didecyl-dimethyl-ammonium-chloride) is mentioned here, whereby the product is added to the irrigation system. This biocide does not appear in the Ctgb's approval database and this product is therefore not or has not been approved in the Netherlands. However, the biocides Dimanin and Dimanin-algendoder can be found in the Ctgb database.
However, these biocides are not permitted on artificial turf fields.

In sand-strewn fields, McLeod mentions moss as the biggest problem, mentioning moss killers as a solution and the author mentions the agent Scott's Enforcer (active ingredients: dichlorophen and sodium hydroxide) and indicates that dichlorophen breaks down by phototransformation within eight days after application if it does not rain (original source Zertal et al., 2004). This biocide does not appear in the Ctgb authorisation database and this agent is therefore not or has not been authorised in the Netherlands.
The crop protection agent Scotts Moss Control with lawn fertilizer can be found in the Ctgb database. However, this agent is not permitted on artificial grass fields.

McLeod cites sources that indicate that moss and algae growth is caused by pollution and reduces permeability. By removing the pollution by mechanical brushing, permeability is increased and moisture content is reduced, so that the growth conditions for moss and algae are worsened.
This reduces the need to use chemicals.
McLeod (2008) shows that in the UK there is a relationship between drainage problems (presumably due to contamination of the infill sand) and the growth of moss and the use of moss and algae control agents on artificial grass pitches with sand filling. No relationship was found between the age of the pitch and algae growth. Control is not part of the maintenance regime, but often a reactive measure when algae or moss problems arise. The chance of algae growth with increasing contamination is probable, but not significant.

2.2.3 Trade journals and news items

In professional literature, most attention is paid to algae control on hockey fields. In this paragraph, attention is paid briefly to the control of moss and weeds. The irrigation of artificial grass is also discussed.

Combating algae

The hockey association (KNHB) regularly sees the problem with algae returning, especially on semi-water fields. It has often been shown that algae nuisance is very difficult to explain. Under apparently the same circumstances, algae occur one time and the field remains clean the second time. This can be related to all kinds of things such as wind, vegetation around the field and the composition of the irrigation water. In general, the cleaner the water, the less likely it is that algae will be a problem (Iersel, 2016).
The quality of irrigation water will be discussed in more detail later in this section.
Bongers and Van der Wiele (2016) indicate that when applying irrigation it is important to add agents to the irrigation water that inhibit algae formation. The application and effectiveness of the added agents partly depends on the location of the field; after all, there are different types of algae on the coast than, for example, in South Limburg. These algae react differently to the control. Mild winters in particular lead to more problems with algae (and mosses). Silica Nova advises spraying with the biological anti-algae agent Biomix Vitaal (Raats, 2016) in addition to brushing. This biocide does not appear in the Ctgb's approval database and this agent is therefore not or has not been approved in the Netherlands.

AlgenControl uses the agent Bio-Guard. This agent is added to the irrigation water, kills algae and stagnates their growth. Various hockey clubs have now gained experience with this procedure, in which a light dosage is sprayed once a week (Anonymous, 2016a). The Ctgb has approved the use of the agent Bio-Guard (formerly Centi-AlgenBac) for the application 'cleaning (hockey) artificial grass fields' (Anonymous, 2016a). Bio-Guard is therefore an approved biocide (approval number 14112) for algae control.

If the hockey field is dirty, it can be pre-treated with Bio-Guard and then cleaned.
On water fields, a single pre-treatment is recommended and on semi-water fields, three pre-treatments with a few weeks in between.
Prevention of algae growth can be achieved by weekly dosing, with direct injection onto the mat being most effective (Anonymous, 2016a).
In 2015, local news reports indicated that the agent Cent-AlgenBac might not be allowed to be used in a water catchment area based on requirements of the Vechtstromen water board (Nikkels, 2015 & Anoniem, 2015). Further information about this is lacking. The agent Bio-guard was previously approved under the name: Cent-AlgenBac.
Hockey club Deventer uses the product from the company Algen Control (Bio-Guard), spraying it once a week with a tractor with a spray boom (Oldenkotte, 2016).

De Boer (2010) indicates that dozens of hockey clubs in the Netherlands use hydrogen peroxide to combat algae in hockey fields, including hockey fields in the municipality of Soest that are sprayed with it. A substance is added to the irrigation water and the field is sprayed with it several times a week (2-3 times) at night. This is mainly a preventive measure. The dosage mentioned is 150-200 cc per m3 of irrigation water.

Both Aquaco and Van Oosten Beregeningsystemen are enthusiastic about the use of enzymes to combat algae. Aquaco's product is called Aquasan and has been tested at various hockey clubs over the past year. This biocide does not appear in the Ctgb's approval database and this agent is therefore not or has not been approved in the Netherlands.
Van Oosten has now had more than two years of experience with enzymes (KG Reiniger) with positive results (Oldenkotte, 2016). In short, KG Reiniger is a 100% organic product based on enzymes. The product can be applied automatically at night with a dosing pump (Anonymous, 2016b). This biocide does not appear in the Ctgb's approval database and this product is therefore not or has not been approved in the Netherlands.

Oldenkotte (2011) indicates that Ubink Sportvelden and Huisman Sportveldinnovatie use agents that burn the algae. The agent of Huisman Sportveld-innovatie (Clean Court) is added to the irrigation water.

Partly due to the ban on professional use of chemical pesticides outside of agriculture, many alternatives have come onto the market, including salt. Salt burns (moss and) algae away immediately but retains water. The salt actually does the same thing as the algae, namely stagnates the drainage of water. This creates an optimal living environment for the algae. In practice, this means that more and more salt is needed, resulting in additional labor and costs (Anonymous, 2016c).
Algae develop on tennis courts due to the petrification of infill sand in an artificial grass tennis court or worn gravel in the top of a gravel tennis court. Each type of court therefore requires its own method of treatment. A good maintenance plan is the basis for preventing algae (Anonymous, 2016c).
Anonymous (2016) states in an article that (moss and) algae can be removed mechanically (with the flat rotating Rototine from SMG) without chemicals. The use of road salt is strongly discouraged, because this leaves residues that form a breeding ground for new algae (and mosses) and also retains moisture better. There are various maintenance machines that can be used on different types of fields and courts. Weekly brushing is mentioned as an important measure.

In 2016, the court decided that a row of trees between the hockey fields of the Mixed Hockey Club in Roden could be cut down, because this made the fields unplayable due to algae growth (Anonymous, 2016d).

In Middelburg algae on sand and artificial grass pitches are mechanically controlled by using a weeder. According to the manager no chemicals are used (Boer, 2011).

Irrigation and quality of irrigation water

In practice, artificial grass sports fields are irrigated for the following purposes:
- Improving the playing technical properties (this applies to the water fields and the semi-water fields) used in hockey)
- Lowering the temperature of the field (and the temperature above the field) during hot periods (more comfort for players)
- Preventing spraying/counteracting dust in dry/warm periods (more comfort for players) and public).

For irrigation a water source is needed. For this purpose use can be made of:
• surface water;
• groundwater;
• rainwater;
• tap (drinking) water.

When it comes to irrigation, the fewer nutrients and organic contaminants there are in the water, the fewer of these are added to the field during irrigation.
In addition, irrigation water, for example, which is extracted from surface water or groundwater, may contain nutrients and micro-organisms (including algae).
Tap water is clean and expensive, but it does reduce the chances of algae growth. The acidity of the water is also important. If it is low, for example in water from a spring, hydrogen peroxide is not effective. This means that the pH must first be adjusted or another product must be used.
Surface water can contain algae, organic matter and nutrients and must first be treated before use in the field. Techniques mentioned are adding chemicals and treatment with UV light (Boer, 2010).

For water fields and semi-water fields it is important that good water is used for irrigation.
There is a chance that the surface water contains algae or is contaminated with the legionella bacteria.
The water can also contain dissolved fertilizers or, for example, an increased concentration of iron. Since 2015, a so-called ecological water system has been in place at the Goes hockey club. With this system, algae growth is limited by the favorable quality of the irrigation water (Oldenkotte, 2017).

Weed and moss control In
Tilburg, the corners and edges of the fields often suffer from moss or weeds, which are controlled with a chemical agent (Raats, 2010).
Ecostyle introduced the product Ultima in 2014. Ultima has a fast effect and works on the basis of the fatty acid Pelargonic acid and the sprout inhibitor Maleic Hydrazide. Ultima can be used for the hard surfaces around sports fields. These are hard-to-reach places, where you cannot reach with machines, but which you can reach with a backpack sprayer (Witt, de 2014). Ultima is an approved crop protection product and included in the database of the Ctgb (approval number 13469).

2.2.4 Information from the sports associations

KNHB (hockey)
A PDF document (general maintenance guide) can be downloaded from the hockey association website. This document discusses algae in the following way.

Sand-strewn fields and semi-water fields
Playing on the field compacts the infill material. Brushing the mat prevents weeds and algae from growing in the mat. From the moment the field is laid, it is important that the field is brushed weekly with a tractor with a triangular brush.
For algae control it is indicated that by placing a frequency-controlled dosing pump a product can be added to the irrigation water. The product contains hydrogen peroxide, among other things. This agent kills bacteria and fungi and oxidizes the metal particles present in the mat.
In the presence of these bacteria in the mat, the dead material will initially end up on top of the mat. This will have to be removed. By then continuing to irrigate preventively with the addition of the product, bacteria will not have a chance to attach themselves to the fibres (source: KNHB).

AlgenControl does this with the pesticide CentiBac-09. This agent is now called Bio-guard and was previously approved under the name: Cent-AlgenBac (Bio-Guard). They indicate that the maintenance and cleaning of the (semi)water fields requires specific knowledge and a good disinfectant and special dosing equipment. The artificial grass mat is vulnerable and the growth of algae is much stronger than with a synthetic grass mat sprinkled with sand. This company advises to use the agent CentiBac-09 (Bio-Guard) once a week in a very low dosage of 0.1% during the period from March to November as a disinfectant to keep the fields free of algae and bacteria. This is done via the existing irrigation system (source: KNHB).

To remove organic and other contamination that accumulates on the field during the year, it is recommended to carry out annual maintenance with a vacuum cleaner (source: KNHB).

KNVB (football)

The KNVB has made a maintenance document available online. This document states that by brushing or dragging the artificial grass mat, the growth of algae, moss and weeds in the run-off areas can be prevented.

Despite good maintenance, weeds and/or algae and moss can still form, especially on the less intensively used run-off areas or in wet and shady places. The use of chemical pesticides varies. The regulations differ per region; there are very strict rules, especially in a water extraction area. A further explanation of the regulations mentioned is missing in the KNVB document. Nowadays, there are also biodegradable agents. A frequently used agent against algae and moss is road salt. However, this may not be used in excess because of the leaching of salt into the subsoil and the drainage and surface water. Weeds, algae and moss formation must be controlled three to four times a year (only the edges of the field), but this can be limited by brushing in the right way (KNVB, 2016d).

KNLTB (tennis association)

Sand artificial grass courts and Red sand artificial grass courts

During the annual/specialist maintenance, activities will be carried out that the association itself often cannot do, or where the investment is such that it is more interesting to have this carried out by a professional party. Often, warranty conditions are also linked to this. These activities include algae and moss control (KNLTB, 2015a). Algae and moss formation often starts along the fencing and the intermediate runs. These places require extra attention when mechanically working the courts (KNLTB, 2015a). No information about resources is shown.

Gravel courts

A method has been developed for gravel courts (Losser method) whereby every spring the contaminated upper 2 to 3 millimetres of gravel are completely removed and replaced by new standard approved 0-2 gravel and in the summer the courts are treated in such a way that they remain flat and algae and moss have no chance to develop. Consistently carrying out these actions leads to no or minimal use of chemical pesticides (KNLTB, 2014).

The basic principle of gravel maintenance is to ensure that the pollution of organic material, moss and algae is removed throughout the year and that the worn parts are replenished. It is important to prevent moss and algae growth by keeping the gravel moving by playing and dragging. The trick is to limit the pollution in such a way that slipperiness is prevented (risk of injury) (KNLTB, 2015b).

KNKV (korfball)

The KNKV does not provide information on maintenance of artificial grass fields. The manual Quality Requirements Korfball Accommodations indicates the negative influence of trees and plant strips on the playability of the fields. Due to the strong shadow effect, the field dries less well and poor playing conditions can arise due to moss and algae formation (KNKV, 2016).

2.3 Conclusion of the literature study

Limited information is available in scientific literature on the maintenance of artificial grass fields. Based on information from trade journals and sports associations, it appears that algae, weeds and moss can be largely prevented with sufficiently frequent maintenance such as brushing, dragging and sweeping. Environmental factors are highly decisive for maintenance. Problems can arise sooner due to shadowing, organic pollution (leaf remains and the like) and the use of nutrient-rich irrigation water (such as surface water).

On artificial grass fields that are irrigated, algae cause the most problems. To combat algae preventively or curatively, various agents are used on the field. Described agents are hydrogen peroxide, Bio-Guard (formerly Cent-AlgenBac), CleanCourt, agents based on enzymes (KG Reiniger, Biomix Vitaal, Aquasan) and salt. Depending on the type of agent, it is dosed via the irrigation system or with a tractor with a spray boom. Bio-Guard is the only agent that is officially approved for use on hockey fields, but according to the legal instructions for use, the agent may only be applied manually or via a small field sprayer with a maximum spray boom height of 30 cm above the field or a shielded sprayer.

There is little attention in the trade journals for the management of weeds and moss at the edges. Information about the means used at the edges of the artificial grass fields is limited.

3 Interviews

3.1 Preparation

In addition to the literature study, ten interviews were conducted. A call was placed on the websites of the Sports and Cultural Technology Association and the Field Manager trade journal in January 2017, asking administrators, municipalities and associations to participate in the interviews (see appendix 1).
Based on this call, two organizations have indicated that they wish to participate.
The other eight interviewed organisations were established through Sweco's contacts, whereby an attempt was made to involve sports companies, associations and municipalities from various parts of the Netherlands in order to obtain a somewhat representative picture.

3.2 Results

Table 3.1 shows the interviewed organisations with an indication of the number of artificial grass fields they manage/maintain.

Table 3.1 Overview of interviewed organizations and indicative number of artificial turf pitches

	INTERVIEWEE	FOOTBALL ZANDINGE-STRAW		SEMI-WA-TERVELD	WATER FIELD	OTHER	TOTAL
1	Municipality 1	14	8	0	5.5	1	28.5
2	Municipality 2	43	38	4	9	12	106
3	Municipality 3	16	2	2	0	0	20
4	Municipality 4	7	3	5	2	0	17
5	Municipality 5	2	1	1	0	0	4
6	Municipality 6	15	11	0	2.5	3	31.5
7	J&E Sports*						900
8	Sports company*						500
9	Schaerweijde Zeist (hockey club)	0	2	2	1	0	5
10	HC Helmond (hockey club)	0	2.5	0	2	0	4.5

***This is a sports company that mainly carries out specialist maintenance for municipalities and associations.**

The results of the interviews have been recorded and included in Appendix 1 for each interviewed organization. The relevant information regarding the use of agents to combat algae, moss and weeds is summarised in tables 3.2 and 3.3. A distinction is made between agents that are applied over the entire field (table 3.2) and agents that are only used on the edge strips of the fields (table 3.3). The latter concerns the transitions from the artificial grass to the adjacent paving.
The results in table 3.2 show that the interviewees use agents on the semi-water fields and full-field water fields to combat algae preventively and curatively. The agents used vary. In one municipality, in addition to the semi-water field (hockey), an agent is also used on the rubber-ring-strewn fields (football) and the full-field sand-strewn field.

Table 3.2 Overview of resources used that are applied in the full field

	INTERVIEWEE	RESOURCES	TYPE FIELDS
1	Municipality 1	Hydrogen peroxide	Water fields (hockey)
2	Municipality 2	KG Cleaner, Bio-Guard (Centi-AlgenBac)	Semi-water fields, water fields
3	Municipality 3	Hydrogen peroxide	Semi-water fields
4	Municipality 4	Bio-Guard (Centi-AlgenBac)	Semi-water fields, water fields
5	Municipality 5	LCI Algae-Des	Rubber infilled fields (football), sand infill field and semi-water field
6	Municipality 6	Hydrogen peroxide	Water fields
7	J&E Sports	EcoNzym Artificial Grass Cleaner (BIO 5a)	
8	Sports company	Biomix ATM Vital	
9	Schaerweijde Zeist (hockey club)	no	n/a
10	HC Helmond (hockey club)	Salty	Water fields (in case of moss formation also on sand-strewn fields)

1. J&E Sports only supplies this product.

1. This company started maintaining a semi-water field in 2018.

Table 3.3 shows that hardly any resources are used at the edges of the fields.
Weeds and moss are often controlled mechanically. On some sports fields, Roundup (glyphosate) or salt is occasionally used.

Table 3.3 Resources used at the edges of artificial turf pitches

	INTERVIEWEE	MEDIUM EDGES
1	Municipality 1	None (mechanical)
2	Municipality 2	None (mechanical/hot water)
3	Municipality 3	Salty
4	Municipality 4	Roundup (glyphosate), mechanical
5	Municipality 5	No
6	Municipality 6	None (mechanical)
7	J&E Sports	None (mechanical)
8	Sports company	No / occasional Roundup (glyphosate)
9	Schaerweijde Zeist (hockey club)	No information
10	HC Helmond (hockey club)	Cleaning vinegar

3.3 Conclusion interviews

The interviews show a diverse picture. On almost all semi-water and water pitches, agents are used to combat algae, using different types and quantities. Except for Bio-guard, the agents used are not approved for use in combating algae on artificial grass. According to the instructions for use, the agent LCI Algae-Des may not be used on artificial grass. According to the approval, this algae agent is intended for combating bacteria, fungi and algae in recirculating cooling water systems.

Municipalities and sports companies are interested in using environmentally friendly resources. One hockey club has stopped using resources and is going to experiment with an artificial grass robot for maintenance. Managers often indicate that it is important that fields are dragged/swept/brushed sufficiently so that weeds, moss and algae have less chance to develop. Regular and sufficient cleaning of artificial grass fields is also an important measure.

On average, the edges of the fields can be mechanically maintained well if this is carried out frequently enough and suitable equipment and sufficient capacity are available.
Salt, cleaning vinegar or Roundup (glyphosate) are occasionally used.

4 Environmental impacts

This chapter discusses the possible average leaching concentrations of the agents used on artificial grass. Of these, the agents that are applied in practice on a full-field basis based on the interviews are considered.

4.1 Overview of resources, dosages and concentrations

Table 4.1 shows the quantities and concentrations of the agents used, to the extent known, that are applied in the full field, per interviewed organisation.

Table 4.1 Overview of quantities and concentrations of agents applied on a full-field basis

	INTERVIEWEE	RESOURSE	QUANTITY	CONCENTRATION	NUMBER FIELDS
1	Municipality 1	Hydrogen peroxide	40 x 6 liter product per field per year	approximately 6 litres of product per 12 m3 of water	3.5
2	Municipality 2	KG Cleaner	20 x 7 liters of product per field per year (average 1 x every 2 weeks)	approximately 6 to 7 liters of product to 7 to 10 m3 of water	13
		KG Cleaner	3x 40 liters of product per field per year	40 liters of product to 400 liters of water	13
		Bio-Guard (Centi-AlgenBac)	1x 20 liters of product per field per year	20 liters of product to 400 liters of water	13
3	Municipality 3	Hydrogen peroxide	20 liters of product per field per year	35% (according to packaging)	2
4	Municipality 4	Bio-Guard (Centi-AlgenBac)	1 x per week per field	according to packaging	7
5	Municipality 5	LCI. Algae-Des	2x 10 liters of product per field per year	1 liter of product to 50 liters of water	2
6	Municipality 6	Hydrogen peroxide	1 to 2 times per week 1 liter of product per field per year	0.15 liters of product per m3 of water (35 - < 50%)	2.5
7	J&E Sports 1)	EcoNzym Artificial Grass Cleaner (BIO 5a)	1x every 2 weeks 5 liters of product per field per year	No information	-
8	Sports company 2)	Biomix ATM Vital	3 to 4 times per field per year (quantity unknown)	No information	1
9	Schaerweijde Zeist	-	-	-	5
10	HC Helmond	Salty	300 kg of salt per field once every two years	-	2

J&E Sports supplies the product, associations/municipalities perform the maintenance themselves. The amount shown is an advisory donation.

1. This company started the maintenance of a semi-water field in 2018.

4.2 Overview of active substances

Table 4.2 shows the products used on artificial grass and their active substance(s).

Table 4.2 Active substances in the products used on artificial turf pitches

RESOURSE	ACTIVE SUBSTANCE	ACTIVE SUBSTANCE 2
Hydrogen peroxide 35%	Hydrogen peroxide	-
Bio-Guard (Centi-Algenbac)	Alkyl (C12-16) dimethylbenzylammonium chloride (ADBAC)	-
LCI Algae-Des	Didecyldimethylammonium chloride (DDAC)	-
Biomix ATM Vital	(2-methoxymethylethoxy)propanol (DPGME)	Enzymes
KG cleaner	Enzymes [1)]	1)

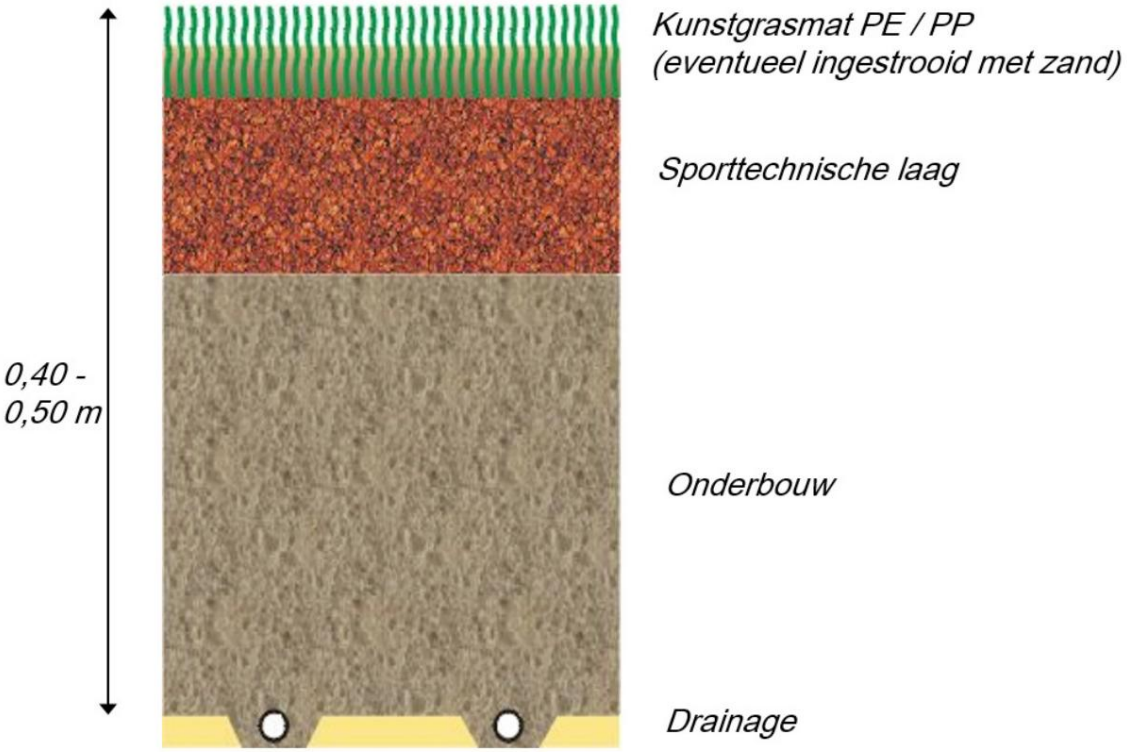
1) No information about the active ingredients has been obtained from the supplier of this product. The starting point based on the packaging is that only enzymes are present as active substance.

4.3 Principles regarding leaching sensitivity of artificial grass field

Hydrology

The structure of an artificial turf field is shown schematically in figure 4.1.

Fig. 4.1. Schematic representation of the construction of an artificial grass field.



The artificial grass mat lies on a substructure of 40 to 50 cm of clean sand, on which a sports technical layer is applied (lava) that provides stability. As a result, the construction of an artificial grass field is sufficiently permeable to prevent puddle formation at ground level and loss of bearing capacity (even after freezing).
In practice, complete drainage of the structure is recommended, whereby the groundwater level must be lower than 0.50 m -mv. If groundwater levels are expected to be above the sub-layer, drainage is installed under the structure. Also in connection with the risk of freezing, the drains are installed just under the structure.

The construction can be applied to (Lenders and Kool, 2010):
1. A well-drained subsoil with relatively high groundwater levels, drained.
2. A poorly drained soil with relatively high groundwater levels, drained.
3. A well-drained subsoil with deep groundwater levels, undrained.

It appears that precipitation on a soil of type 3 infiltrates completely and that only leaching via groundwater is relevant. For types 1 and 2, faster drainage to surrounding surface water will also occur in wet periods.
Lenders and Kool (2010) describe the discharge via drainage during heavy showers: half to 2/3 of the precipitation is discharged via surface water during heavy showers. Under normal circumstances, this will be less, certainly in the summer season, when groundwater levels will be below drainage level almost everywhere due to the precipitation deficit then present.

By means of a first approximation it can be calculated in what way precipitation is discharged via drainage. In the soil moisture of the construction approximately 5 cm of water is 'stored' as hanging water.
That water will dilute a normal shower of a few centimetres and reach the bottom of the structure in diluted form over a longer period. On average, 70 mm of precipitation falls in the Netherlands per month. It therefore takes almost six weeks to flush the structure, without taking into account evaporation, without taking into account irrigation of water fields and without taking into account decomposition and 'retardation' of substances in the subsoil.

4.4 Enzymes and salt

For the four chemical components in Table 4.2, the relevant substance properties for average distribution in the environment have been considered, namely leaching sensitivity and degradability.
Enzymes are not considered further. Enzymes are natural proteins that serve as catalysts in chemical reactions. Adding enzymes promotes the natural breakdown of dead algae, which reduces slipperiness. It is not clear whether the enzymes also have an effect on living algae and therefore whether they should be classified as a biocide. The amount of active substance is also not stated and the substance properties are not known.

Salt is also not considered further, although it could theoretically have an effect on surface water if it is not flushed.

When applying 300 kg of salt and dilution with 5 centimetres of water (the water present in the soil profile) on a hockey field of 0.5 hectares, the salt is diluted with 250 m3 of water. A concentration of 1200 mg/l NaCl is then calculated, a chloride concentration of 700 mg/l. This is the same order of magnitude concentration as that found in surface water in the West of the Netherlands and Flevoland, and which can still be characterised as fresh, but where sensitive species could suffer damage. However, based on expert judgement, it is expected that this situation will not or hardly occur in practice due to dilution with surface water and the slow nature of the

salt is released via drainage during the following weeks: If it is quickly released into surface water due to a heavy shower, the salt load will also be diluted more, expected to be well below the MTR of 200 mg/l and below the drinking water standard of 150 mg/l.

With regard to leaching into groundwater, no effect at all is to be expected. When applied once every two years, the concentration in groundwater is increased by 50 mg/l, which is comparable to, for example, the increase caused by fertilization in agricultural areas.

4.5 Hydrogen peroxide (EU, 2003)

Hydrogen peroxide (H2 O2) is a strong oxidizer and therefore a very reactive substance. Hydrogen peroxide is, like water, a strongly polar compound. It therefore has a strong affinity for the aqueous phase and therefore a very low log Kow (partition coefficient between octanol and water) of -1.5. A Koc (adsorption coefficient of compound to organic matter fraction of soil) value of 0.2 l/kg is generally assumed. This means that hydrogen peroxide hardly binds to organic particles and is therefore very mobile in soils.
Hydrogen peroxide can be quickly broken down abiotically due to its reactive nature, as the molecule spontaneously decomposes and when it reacts with other substances. In water of 15-20 degrees, the half-life is in the order of hours, which means that there will be nothing left in the groundwater. As a result, hydrogen peroxide is often only present in the environment for a short time. However, the abiotic half-lives in water or soils show a lot of variation depending on the circumstances, which means that no 'standard' values for degradation are available. Biodegradation tests are often not applicable for inorganic substances such as hydrogen peroxide. It is known that enzymes produced by aerobic bacteria can quickly convert hydrogen peroxide into water and oxygen. Known half-lives vary between 2 minutes and 5 days. Hydrogen peroxide can therefore be quickly broken down both abiotically and biotically.

Hydrogen peroxide will hardly rinse out. It should be noted that the strong oxidative properties could cause breakdown products / compounds to form that would not normally form.

4.6 Alkyl(C12-16)dimethylbenzylammonium chloride (Ctgb, 2016)

Alkyl(C12-16)dimethylbenzyl ammonium chloride (C9 H13NClR with R = C12H25, C14H29 or C16H33) or ADBAC is a quaternary ammonium salt. The nitrogen atom is bonded to an alkyl group, consisting of 12, 14, or 16 carbon atoms, two methyl groups and a benzene group. ADBAC is a cationic surfactant that is characterized by an almost irreversible bond with organic matter. The known values for the partition coefficient (Koc) are between 1.6E6 and 2.6E6 l/kg, which means that ADBAC binds (even) better to soils than DDAC (see par. 4.7). For ADBAC, the high sorption characteristics are expected to result in very low concentrations in groundwater, lower than the general water quality standard that is applied for crop protection products, biocides and their human toxicologically relevant degradation products per individual substance (BKMW, 2009). The leaching of this substance is assessed as low. The half-life for ADBAC in water is 15 days and in soils 76 days. ADBAC therefore breaks down more easily in soils than the quaternary ammonium salt DDAC.

4.7 Didecyldimethylammonium chloride (Ctgb, 2016)

Didecyldimethylammonium chloride (C22H48NCl) or DDAC is also a quaternary ammonium salt in which the nitrogen atom is bonded to two methyl groups and two decyl groups. It is a cationic surfactant that lowers the surface tension of water, like soap. DDAC is characterized by

an almost irreversible interaction with organic particles, resulting in a very high partition coefficient Koc of 1.1E6 l/kg. Leaching into groundwater can therefore be virtually ruled out, which means that concentrations in groundwater will generally be well below the reference value (0.1 µg/l; BKMW, 2009). The leaching of this substance is therefore assessed as low.
DDAC is biotically degradable, but as far as is known, no degradation data in water are available.
In risk studies, a half-life of 15 days is used. DDAC degrades more slowly in soils, with a half-life of 212 days. Due to this relatively long half-life, DDAC is relatively persistent in soils.

4.8 (2-methoxymethylethoxy)propanol (OECD SIDS, 2003)

Dipropylene glycol methyl ether, (2-methoxymethylethoxy)propanol or DPGME (C7 H16O3) is an organic compound. This hydrophilic glycol ether is often used as an industrial solvent. Known partition coefficients are -0.06 (log Kow) and 10 (Koc). This means that leaching of DPGME towards the groundwater can occur, they are hydrophilic substances. The RIVM refers to an indicative MTR concentration (maximum permissible risk level) in groundwater of 190 µg/l, although this has not been established by policy. This does apply to an indicative MTR concentration of 190 µg/l in surface water (RIVM, 2018).
Propylene glycol ethers are generally not present in the environment for long. In water, DPGME is biotically degradable under aerobic conditions. A test showed that more than 60% of DPGME was degraded within 28 days. Other forms of propylene glycol ethers also degrade rapidly in soil.

4.9 Overview of concentrations

The active substances described in the previous paragraphs are applied to artificial grass fields (hockey) in one year with a certain load (g/m2). Agents are applied via the irrigation system or with a spray boom. The mass applied per m2 is initially diluted by adding water before use. Then the precipitation surplus is added in one year. By dividing the mass per m2 by the volume of water per m2 , is there an indicative average concentration is calculated, if the total load is dissolved in one year. These concentrations are shown in table 4.3. Two scenarios have been taken into account for ADBAC.

Table 4.3 Indicative leaching concentrations of active substances*

ACTIVE SUBSTANCE	CONCENTRATION ACTIVE SUBSTANCE (G/L)	TAX (G/M2/YEAR)	EXTRA WATERFLUX (L/M2/YEAR)	PRECIPITATION SURPLUS (L/M2/YEAR)	CONCENTRATION (MG/L)
Hydrogen peroxide	350	17	95	300	42.3
DDAC	450	1.8	0.2	300	6.0
DPGME	50	1.0	0.1	300	3,3
ADBAC	1 to 500	0.003 to 2.0	0.1 to 2.5	300	0.01 to 6.6

***The starting points for the calculations are included in Appendix 3.**

The concentrations shown in Table 4.3 will not be the concentrations of an active substance that reach the groundwater. For DDAC and ADBAC, the high partition coefficients ensure strong sorption to soil particles and therefore minimal leaching of this substance towards the groundwater. Hydrogen peroxide and DPGME can leach into the groundwater, but break down quickly, which means that concentrations in the groundwater remain limited. For hydrogen peroxide and DPGME, the concentrations in Table 4.3 should therefore mainly be seen as worst-case concentrations (maximum). These vary between more than

40 mg/l for hydrogen peroxide to approximately 3 mg/l for DPGME. The maximum concentrations of quaternary ammonium salts are 6.0 and 6.6 mg/l for DDAC and ADBAC respectively. The quantities that may reach the groundwater will be well below this due to sorption.

On artificial grass fields (hockey) a number of products are applied full-field that contain different active substances. The substance properties of the active substances of products that emerged from the surveys have been inventoried and the practical application has been mapped out in order to calculate concentrations in the applied water and indicative concentrations in the soil moisture phase (unsaturated zone).
The results are summarized in Table 4.4. These concentrations do not take degradation into account.

Table 4.4: Indicative leaching and leaching concentrations of active substances***

ACTIVE SUBSTANCE	TAX (G/M2/YEAR)	CONCENTRATION WATER (MG/L)	KD IN MINERAL SOIL (L/KG)	CONCENTRATION SOIL MOISTURE (µG/L)*
Hydrogen peroxide	17	42.3	0.01	42,000**
DDAC	1.8	6.0	55,000	0.1
DPGME	1.0	3,3	0.5	2200**
ADBAC	0.003 to 2.0	0.01 to 6.6	80,000	0.0001 to 0.1

*** calculated as equilibrium concentration in 1 litre of soil with 10% moisture content (unsaturated) and 0.5% organic matter.**

**** substances break down well and generally in the environment**

*****The starting points for the calculations are included in Appendix 3.**

4.10 Measured concentrations

None of the above-mentioned active substances are measured in groundwater in standard analysis packages for crop protection products and biocides that provinces use for groundwater. There are also no measurements of these substances in the pesticide atlas (www.bestrijdingmiddelenatlas.nl) . For three of the four active substances, despite the many uncertainties that play a role in the leaching of chemical substances, it can be assumed without further ado that they cannot be measurably present in groundwater after application to artificial grass fields.

The calculated concentrations of active substances in pore water are often already below the groundwater limit of 0.1 µg/l, for two substances without taking degradation into account.

The calculated concentration of hydrogen peroxide is higher, but is not relevant because this substance is very reactive and unstable. The calculated concentration for (2-methoxymethylethoxy)propanol is not only above the groundwater limit, but also considerably above the MTR of 190 µg/l. Without degradation, this substance could leach into groundwater and surface water (via drainage) in high concentrations. Although it is known that this substance breaks down relatively quickly in the environment, this does not mean that for this specific application on artificial grass pitches with a humus-poor sand substructure, the leaching will remain below the standard.

5 Conclusions and recommendations

This chapter describes the conclusions per research question. Finally, the recommendations follow.

5.1 Conclusions

Which crop protection products and biocides are used on artificial turf pitches to control weeds, moss and algae?

Weeds, mosses and algae on the edge strip (outer strip of approximately 1 m with transition to adjacent paving) of artificial grass fields are controlled in various ways. This is done mechanically (brushing, dragging, sweeping) or with hot water treatment. In practice, Roundup (glyphosate) or other agents that work on the basis of acids and sprout inhibitors are also (still) used. Salt is also occasionally spread. From the literature study and the interviews it can be concluded that the edges of artificial grass fields can be maintained without chemical agents, provided that maintenance (brushing and cleaning) is carried out sufficiently frequently and suitable equipment is available.

The general picture is that with sufficient regular maintenance such as dragging, brushing and leaf blowing, problems with algae, moss and weeds can be prevented. This often requires customization because the local circumstances, for example shadowing by trees and the quality of the irrigation water used, have an influence.

On hockey fields (semi-water fields and water fields) that are irrigated, full-field agents are used to combat algae preventively and curatively. The agents used are hydrogen peroxide, Bio-Guard (formerly Centi-AlgenBac), KG Cleaner, Biomix Vitaal, EcoNzym Artificial Grass Cleaner (BIO 5a), CleanCourt and LCI Algae-Des. The agents hydrogen peroxide, Bio-Guard (formerly Centi-AlgenBac) and KG Cleaner are applied via the irrigation system. In addition to hydrogen peroxide, all agents are also applied with a spray boom (via a tractor with a liquid tank). There is one municipality that also treats the artificial grass football fields and the sand-filled field with an agent against algae.

Which crop protection products and biocides are permitted on artificial turf pitches to control weeds, moss and algae?

As of 31 March 2016, an amendment to the Decree on crop protection products and biocides came into effect. As a result, professional users are prohibited from using crop protection products on a paved surface outside of agriculture and horticulture. However, exceptions have been made for sports fields, which are used in practice by municipalities and contractors. There are also a number of municipalities that have been managing chemical-free for some time. These municipalities use alternatives to keep the edges of fields free of moss and weeds. This is done mechanically or with hot water treatment.

Products that are intended to combat algae are biocides. Substances that are intended to combat mosses and weeds are crop protection products. All substances that are biocides or crop protection products may only be used if they have been granted permission by the Board for the Authorisation of Plant Protection Products and Biocides (Ctgb) for the relevant use. If the product is not authorised for the relevant use, then there is a violation.

In addition, the product must be used according to the instructions for use.

The Ctgb only allows the biocide Bio-Guard. This biocide may be used on artificial grass to combat algae on semi-water and water artificial grass sports fields during periods when they are not being played on.

Hydrogen peroxide is not a legally permitted agent for combating algae on artificial grass. However, it appears that a local water board has given a municipality permission to use hydrogen peroxide for combating algae on artificial grass fields because no (long-term) negative impact on water quality is expected. This seems contradictory and raises questions. The other agents used also do not have a permit from the Ctgb for combating algae on artificial grass fields.

The legislation and regulations regarding the use of agents for algae control on artificial grass pitches can be better determined with the help of the guideline for determining the boundary between cleaning agents and disinfectants (biocides) published in 2017. For example, when agents such as salt and hydrogen peroxide are used to control algae on artificial grass, this is a biocide and an authorisation for the agent used is required. If cleaning agents are also intended to work as a biocide, the Biocides Regulation also applies. The Biocides Consultation Status Determination (BOS) could hold the cleaning agents used against this guideline to assess whether they are illegal biocides.

What are the substance properties of crop protection products and biocides used on artificial grass fields? Can these substances leach out based on these substance properties?

The material properties of the active substances of products that emerged from the surveys were inventoried and the practical application was mapped out in order to calculate concentrations in the applied water and indicative concentrations in the soil moisture phase (unsaturated zone). The results are shown in table 4.4.

It is concluded that the immobile substances hardly leach out; the concentrations of the tertiary ammonium salts are at or below the groundwater standard of 0.1 ug/l.
The leaching of the two more mobile active substances is indicated in more detail below. For DPGME a leaching concentration is calculated that is above the indicative MTR concentration of 190 µg/l.

Hydrogen peroxide

Hydrogen peroxide is a strong oxidizer and hardly binds to organic particles and is therefore very mobile in soils. Due to its reactive nature, hydrogen peroxide can be quickly degraded abiotically by the molecule spontaneously decomposing and by reacting with other substances. As a result, hydrogen peroxide is only present in the environment for a short time. In high concentrations, it is even explosive when it comes into contact with flammable substances.

In this sense, it is not a substance that breaks down, but a substance that reacts and therefore spontaneously disintegrates. After passing through the soil it can be assumed without further ado that no peroxide will be present at all, unless applied in a very overdose to a very inert environment (silver sand) and when with so much water that leaching to surface water occurs. However, dosing is aimed at the top layer and will therefore take place in a dry period in which only the top few centimetres of the soil/artificial grass layer are saturated with peroxide water.

Biomix ATM Vital

In addition to enzymes, this product contains the active substance dipropylene glycol methyl ether, (2-methoxymethylethoxy) propanol or DPGME (C7 H16O3). This is an organic compound. Propylene glycol ethers are generally not present in the environment for long. In water, DPGME is biotically degradable under aerobic conditions. Other forms of propylene glycol ethers also break down quickly in soil.

To what extent are residues measured in ground and surface water and how does this relate to other substances? If not found in ground and surface water, what can be said about leaching to ground and surface water based on substance properties and in relation to substances found in ground and surface water?

None of the above-mentioned active substances are measured in groundwater in standard analysis packages for crop protection products and biocides that provinces use for groundwater and that water boards use for surface water. For three of the four active substances, despite the many uncertainties that play a role in the leaching of chemical substances, it can be assumed without further ado that they cannot be measurably present in groundwater after application to artificial grass fields.

The calculated concentrations of active substances in pore water are often already below the groundwater limit of 0.1 µg/l, even without taking degradation into account. They are therefore also below MTR standards for surface water.

The calculated concentration of hydrogen peroxide is higher, but is not relevant because this substance is very reactive and unstable. The calculated concentration for (2-methoxymethylethoxy) propanol (DPGME) is not only above the groundwater limit but also well above the MTR of 190 µg/l. Without degradation, this substance is the only substance that can be washed out in high concentrations into groundwater and surface water (via drainage). Although this substance is known to break down relatively quickly in the environment, this does not mean that the leaching will remain below the standard for this specific application on artificial turf pitches with a humus-poor sand substructure.

In order to assess this risk further, it is desirable to gain further insight into the dosages and concentrations of agents in which this active substance is present, such as the product Biomix ATM Vitaal, used in practice. The starting point for the calculation in this study concerns an advisory gift from one organisation.

Other agents such as Roundup (based on the active ingredient glyphosate) and other herbicides that are applied to hard surfaces do appear in measurement networks, because they are generally used and measured in larger areas (urban areas). The risk of these substances therefore does not need to be inventoried specifically for artificial grass pitches, because this is already done via other routes, which is not the case for the specific forms of algae control on artificial grass pitches.

5.2 Recommendations

Clarify legislation and regulations regarding (algae) agents on artificial grass

It is recommended to clarify legislation and regulations regarding the use of (algae) agents on artificial grass resources on artificial grass fields. It is recommended to communicate this in an understandable and accessible manner.

Stimulate awareness and knowledge sharing regarding artificial grass maintenance

Awareness of the importance of regular mechanical and specialist maintenance should be stimulated. By performing sufficient, careful and high-quality preventive and specialist maintenance (measures include dragging/ sweeping/brushing and cleaning), the need to use approved chemical agents can be reduced. It is recommended to investigate the effectiveness of mechanical measures objectively and independently in a pilot. Different methods can be applied within one field, which can provide insight into the effectiveness of the methods.

Investigate the (cost)effectiveness of maintenance measures

In this study, no attention was paid to the costs of the measures. It is recommended to make the costs of the maintenance measures transparent so that insight is obtained into the cost-effectiveness of permitted mechanical, biological and chemical maintenance methods.

Make the application of cleaning agents transparent

The use of enzyme-based cleaning agents to reduce algae nuisance is relatively new. Since current dosages and specific information on the active ingredients of certain agents (based on enzymes) are lacking, it is recommended to conduct further research on this.

Share the results and join forces

It is recommended that the results of experiments and practical experiences be shared among managers of sports complexes, sports companies and municipalities.

By focusing on bundling knowledge and sharing knowledge and information about techniques for combating and preventing algae and moss, the desired situation can be worked towards. It is recommended to tackle this as the Sports and Cultural Technology Industry Association with STOWA and to do this in collaboration with the Knowledge Network Biocides facilitated by the RIVM.

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Appendix 1 Interview results

Text call for websites

Call for website of the Sports and Cultural Technology Association (December 9, 2017)

Do you want to contribute to a future-proof and sustainable sports environment for athletes and the environment?

Sweco will soon start interviews with sports field managers to get an up-to-date picture of the resources used on artificial grass. The BSNC and STOWA cordially invite you to this.
The interviews are part of an assignment from BSNC and STOWA to Sweco in which the possible risks of leaching of crop protection products, biocides and other used maintenance products (salt, hydrogen peroxide, etc.) from artificial grass sports fields are investigated.

Managers of sports complexes where different types of artificial grass and synthetic fields are present (such as sand-filled, rubber-filled fields, water fields and tennis courts) are given preference in the study.

Interested?

Please send an email with your contact details to jochem.knol@sweco.nl or jaap.dewit@sweco.nl. They will then contact you.

Background: The Green Deal Sports Fields

The sports sector strives for further sustainability of the maintenance of sports fields. The Sports and Cultural Technology Industry Association (BSNC) has therefore laid down the sector's ambitions to reduce crop protection in a Green Deal. 'Green Deal' Sports calls on all sports field managers to take their social role and create a healthy, future-proof and sustainable sports environment for athletes.

As a manager, would you like to contribute to a sustainable sports environment?

Call for proposals for the Sports and Cultural Technology Association website (9 January 2017)

Sweco will soon start interviews with sports field managers to get an up-to-date picture of the resources used on artificial grass. Trade association BSNC and knowledge centre Stowa invite interested parties to participate.
The interviews are part of an assignment from BSNC and Stowa to Sweco in which the possible risks of leaching of crop protection products, biocides and other used maintenance products (salt, hydrogen peroxide, etc.) from artificial grass sports fields are investigated. Managers of sports complexes where different types of artificial grass and synthetic fields are present (such as sand-filled, rubber-filled fields, water fields and tennis courts) are given preference in the research.

Anyone interested in participating can send an email with contact details to jochem.knol@sweco.nl or jaap.dewit@sweco.nl without obligation. They will then contact you.

Discussion report interview municipality 1 in the context of the research into the emission of crop protection products from artificial grass fields

Date: February 10, 2017

Present: municipality 1 Jaap de Wit (Sweco)

Reporting: J. de Wit (Sweco)

Checked: municipality 1

Status: final

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1 General Municipality 1
manages approximately 27 artificial grass fields. These are 15 rubber-filled artificial grass fields (14 football and 1 rugby), 5 and 1/2 hockey water fields, 6 sand-filled hockey fields and one korf and one handball field (sand-filled). This year, an additional sand-filled artificial grass hockey field will be constructed. The municipality does not maintain tennis courts. The municipality deliberately chooses not to construct semi-water fields due to the problem with algae in the fields in question.

The artificial grass fields were constructed in 2005 (football), 2008, 2009 and 2011, 2013 (rugby) and 2014. In 2016 the first mat was replaced. At one of the hockey clubs, 3.5 new water fields and 4 sand-filled fields were constructed in 2010. At another hockey club, 2 sand-filled fields were converted into water fields in 2012 and 2014 and there are also 2 sand-filled fields from 2009 and 2012. The municipality has not received any complaints about slippery fields.

The municipality's work and development company performs regular and weekly maintenance. Major/or annual maintenance is the responsibility of the construction contractor for the first 5 years. They have their own maintenance equipment. Henrie determines the management and maintenance and checks the quality.

Maintenance of rubber-filled fields (football/rugby)

2 No agents are used on the rubber-filled fields to combat weeds, moss or algae. Maintenance consists of dragging/ brushing the fields once every 2 weeks. Depending on the weather conditions, the right machine is chosen (there are 3 different machines available).

An external company carries out a deep cleaning of the fields twice a year, during which the infill is loosened and cleaned.
The edges of the fields are cleared of weeds monthly with a brush machine (Mug) or manually. The frequency is adjusted depending on the weather. When Municipality 1 started with chemical-free management, it initially cost the municipality more time and extra work. Now it is a matter of good maintenance and then it is easy to do and does not require any extra time.

An app is also used that provides insight into the maintenance performed and points of attention from the association. This allows for faster switching.
Depending on the location of a field, maintenance can be adjusted (often custom-made and experiences per field). Leaf blowing is important to prevent pollution.

3 Maintenance of sand-filled fields (hockey, korfball and handball)

The maintenance of the sand-filled artificial grass fields is similar to that of the rubber-infill artificial grass fields. No agents are used on these fields either.
Even outside the playing season (autumn/winter) these fields are brushed/dragged/weeded once every 2 weeks. This is essential to prevent algae, moss and weeds.
By using the Reekmaster, the top layer of sand-strewn fields can be worked deeper. Here too, there is a choice of three different machines. Depending on weather conditions, the machine is differentiated. The working direction can also differ.

4 Maintenance of water fields (hockey)

One of the hockey complexes has a 3 1/2 water field. Due to the maintenance contract for the field, hydrogen peroxide is added to the irrigation system. The municipality doubts whether this is absolutely necessary and whether it prevents algae. The irrigation takes place at night and is carried out twice a week. 4 litres of hydrogen peroxide are used per irrigation session on 12 m3 of water per irrigation session.

Various means have been tried in the past to combat algae, but according to the municipality they did not have the desired effect. The problems with algae depend on the weather, a mild winter for example causes more problems. Snow and frost cause less algae. The fields are brushed/swept depending on the type of mat.

Surface water is used for the irrigation of the fields on one of the hockey complexes, which first passes through a filter installation. The water comes from the Oosterplas.

The water fields are deep cleaned once or twice a year. The fields on the wooded side of one of the hockey complexes are cleaned twice a year due to increased organic pollution.

Municipality 1 prefers to clean the fields twice a year instead of using very expensive chemicals.

On the hockey fields (water fields) at one of the hockey complexes no agents are used (not even hydrogen peroxide). The fields are deep-cleaned twice a year. The water for irrigation is taken from a nearby ditch.

Since 2014, the clamping system is mandatory around a water field. This large area where many weeds grow and pollution is a place where dirt can accumulate and algae and moss can grow.

When laying fields, there is an increasing preference for laying paving with as few joints as possible, e.g. concrete slabs, so that as little weeds as possible can grow.

Municipality 1 indicates that artificial grass can be maintained well without chemical agents. Municipality 1 is always open to pilots to test new environmentally friendly agents that can save on deep cleaning, for example.
It is proposed to also include privatised associations in the research.

5 Summary overview of used agents for moss, algae and weeds

Rubber-filled fields: no resources
Sand-strewn fields: no resources
Water fields complex 1: no resources
Water fields complex 2: = 6 liters of hydrogen peroxide per 12 m3 of water / 40 x 240 liters of hydrogen peroxide per year.
Request concentration from company

Discussion report interview municipality 2 in the context of the research into the emission of crop protection products from artificial grass fields

Date: February 23, 2017

Present: municipality 2 (two people) and Jaap de Wit (Sweco)

Reporting: Jaap de Wit (Sweco)

Checked: Municipality 2

Status: final

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1 General Municipality 2
manages approximately 106 artificial grass fields. This concerns:

- 43 artificial grass football fields (cork, TPE, EPDM and 2 more fields with coated SBR as infill)
- 9 hockey water fields
- 4 semi-water fields (hockey)
- 27 sand-filled hockey fields and 11 (sand-filled) korfball fields
- 11 Multifunctional fields
- 1 Rugby field

The artificial grass hockey fields have been managed by the municipality since the transition from private to municipal management (approximately 8 years ago).
Maintenance requires customization. The location of the field also determines the degree of and sensitivity to pollution by shadow and environmental effects. The required maintenance is adjusted to this.

The municipality has its own equipment. For deep cleaning of the (semi) water hockey fields, an external party is involved.

It is important that clubs keep the fields themselves as clean as possible, for example by preventing the artificial grass from being walked on after walking on natural grass and organic material from being walked on. There is also sometimes nuisance from droppings from seagulls/geese, which makes the fields even more dirty.

The municipality aims to keep algae, moss and weeds manageable through maintenance. Preventatively, pollution of the fields is prevented by frequently removing leaves and also keeping the area around the fields (paths etc.) clean.

In the past, the municipality has experimented with hydrogen peroxide and salt, but no longer uses this due to its limited effect and potential negative environmental impact.
The aim of the managers is to work as environmentally friendly as possible. The municipality is open to the use of new techniques and resources and regularly experiments to improve maintenance. For example, experiments are currently being conducted with a brush cutter on which a small brush head is mounted to be able to brush corners/ edges.

2 Maintenance of artificial grass football fields No agents are
used on the artificial grass football fields to combat weeds, moss or algae. Regular maintenance consists of dragging/ brushing the fields and removing leaves once every 2 weeks.

In addition, the infill layer is mechanically loosened (zigzag machine) and cleaned once or twice a year. No agents are used for this.

Weeds and moss at the edges of fields are controlled with hot water. This is done 4 or 5 times a year, with weeds and moss being sprayed with hot water using a spray lance. This gives good results and has not caused any damage to the artificial grass fields to date. It is important that the weeds and moss are well maintained.

Maintenance of sand-filled fields (hockey, korfball)

3 The maintenance of the sand-filled artificial grass fields is similar to that of the football artificial grass fields. No agents are used on these fields either.
Outside the playing season (autumn/winter) these fields are brushed/dragged once every 3 to 4 weeks.

Weeds and moss at the edges are treated with hot water and then removed.

4 Maintenance of semi-water fields and water fields (hockey)
The semi-water fields and water fields are brushed/swept once every 2 weeks.
When brushing/sweeping the fields, edges and, for example, clamp gutters are swept once more due to a higher degree of contamination.

Depending on the location, the hockey fields are irrigated with spring or surface water. The
irrigation water is first filtered (sand filter/ultraviolet). The composition of the water is controlled to a limited extent.

The municipality promotes not sprinkling (irrigation) of fields so that fields can sometimes dry out well, which is beneficial to prevent algae explosions. However, the association often determines the playing. This also depends on the level. Top clubs, for example, irrigate more often (more training sessions), which causes pollution/algae to occur sooner.

To prevent algae, the agent KG Reiniger is used. This agent is added manually to the irrigation system. This gives the municipality better control over its use, so that it is more effective. This agent is used depending on the weather conditions, the degree of contamination and the location of the field. Approximately 6 to 7 litres of agent are added per irrigation session (on 7 to 10 m3 of water) per field.

The municipality also carries out a treatment with the agent KG cleaner 3 times a year by a tractor with a field sprayer. In this case 40 liters of agent is used on 400 liters of water.

Once a year the fields are deep cleaned. This can be done in the autumn or possibly in the spring. Prior to this cleaning, 1 or 2 days before cleaning, the agent Centibac (algae control) is applied with a field sprayer in case of serious pollution or KG (20 liters Centibac to 400 liters water).

The markings and, for example, the clamp gutter are cleaned manually every year with a high-
pressure cleaner for this service.

Weeds and moss at the edges are sprayed with hot water.

The municipality registers all resources used for its own insight into total usage.

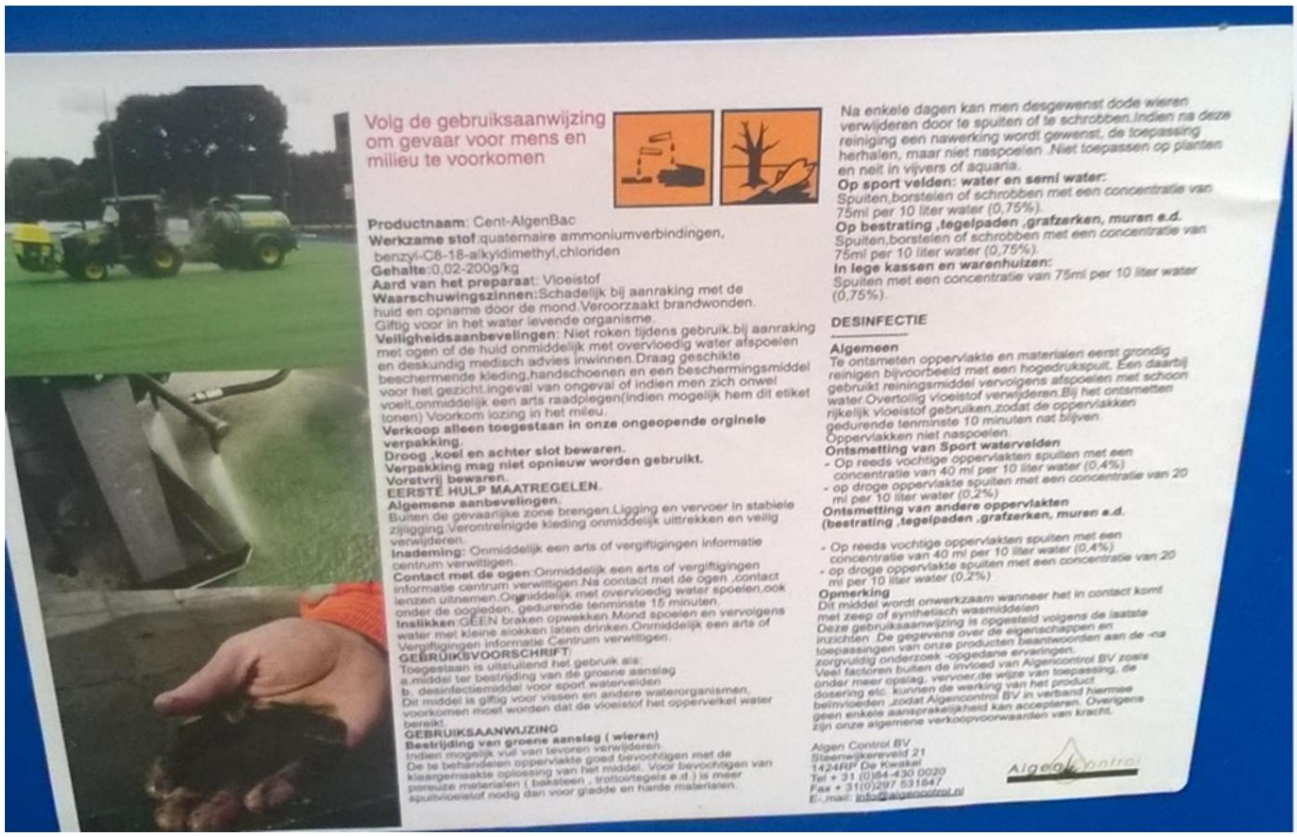
5 Summary overview of used agents for moss, algae and weeds

Artificial grass football fields: no resources

Semi-water fields and water fields
(hockey fields)

- 6 to 7 liters KG Cleaner per irrigation session (on 7 to 10 m3 of water) This depends on the weather during the season. On average once every 2 weeks.
- 3 times a year KG cleaner (40 liters of product) on 400 liters of water)
- Centibac once a year (20 liters per 400 liter of water).

Photos labels



Discussion report interview municipality 3 in the context of the research into the emission of crop protection products from artificial grass fields

Date: February 27, 2017

Present: Municipality 3 (1 person) and Jochem Knol (Sweco)

Reporting: J. Knol (Sweco)

Checked: municipality 3

Status: final

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1 General Municipality 3
manages approximately 20 artificial grass fields. These are 16 rubber-filled artificial grass fields (14 football and 2 korfball), 2 hockey semi-water fields and 2 sand-filled korfball fields. The municipality does not maintain tennis courts.
The oldest fields in municipality 3 are 11 years old, one or two fields are constructed annually.

The paving around the fields is a big problem. In municipality 3, no chemical pesticides are used here, but they have switched to burning the paving four times a year.

Maintenance of rubber-filled fields (football/korfball)

2 The fields are dragged weekly and the penalty points/goal areas are filled with SBR. Salt is spread in the edges 2 to 3 times a year to combat weeds.
This amounts to a total of 10 to 15 kg of salt per field per year. A major maintenance service is carried out annually, during which the infill layer is loosened and cleaned.

Maintenance of sand-filled fields (korfball)

3 The fields are dragged weekly. Salt is spread in the edges 2 to 3 times a year to combat weeds. This amounts to a total of 10 to 15 kg of salt per field per year.

4 Maintenance of semi-water fields (hockey)
The fields are dragged weekly and sand is added to the intensively played areas (penalty spot). Salt is spread in the edges 2 to 3 times a year (10 to 15 kg per field per year). The fields are irrigated, with a total of 20 litres of hydrogen peroxide 35% added to the irrigation water per year. This only happens in the summer period when temperatures are higher than 8o C.

5 Summary overview of used agents for moss, algae and weeds

Rubber-filled fields:	salt at the edges (10 to 15 kg per year) salt at the
Sand-strewn fields:	edges (10 to 15 kg per year) salt at the edges (10
Semi-water fields:	to 15 kg per year) 20 liters of hydrogen peroxide 35% per field

Photos labels resources used

Discussion report interview municipality 4 in the context of the research into the emission of crop protection products from artificial grass fields

Date: February 17, 2017

Present: Municipality 4 and Jaap de Wit (Sweco)

Reporting: J. de Wit (Sweco)

Checked: municipality 4

Status: final

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1 General Municipality 4
manages approximately 20 artificial grass fields. This includes 4 rubber-filled artificial grass fields (which are 10 to 11 years old) and 3 TPE-filled artificial grass football fields. These fields were constructed at the same time approximately 10 years ago.

In total, this municipality manages three sand-filled fields, two of which are hockey fields and a combined korfball-hockey field. There are 5 semi-water fields that were constructed approximately 3 to 4 years ago. Last year, two water fields (hockey) were constructed.

The municipality partly carries out the maintenance itself. Due to insufficient capacity, external parties are also called in. The specialist maintenance is also carried out by external parties.

2 Maintenance of artificial grass football fields The maintenance
of these fields consists of sweeping/dragging the fields once every 1 to 2 weeks (on average once every 1.5 weeks). The infill is also cleaned twice a year. A special edge brush has been developed for the edges, with which the edges of the fields are brushed.

For the control of weeds and moss at the place of the adjacent pavement/run-off strip, Roundup
is used. This is done 3 to 4 times a year.
The drug is administered with a backpack sprayer in a dosage according to the packaging by people who are in possession of a spraying license.

Maintenance of sand-filled fields (hockey, korfball)

3 The maintenance of the sand-filled artificial grass fields is comparable to that of the football artificial grass fields.

Three sports parks did the maintenance, 2 or 3 parks did the maintenance themselves at first. When the transition to the municipality, the municipality first tackled the overdue maintenance, including a full-field treatment by Algencontrol to combat algae. The sand infill was also removed and clean sand was returned.

In the winter/autumn period (outside the playing season) the fields are always kept leaf-free. There is less brushing/sweeping during this period, instead of 1 or 2 times every 2 weeks the frequency is 1 time every 2 or 3 weeks.
The infill on the fields is also cleaned twice a year, although this is sometimes done less often.

The edges of the fields are cleaned with an edge brush, just like the artificial grass fields, and Roundup is used on the edges 3 or 4 times a year.

The municipality takes into account in the multi-year planning a deep cleaning of the sand-strewn fields with a frequency of once every 7 years. The polluted sand is removed and clean sand is returned.

4 Maintenance of semi-water fields (hockey)
The regular maintenance of the semi-water fields is the same as for the sand-strewn fields. On these fields, algae control is additionally carried out weekly. With a tractor with a field sprayer, the Algencontrol agent is applied in the right weather conditions in accordance with the supplier's specifications. No agents are added to the irrigation water.

It is important that leaves are removed so that there is as little pollution as possible. Due to the presence of Larch trees, the fields are more likely to be polluted by the falling needles.

The fields are irrigated with groundwater, and there is an iron removal installation at the Maarn hockey complex.

In the multi-year plan, the municipality takes into account a deep cleaning of the SEM water fields with a frequency of once every 7 years.
In the specification of the tender for maintenance it is stated that algae on hockey fields must be combated. There are no known complaints about pollution/slipperiness of the fields.

5 Maintenance of water fields (hockey)
The maintenance of the semi-water fields is identical to the maintenance of the semi-water fields.

In the multi-year plan, the municipality takes into account a deep cleaning of the water fields with a frequency of once every 7 years.

The municipality is considering alternatives in connection with the upcoming ban on the use of chemical agents. It is possible that weekly maintenance with the edge brush will have to be carried out. The municipality indicates that it is important to also consider the cost side of the management of artificial grass.

6 Summary overview of used agents for moss, algae and weeds Artificial grass football fields: Roundup run-off strip/hardening in dosage according to packaging, 3 to 4 times per year The agent is sprayed into the seams between the mat and the hardening. This is done selectively.

Sand-strewn fields:	Roundup run-off strip/hardening in dosage according to packaging, 3 to 4 times a year The product is applied in the seams between the mat and the pavement is sprayed. This is done selectively.
Semi-water fields and water fields:	Roundup run-off strip/hardening in dosage according to packaging, 3 to 4 times a year The product is applied in the seams between the mat and the pavement is sprayed. This is done selectively. Algae control with the Algencontrol method, 1x per week with dosage according to packaging

Discussion report interview municipality 5 in the context of the research into the emission of crop protection products from artificial turf fields

Date: February 27, 2017

Present: work organization municipality 5 and Jochem Knol (Sweco)

Reporting: J. Knol (Sweco)

Checked: Municipality 5

Status: Final

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1 General

In municipality 5, maintenance is carried out by a work organization. There are 4 artificial grass fields under management. This concerns 2 rubber-filled artificial grass fields (football), a sand-filled hockey field and a semi-water field (hockey). If regularly brushed, harrowed, blown and swept and sprayed twice a year there are no specific maintenance problems.

Maintenance of rubber-filled fields (football)

2 Regularly sweep, harrow, blow and brush the infill layer. The point is that the brushes take the edges well.
Preventive algae control is carried out with the agent LCI. Algae-Des 2.5%. This is carried out twice a year with a ratio of 1 to 50 (2.5%). In total, 20 litres per field used per year.

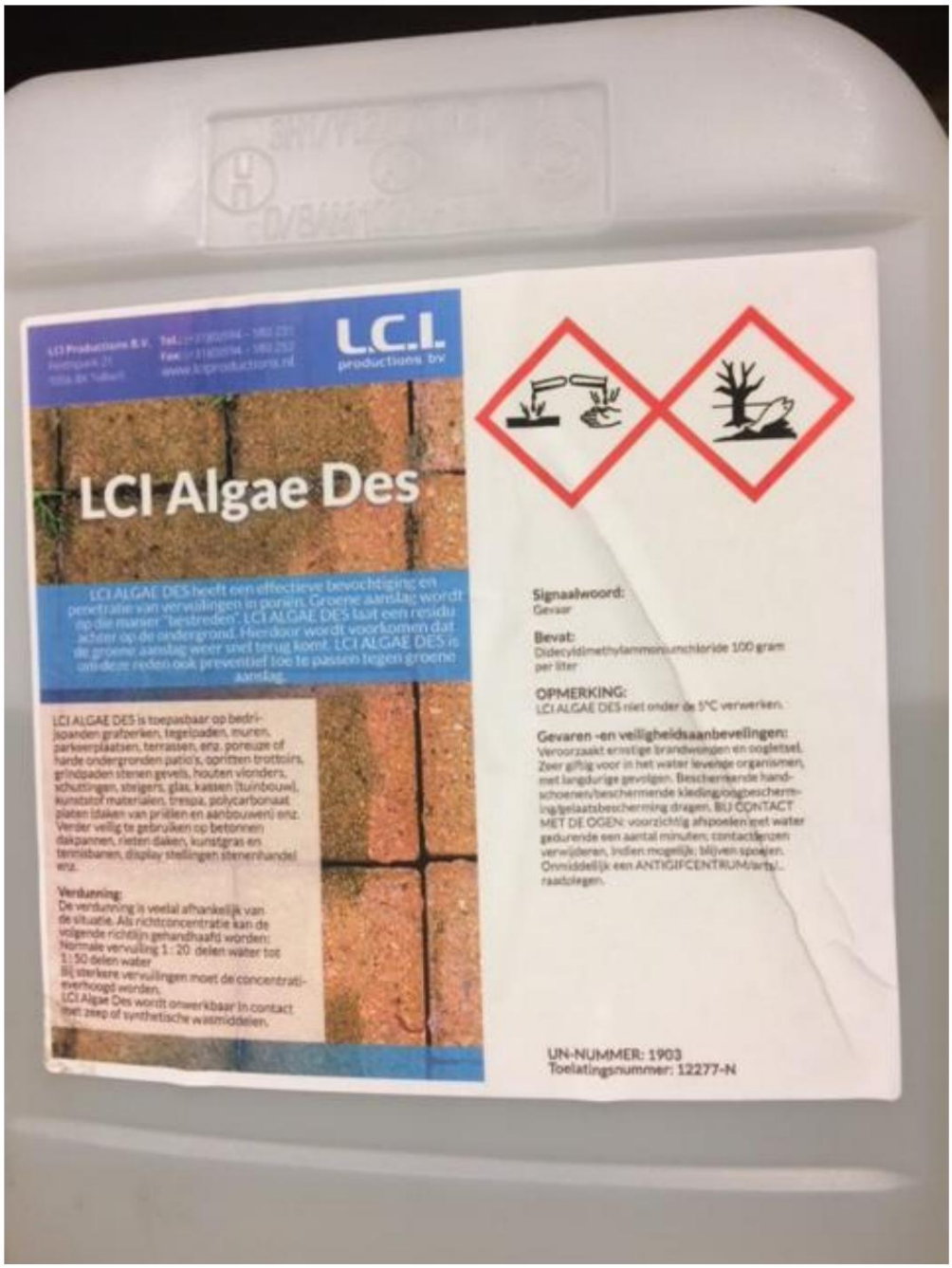
Maintenance of a sand-filled field and a semi-water field (hockey)

3 Regularly sweep, harrow, blow and brush and top up the infill layer. The point is that the brush the edges well
Preventive algae control is carried out with the agent LCI. Algae-Des 2.5%. This is carried out twice a year with a ratio of 1 to 50 (2.5%). In total, 20 litres per field used per year.

4 Summary overview of used agents against algae

Rubber-filled fields: LCI. Algae-Des 2.5% / 10 liters, 2x per year
Sand-strewn and semi-water fields: LCI. Algae-Des 2.5% / 10 liters, 2x per year

Photo label



Discussion report interview municipality 6 in the context of the investigation into the emission of crop protection products from artificial grass fields

Date: March 9, 2017

Present: Municipality 6

Reporting: J. de Wit (Sweco)

Checked: municipality 6

Status: final

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1 General Municipality 6
manages approximately 15 artificial grass football fields (13 TPE and 2 rubber infill), 3 practice fields (football), 6.5 hockey fields (of which 2.5 water fields and 4 sand-filled hockey fields). There are also approximately 7 sand-filled korfball fields under management.
Municipality 6 carries out regular maintenance on the artificial grass football fields and the sand-filled fields.
The specialist maintenance (deep cleaning) is carried out by other parties. The hockey fields are carried out by another organisation on the basis of a 10-year maintenance contract.

The municipality has made an agreement with the associations not to use chemicals to tackle algae, moss and weeds. This agreement is being adhered to well. In municipality 6, the public space has been maintained chemical-free for 30 years. This also means that people are used to the fact that there may be a little weed or moss present. From an environmental perspective, the use of salt has also been stopped completely since 2017.

2 Maintenance of artificial grass football fields Regular
maintenance consists of brushing the fields once a week and removing leaves (in the winter period). Every month, the infill is pulled loose with a machine (Erator). In case of heavier pollution, a machine (Topair) is used to remove the coarse pollution from the field.

The outer edges of the fields are brushed (front brush) and the outer edge is also cleaned with the Topair.
During the growing season this is done on average once a month.

Every now and then a deep cleaning is carried out to increase the permeability of the field.

Brushing can be used to keep weeds and moss under control if done in time.
One football field is equipped with a sprinkler system. This is used occasionally.

Maintenance of sand-filled fields (hockey/korfball)

3 The maintenance of the sand-filled artificial grass fields is comparable to that of the football artificial grass fields.

The korfball fields are not brushed during the autumn/winter period (when korfball is played indoors).

The fields are deep cleaned once a year. No agents are used for this.
Since the hockey fields are quite young (about 4 years old) there are few problems with pollution.

Because all the fields are fairly open (no trees, so little shade and pollution), the fields are well exposed to light and wind, which is beneficial to prevent algae.

4 Maintenance of water fields (hockey)
The regular maintenance of the water fields is comparable to the other artificial grass fields.
Once every 3 years a deep cleaning is carried out, during which the fields are cleaned with water and high pressure.

Since the fields were constructed, algae have been combated preventively with hydrogen peroxide.
This agent is added to the irrigation system. This is added on average once a week to two weeks, depending on the association's insights. The irrigation is carried out in the evening by volunteers. De-ironed groundwater is used for irrigation. There have been no complaints about the slipperiness of the hockey fields.

The clamp gutter is more likely to become polluted with algae and moss due to the accumulation of dirt. A machine has been made available to the associations so that volunteers can clean the clamp gutter. The edge of the field is also included in this.

The municipality is open and also facilitates alternatives. A possible idea is the application of enzyme-based agents as an alternative to hydrogen peroxide.

5 Summary overview of agents used for moss, algae and weeds Artificial grass football fields: no agents Sand-strewn fields: no agents Water fields: hydrogen peroxide once or twice a week.

The recommended dosage is 0.15 litres per m^3 of irrigation water, so approximately 1 litre per spraying session per field. See product sheet in appendix 2.

Discussion report interview J&E Sports in the context of the research into the emission of crop protection products from artificial turf fields

Date: February 6, 2017

Present: John van Gennip (J&E Sports) and Jaap de Wit (Sweco)

Reporting: J. de Wit (Sweco)

Verified: John van Gennip (J&E Sports)

Status: final

1 General

J&E Sports maintains approximately 900 different artificial grass fields/tennis courts spread throughout the Netherlands (including football, tennis, korfball, athletics, hockey, rugby, combination fields and football fields). This includes approximately 300 football fields, 150 hockey fields and 75 korfball fields and various types of fields such as rubber, cork, sand-filled, semi-water and water fields.

J&E Sports carries out annual specialist maintenance for the majority of the fields out. Regular maintenance is also carried out at a single location.
The specialist maintenance mainly concerns the decompaction and cleaning of the artificial grass fields. Part of the specialist maintenance (deep cleaning of hockey fields) is carried out by subcontractors.

The quality of maintenance of artificial grass fields varies greatly per municipality/association.
Know-how and involvement of the field manager is important for a qualitatively well-maintained field. The available budget for the municipality/association often also determines the quality. Lack of experience, ignorance or insufficient knowledge can be a reason why there are problems with, for example, algae on hockey fields.

In practice, maintenance is often less than desired. There are practical tools, such as working with a logbook that is checked, to stimulate maintenance.

Clubs often sound the alarm when it is too late. It is important to report pollution in time. For example, on new hockey fields (water or semi-water fields) there are often no problems for the first 3 to 4 years and then problems can arise in a short time.
Once there is organic material etc. in the field it is difficult to remove. It is therefore important to remove leaves and other organic material. This is a task for the association and this must be done as soon as possible.

When delivering new artificial grass pitches, J&E Sports always schedules sufficient time to properly explain the necessary maintenance of an artificial grass pitch together with the maintenance man. to take.

Mosses and weeds

2 There are hardly any mosses or weeds on artificial grass fields, at most at the edges and occasionally. This is often due to insufficient maintenance by the association/municipality.

With mechanical maintenance (brushing) weeds and moss can be prevented and controlled. J&E Sports does not use chemical agents to control weeds and moss.

artificial grass fields. A weed brush is used for the edges of the fields, which mechanically removes moss and weeds. By regularly brushing sufficiently (once a week), weeds and mosses do not stand a chance.

Algae

3 Algae do not occur on artificial grass football fields (filled with rubber, plastic or cork). Algae are a problem on hockey fields, semi-water fields and water fields, because they are irrigated. Fields that are irrigated (too) often

and (too) often moist have the most problems with algae.
In practice, associations themselves use various means such as hydrogen peroxide, salt, quaternary ammonium compounds to combat algae. J&E Sports does not have this in view.

J&E Sports only supplies an agent based on enzymes (Biomix). This agent is applied directly to the field with a spray machine. This is carried out by the associations/municipalities themselves. J&E Sport advises to
use 5 litres of Biomix
once every 2 weeks. In combination with an annual deep cleaning and sufficient regular maintenance, algae problems can be prevented.

The exact maintenance is custom-made. The sensitivity to algae growth is strongly dependent on the location (shade, leaves of trees) and, for example, the quality of the irrigation water.

Algae can be prevented by preventive measures such as sparingly spraying with the correct water quality, regular maintenance: brushing by the association (at least once a week for all fields), at least once deep cleaning, spraying once a week or every two weeks with enzyme agent and annual cleaning.

On semi-water fields algae are more difficult to control. These fields should be sprayed as little as possible and maintained more like sand-filled fields. Regular brushing and good monitoring of the field so that problems are detected in time help to control the problem. It often starts at the edges.

This allows timely intervention to prevent the spread to the field.

The execution of a deep cleaning depends on the wishes of the association/municipality. In practice this can vary from 4 times per year to 1 time per 4 years.

Discussion report on interview with sports company in the context of the research into the emission of crop protection products from artificial turf fields

Date: January 18, 2017

Present: sports company and Jaap de Wit (Sweco)

Reporting: J. de Wit (Sweco)

Checked: Sports company

Status: Final

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1 General The sports company maintains approximately 500 artificial grass fields spread across the Netherlands (football, tennis, korfball, athletics, hockey, rugby). For the most part, this concerns annual specialist maintenance. In addition to specialist maintenance, regular maintenance is also carried out on 60 to 70 artificial grass fields. The required maintenance of an artificial grass field depends on various factors, such as the type of field, the location in terms of shade, playing intensity, etc. The required maintenance is often customised. It is important to take sufficient preventive measures. In practice, people sometimes react too late, partly because they invest too little in advance or reserve too little budget for the implementation of preventive maintenance measures. However, there does seem to be a shift in this.

Mosses and weeds

2 On artificial grass football fields (filled with rubber, plastic or cork) there are hardly any mosses and weeds, at most at the edges and occasionally.

On sand-strewn artificial grass fields, mosses and weeds hardly stand a chance due to good maintenance and playing on the playing field. Mosses and weeds do occur along the edges of the field (outer edge with a width of approximately 0.5 m), but this also depends on the frequency of regular maintenance. Moss and weeds are often the result of insufficient or overdue maintenance.

With mechanical maintenance (brushing) weeds and moss can be prevented and controlled well. Occasionally, the sports company manually sprays with a backpack sprayer with Roundup (diluted) to control weeds at the edges. Some municipalities have banned the use of chemicals. In these municipalities, weeds and moss are controlled mechanically or manually by the sports company.

In practice, regular maintenance (bi-weekly) is often done by the associations, clubs or municipalities themselves. It is possible that they also use chemical agents to combat moss and weeds at the edges. The sports company does not have this in mind.

In the event of a total ban on the use of chemicals on artificial grass, the sports company expects that weeds and moss on artificial grass can be effectively controlled mechanically or with biological means. The use of steam or hot water is not a suitable alternative because this can damage the artificial grass fibres.

18-01-2017

Algae

3 On artificial grass football fields (filled with rubber, plastic or cork) there are virtually no algae. Algae are a problem especially on hockey fields, semi-water fields and water fields, because these are irrigated. Clubs often use hydrogen peroxide or the agent Centibac to combat algae on hockey fields. These agents are then added to the irrigation water. The sports company does not supply these installations or agents itself.

Starting next year, the sports company will start maintaining 1 hockey field (semi-water field). To prevent algae, the sports company expects to use the Biomix ATM Vitaal agent, an agent that works on the basis of enzymes, 3 to 5 times a year. The frequency of use is not exactly fixed. The starting point is that the fields are algae-free so that hockey can be played at all times. Another sports company has been working with agents based on enzymes for a number of years with good results.

The sports company indicates that an effective means to prevent algae growth on hockey fields (semi-water fields and water fields) remains necessary. An alternative such as deep cleaning with water based on high pressure (twice a year) will be more expensive.

Discussion report interview Schaerweijde in the context of the research into the emission of crop protection products from artificial grass fields

Date: February 6, 2017

Taken by telephone from A. Schuurman (Schaerweijde ZSV) by Jaap de Wit (Sweco)

Reporting: J. de Wit (Sweco)

Checked: A. Schuurman (Schaerweijde ZSV)

Status: final

Schaerweijde ZSV is a hockey club with 5 hockey fields where both water fields, semi-water fields as sand-filled fields are present. The sports complex is located in Zeist (Utrechtse Heuvelrug) in a water extraction area.

Schaerweijde currently does not use any chemical or biological agents for the maintenance of the hockey fields. In the past, agents were used, or experiments were conducted (including hydrogen peroxide and Centibac), but these agents did not have the desired effect, which is why their effectiveness is questionable.

The maintenance of the fields now consists of frequent dragging and an annual deep cleaning.
This has been done this way for about 4 years now. As a result, there are no problems with moss, weeds and algae. Algae remain a problem only on the semi-water fields. There is a need for a means to combat this effectively.

Schaerweijde will be the first association in the Netherlands to experiment with the Astrobot this year. This is a robot that fully automates the maintenance of artificial grass. This robot brushes/sweeps the fields and removes organic material.
No chemicals are used.

Discussion report interview HC Helmond in the context of the research into the emission of crop protection products from artificial grass fields

Date: February 13, 2017

Present: P. de Wolf (HC Helmond Beheer Foundation) and Jaap de Wit (Sweco)

Reporting: J. de Wit (Sweco)

Checked: P. de Wolf (HC Helmond Beheer Foundation)

Status: final

HC Helmond is a hockey club with four full hockey fields and a mini field where both water fields and sand-filled fields are present. The sports complex is located in Helmond (sports park Warande) and borders the EHS (de Goorloop) and the GLE (Croy) as well as a (nature core area). There are two artificial water fields, two sand-filled hockey fields and one sand-filled mini field (20x30 m) present.

There are plans to expand the hockey complex so that in the future there will be six full-fledged hockey fields. Primarily, no water fields will be constructed now and in the future based on technical wishes for the game (policy plan). Hc Helmond believes that all types of sports floors/fields should be available at a hockey accommodation. In addition to the available water fields and the sand field, two semi-water fields will be constructed on which the need for irrigation does not apply. A secondary argument is the algae problem. In the new construction plans, the fields will no longer be surrounded by many trees so that shadowing is prevented (less chance of moss/algae).

The club has been privatised since 1985 and must build its own facilities and carry out and finance the management and maintenance itself. The club has its own equipment and (partly paid) volunteers who carry out regular maintenance.

Maintenance of sand-strewn fields The sand-strewn fields are dragged/swept at least once a week. A roller broom is used for the corners.

Once a year, specialist maintenance is carried out on the basis of a multi-year contract. J&E Sports carries this out with a machine (Sportchamp) whereby the top cm of sand is loosened and cleaned. The contamination is removed.
On one of the sand-strewn fields that lies in the armpit of the forest edge (shaded spot), moss formation was present before the mat was replaced. Salt was previously used to combat this (curative). Salt is not used as a preventive measure on the fields.

Weeds and moss grow at the edges of the fields. As far as possible, this is removed manually. Every year, a round is made on the complex with cleaning vinegar (since 2015). Before 2015, Roundup was sprayed very specifically in a minimum concentration (2% solution). This work was carried out by a volunteer and also a qualified gardener.

Maintenance water fields The
water fields are swept/dragged once every 2 weeks (regular maintenance). Specialist maintenance takes place once every 2 years, during which the fields are deep-cleaned.
For the past 2 years, the fields have been pretreated 48 hours in advance with 300 kg of salt to loosen algae and pollution before deep cleaning (this method was adopted by RKHV Union in Nijmegen due to positive experiences). Centibac was previously used for this, but this was stopped partly because the supplier did not want to disclose the composition, the effectiveness was doubted and for cost reasons. In 2017, Bio-Enzym was used to investigate to what extent this agent can limit the algae and moss problem.

Until 2013, hydrogen peroxide (0.01 millimol per litre) was added to the irrigation water via a dosing unit and until 2015 Centibac (0.05 millimol per litre). At present, nothing is added to the irrigation water. 8 m3 is applied per irrigation session per field.

The irrigation water comes from a water basin constructed on the complex with a capacity of approximately 600 m3. This basin is supplemented with rainwater collected via the drainage and irrigation water. Only during prolonged droughts does mains water have to be used (in 2016-2017 a total of 4,500 m3).

The pool is covered with a foil so that no sunlight enters and less waste (leaves etc.) ends up in it. This system has been working satisfactorily for 12 years. Several associations have copied the system.

Summary overview of the products used for moss, algae and weeds Sand-strewn fields: salt for moss formation (curative), Cleaning vinegar several times a year targeted along the edges

Water fields:	preventive: until 2013: hydrogen peroxide (0.01 millimol per liter) and 2013-2015: Centibac (0.05 millimol per liter), 8 m3 of water per irrigation session approx. 400 irrigation sessions per field per year. 300 kg of salt per field (once every 2 years)
	Cleaning vinegar several times a year, directed along the edges

Appendix 2 Specifications of resources used

OQEMA

Safety data sheet

in accordance with Regulation (EC) No 1907/2006
(REACH)

Hydrogen peroxide 35 - < 50%

Version number: 13.0
Replaces the version of: 18.06.2013 (12)

Revision: 24.08.2016
First version: 17.09.2001

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identification

Trade name — **Hydrogen peroxide 35 - < 50%**

Registration number (REACH) — not relevant (mixture)

CAS number — not relevant (mixture)

1.2 Relevant identified uses of the substance or mixture and uses advised against

Relevant identified uses

Chemical product for various applications
Laboratory chemicals
Metalworking
Oxidizing agent
Bleach
Textile aid
Paper industry

1.3 Details of the supplier of the safety data sheet

OQEMA
Ekkersrijt 1301
5692 AJ Son
The Netherlands

Phone: ++31 (0) 499 - 471325

e-mail (authorized person) — msds-nl@oqema.com

1.4 Emergency telephone number

Poison Control Center

Country	Name	Postcode/city	Telephone	Fax
The Netherlands	National Poisons Information Center (NVIC)		++31 - 30 - 2748888	

As above or next to toxicological information center.
For use exclusively to inform professional caregivers in cases of acute poisoning.

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008 (CLP)

Classification according to GHS				
Section	**Hazard class**	**Category**	**Hazard class and category**	**Danger warning interpretation**
3.1O	acute oral toxicity	4	Acute Tox. 4	H302
3.1I	acute inhalation toxicity	4	Acute Tox. 4	H332
3.2	skin corrosion/irritation	2	Skin Irrit. 2	H315
3.3	serious eye damage/eye irritation	1	Eye Dam. 1	H318
3.8R	specific target organ toxicity in single exposure exposure (respiratory tract irritation)	3	STOT SE 3	H335

see SECTION 16 for full text

Additional information

This mixture does not contain any substances that are assessed as PBT or vPvB.

2.2 Label elements

Labelling according to Regulation (EC) No 1272/2008 (CLP) Labelling:

Signal word danger

Icons

GHS05, GHS07

Hazard statements

H302+H332 Harmful if swallowed or inhaled.
H315 Causes skin irritation.
H318 Causes serious eye damage.
H335 May cause irritation of the respiratory tract.

Safety recommendations

P220 Keep/store away from clothing/flammable materials.
P261 Avoid breathing dust/fume/gas/mist/vapours/spray.
P261 Avoid breathing mist/vapours/spray.
P280 Wear protective gloves/protective clothing/eye protection/face protection.

P302+P352 IF ON SKIN: Wash with plenty of water.
P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes.
minutes; remove contact lenses, if possible; continue rinsing.
P308+P311 IF (possible) exposure: Call a POISON CENTER/doctor.

Hazardous components for labelling hydrogen peroxide

2.3 Other dangers

There is no further information.

Results of PBT and vPvB assessment

This mixture does not contain any substances that are assessed as PBT or vPvB.

SECTION 3: Composition/information on ingredients

3.1 Substances

not relevant (mixture)

3.2 Mixtures

Description of the mixture

Hazardous components according to GHS

Name of the substance	Identification	Wt.%	Classification according to GHS	Icons
hydrogen peroxide	CAS No 7722-84-1 EC No 231-765-0 Catalogue no. 008-003-00-9 REACH reg. no. 01-2119485845-22-XXXX	35 - < 50	Ox. Liq. 1 / H271 Acute Tox. 4 / H302 Acute Tox. 4 / H332 Skin Corr. 1A / H314 Eye Dam. 1 / H318 STOT SE 3 / H335 Aquatic Chronic 3 / H412	

SECTION 4: First aid measures

4.1 Description of first aid measures

General remarks

Remove victim from danger area and lay down.
Remove contaminated clothing immediately.
Do not leave the victim unattended.
In case of doubt or if symptoms persist, consult a doctor.

By inhalation

Provide fresh air.
In case of irregular breathing or respiratory arrest, seek medical advice immediately and administer first aid.
In case of respiratory irritation, consult a physician.

In case of skin contact

Wash with plenty of soap and water.
If skin irritation occurs: consult a doctor.

By eye contact

In case of contact with eyes, rinse immediately with plenty of water and seek medical advice to collect.

Remove contact lenses, if present and easy to do. Continue rinsing.

If swallowed

Rinse mouth - DO NOT induce vomiting.
Seek immediate medical attention.

Information for the doctor

no

4.2 Most important acute and delayed symptoms and effects

Coughing, pain, choking and difficulty breathing.
Headache.
Malaise.

Gastrointestinal complaints.
Skin corrosion/irritation.

Risk of serious damage to eyes.
Risk of blindness.
Pulmonary edema.

4.3 Indication of any immediate medical attention and special treatment required

Later observation of pneumonia or pulmonary edema.
Symptoms may not appear for several hours, so medical observation is recommended for up to 48 hours after the exposure needed.

SECTION 5: Firefighting measures

5.1 Fire extinguishers

Suitable extinguishing agents

water jet, alcohol resistant foam, extinguishing powder, carbon dioxide (CO2)

Unsuitable extinguishing agents

full water jet

5.2 Special hazards arising from the substance or mixture

Hazardous decomposition products: Section 10.
Danger of container bursting.

Spontaneous decomposition of the material.

5.3 Advice for firefighters

In case of fire and/or explosion do not breathe fumes.
Coordinate fire-fighting measures with the environment.
Do not allow extinguishing water to enter drains or surface water.
Collect contaminated extinguishing water separately.
Extinguish with normal precautions from a reasonable distance.

Special protective equipment for firefighters

wear suitable respiratory equipment

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

For persons other than the emergency services

Bringing people to safety.
Ventilate the affected area.
Wear appropriate protective equipment (including personal protective equipment specified in Section 8 of the Safety Data Sheet) to prevent contamination of skin, eyes and personal clothing.

For the emergency services

Wear respiratory protective equipment when exposed to vapours/dusts/aerosols/gases.

6.2 Environmental precautions

Prevent product from entering drains, surface water or groundwater.
Retain and remove contaminated wash water.

6.3 Methods and material for containment and cleaning up

Advice on how to clean up the spilled product

Clean up any spilled/leaked material.
Kieselguhr (diatomite).
Sand.
Universal binder.

Appropriate containment methods

Use of absorbent materials.

Other information relating to the discharge or release

Place in suitable containers for disposal.
Ventilate the affected area.

6.4 Reference to other sections

Personal protective equipment: see section 8.
Incompatible materials: see section 10.
Instructions for disposal: see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling of the substance or mixture

Avoid contact with skin and eyes.
Do not breathe vapours.

Measures to prevent fire and aerosol or dust formation

Use local and general ventilation.

Specific comments/data

No.

Handling incompatible substances and mixtures

Keep away from.
Alkaline products.
Bases.
Organic materials.
Flammable substances.
Reducing agents.
Pulp/paper.

Measures to protect the environment

Avoid release to the environment.

Advice on general occupational hygiene

Do not eat, drink or smoke in work areas.
Wash hands after use.
Preventive skin protection (skin protection creams) is recommended.
Remove contaminated clothing and protective equipment before entering areas where work is being carried out.
eaten.

7.2 Conditions for safe storage, including any incompatibilities

Risk of ignition

No.

Incompatible substances or mixtures

Incompatible materials: see section 10.
Please note advice for storage of chemicals.

Protect from external exposure, such as

heat

Consideration of other advice

Keep away from food, drink and animal feeding stuffs.

Ventilation requirements

Store substances that emit vapours or gases that are hazardous to health in a place where they can be permanently extracted.
Measures to ensure adequate ventilation.

Compatible packaging

Only approved packaging (e.g. according to ADR) may be used.

7.3 Specific end use

No information available.

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Relevant DNELs of components of the mixture

Name of the substance	CAS No	End-point	Threshold value	Protection objective, route of the exposure	Used in	Exposure duration
hydrogen peroxide	7722-84-1	DNEL	1.4 mg/m³	human, via inhalation	(industrial) employees	chronic - lo- bald effects
hydrogen peroxide	7722-84-1	DNEL	3 mg/m³	human, via inhalation	(industrial) employees	acute - local ef- to affect

Relevant PNECs of components of the mixture

Name of the substance	CAS No	End point	Threshold- value	Environmental compa- ments	Exposure- duration
hydrogen peroxide	7722-84-1	PNEC	0.013 mg/l	fresh water	short term (one-time)
hydrogen peroxide	7722-84-1	PNEC	0.013 mg/l	seawater	short term (one-time)
hydrogen peroxide	7722-84-1	PNEC	0.014 mg/l	water	issue with intermediate pose
hydrogen peroxide	7722-84-1	PNEC	4.66 mg/l	sewage treatment ring installations (STP)	short term (one-time)
hydrogen peroxide	7722-84-1	PNEC	0.047 mg/kg	freshwater sediment	short term (one- (malignant)
hydrogen peroxide	7722-84-1	PNEC	0.047 mg/kg	short term (one-time)	marine sediment
hydrogen peroxide	7722-84-1	PNEC	0.002 mg/kg	soil	short term (one-time)

8.2 Exposure Control Measures

Appropriate technical measures

General ventilation.

Individual protection measures (personal protective equipment)

Eye/face protection

Wear eye/face protection.

Protection of the hands

Material	Material thickness	Breakthrough time of the glove material
NBR: acrylonitrile butadiene rubber	ÿ 0.7 mm	>480 minutes (permeation level: 6)
FKM: Fluoroelastomer	ÿ 0.65 mm	>480 minutes (permeation level: 6)

Wear suitable gloves.
Chemical resistant gloves tested according to EN 374 are suitable.
Determine leak tightness/impermeability before use.
When reusing the gloves, clean them before removing and then allow them to air thoroughly.
It is recommended to check the chemical resistance of the above in case of special applications
to check the safety gloves mentioned together with the supplier of the gloves.

Respiratory protection

In case of insufficient ventilation, wear suitable respiratory equipment.
Type: NO-P3 (against nitrous gases and particles, colour code: blue/white).

Control of environmental exposure

Take appropriate measures to prevent environmental contamination.
Prevent product from entering drains, surface water or groundwater.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

Prevent

Physical condition	liquid
Form	liquid
Colour	this information is not available
Smell	light sharp
Odor threshold	this information is not available

Other safety parameters

pH value	1 - 3 (20 °C)
Melting/freezing point	-52 °C
Initial boiling point and boiling range	114 °C
Flashpoint	not applicable

Evaporation rate	this information is not available
Flammability (solid, gas)	not relevant (liquid)

Explosion limits

Lower Explosive Limit (LEL)	this information is not available
Upper explosion limit (UEL)	this information is not available
Vapor pressure	23 hPa at 20 °C
Density	1.19 g/cm³ at 20 °C
Vapor density	this information is not available
Relative density	this information is not available

Solubility

Solubility in water	can be mixed in any ratio

Partition coefficient

n-octanol/water (log KOW)	-1.57
Auto-ignition temperature	this information is not available
Relative self-ignition temperature of solid substances	not relevant (Liquid)
Decomposition temperature	>60 °C

Viscosity

Kinematic viscosity	this information is not available
Dynamic viscosity	1.2 mPa s at 20 °C
Explosive properties	non-explosive
Oxidizing properties	cannot be classified as oxidizing

9.2 Other information

Surface tension	75.68 N/m (20 °C)

SECTION 10: Stability and reactivity

10.1 Reactivity

The mixture contains (a) reactive substance(s).
Strong oxidizing agents (strong oxidizing).

10.2 Chemical stability

Exothermic decomposition.
Danger of exothermic decomposition at high temperatures, in contact with other substances (such as acids, compounds of heavy metals or amines), friction or impact.

10.3 Possibility of hazardous reactions

Danger of violent reaction, ignition and explosion in contact with flammable or combustible materials.
Dangerous/dangerous reactions with.
Organic matter.
Dust.
Sweeping dirt.
Wood.
Paper and cardboard.
Edible oils and fats.
Heavy metals and their salts.
Bases.

10.4 Conditions to avoid

Keep away from heat.
UV radiation/sunlight.

10.5 Incompatible materials

keep away from acids, bases, salts of heavy metals and reducing substances, away love metal salts

10.6 Hazardous decomposition products

Oxygen.

SECTION 11: Toxicological information

11.1 Information on toxicological effects

No test data are available for the mixture as a whole.

Classification procedure

The method for classifying mixtures based on the components of the mixture (sum formula).

Classification according to GHS (1272/2008/EC, CLP)

Acute toxicity

Harmful if swallowed.
Harmful if inhaled.

Acute toxicity assessment (ATE) of the components in the mixture			
Name of the substance	CAS No	Route of exposure	ATE
hydrogen peroxide	7722-84-1	oral	1,193 mg/kg
hydrogen peroxide	7722-84-1	inhalation: vapour	11 mg/l/4h

Acute toxicity of the components in the mixture					
Name of the substance	CAS No	Exposure-ling route	End point	Value	Species
hydrogen peroxide	7722-84-1	oral	LD50	1,193 mg/kg	rat
hydrogen peroxide	7722-84-1	dermal	LD50	>2,000 mg/kg	rabbit

Skin corrosion/irritation

Causes skin irritation.

Serious eye damage/eye irritation

Causes serious eye damage.

Respiratory or skin sensitization

Cannot be classified as sensitizing.

Germ cell mutagenicity

Cannot be classified as a germ cell mutagen (mutagenic).

Carcinogenicity

Not classified as carcinogenic.

Reproductive toxicity

Cannot be classified as a toxic substance for reproduction.

Specific target organ toxicity - single exposure

May cause irritation of the respiratory tract.

Specific target organ toxicity - repeated exposure

Cannot be classified as a specific target organ toxicant (repeated exposure).

Danger of inhalation

Not to be classified as hazardous by aspiration.

SECTION 12: Ecological information

12.1 Toxicity

Aquatic toxicity (acute)

No test data are available for the mixture as a whole.

(Acute) aquatic toxicity of components of the mixture

(Acute) aquatic toxicity of components of the mixture

Name of the substance	CAS No	End point	Value	Species	Exposure-duration of term
hydrogen peroxide	7722-84-1	LC50	16.4 mg/l	fish	96 h
hydrogen peroxide	7722-84-1	ErC50	1.38 mg/l	algae	72 h

Aquatic toxicity (chronic)

No test data are available for the mixture as a whole.

(Chronic) aquatic toxicity of components of the mixture

(Chronic) aquatic toxicity of components of the mixture

Name of the substance	CAS No	End point	Value	Species	Exposure-duration of term
hydrogen peroxide	7722-84-1	EC50	466 mg/l	micro-organisms	30 min
hydrogen peroxide	7722-84-1	NOEC	0.63 mg/l	invertebrate aquatic organisms	21 d
hydrogen peroxide	7722-84-1	LOEC	1.25 mg/l	invertebrate aquatic organisms	21 d

12.2 Persistence and degradability

Biodegradation

The relevant substances of the mixture are readily biodegradable.

Persistence

No data available.

12.3 Bioaccumulation

No data available.

12.4 Mobility in the soil

No data available.

12.5 Results of PBT and vPvB assessment

This mixture does not contain any substances that are assessed as PBT or vPvB.

12.6 Other adverse effects

No data available.

Endocrine disrupting capacity

None of the ingredients are listed.

Comments

Water Hazard Class: 1 (Slightly hazardous to water)

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Dispose of this material and its packaging as hazardous waste.

Information on wastewater discharge

Do not throw waste into the sink.

Waste treatment of containers/packaging

It is hazardous waste; only approved packaging (e.g. according to ADR) may be used.
used.
Contaminated packaging can be treated like the substance itself.

Comments

Please note the relevant national or regional provisions.

SECTION 14: Transport information

14.1 UN number	2014
14.2 Proper shipping name in accordance with the UN model regulations	HYDROGEN PEROXIDE, AQUEOUS SOLUTION
14.3 Transport hazard class(es)	
Class	5.1
Additional hazard/additional hazards	8 (corrosive effects)
14.4 Packaging group	II
14.5 Environmental hazards	not hazardous to the environment, according to the regulations for the transport of dangerous goods

14.6 Special precautions for user

The regulations for dangerous goods (ADR) must also be complied with in the company.

14.7 Transport in bulk according to Annex II of MARPOL and the IBC Code

The cargo is not intended to be transported in bulk.

14.8 Information for each of the UN Regulations

Transport of dangerous goods by road, rail or inland waterway (ADR/RID/ADN)

UN number	2014
Correct shipping name	UN2014, HYDROGEN PEROXIDE, SOLUTION IN WATER, 5.1 (8), II, (E)
Class	5.1
Classification code	OC1
Packaging group	II
Hazard labels	5.1+8

Exempted Quantities (EQ)	E2
Limited Quantities (LQ)	1 L
Transport category	2.
Tunnel restriction code	E
Hazard Identification Number (GEVI)	58

International Maritime Dangerous Goods Code (IMDG)

UN number	2014
Correct shipping name	UN2014, HYDROGEN PEROXIDE, AQUEOUS SOLUTION, 5.1 (8), II
Class	5.1
Additional hazard/additional hazards	8
Packaging group	II
Hazard labels	5.1+8

Special provisions	-
Exempted Quantities (EQ)	E2
Limited Quantities (LQ)	1 L
EmS	FH, SQ

Stowage category	D
Segregation group	16 - Peroxides

International Civil Aviation Organization (ICAO-IATA/DGR)

Transport prohibited.

UN number	2014
Correct shipping name	
Information on the transport document (shipper's declaration)	salvage packaging
Class	5.1
Additional hazard/additional hazards	8
Packaging group	II
Hazard labels	5.1+8

Exempted Quantities (EQ)	E2
Limited Quantities (LQ)	0.5 L

SECTION 15: Regulations

15.1 Specific safety, health and environmental regulations and legislation for the substance or the mixture

Relevant provisions of the European Union (EU)

Restrictions according to REACH, Annex XVII

none of the ingredients are listed

List of substances subject to authorisation (REACH, Annex XIV)

none of the ingredients are listed

Substance of Very High Concern (SVHC)			
Name according to inventory	**CAS No**	**Recorded in**	**Comments**
not mentioned			

Seveso Directive

2012/18/EU (Seveso III)			
No.	**Hazardous substance/hazard categories**	**Threshold values (tonnes) for application of regulations for low-threshold establishments and high-threshold establishments**	**Nuts**
	not awarded		

Directive 2011/65/EU on the restriction of the use of certain dangerous substances substances in electrical and electronic equipment (RoHS) - Annex II

none of the ingredients are listed

Regulation 166/2006/EC on the establishment of a European register for the Release and Transfer of Pollutants (PRTR)

none of the ingredients are listed

Directive 2000/60/EC establishing a framework for Community action concerning water policy

none of the ingredients are listed

Regulation 98/2013/EU on the marketing and use of precursors for explosives

Explosives precursors subject to restrictions			
Name of the substance	**CAS No**	**Registration type**	**Boundary value the**
hydrogen peroxide	7722-84-1	Appendix I	12% w/w

Legend

Appendix I Substances which may not be offered to private individuals, either on their own or in mixtures or substances containing the substances mentioned, unless the concentration is equal to or less than the limit values stated below

Störfall-Verordnung - 12. BImSchV (Hazardous Incident Ordinance)

No.	Hazardous substance/hazard categories	Threshold values (tonnes)		Nuts
3	oxidizing	50	200	

National regulations (Netherlands)

General Assessment Methodology for substances and preparations (ABM)

Indication of water hazard	
Category	**Text**
7	toxic to aquatic organisms

Remediation effort **B**

SZW list of CMR effects

none of the ingredients are listed

SECTION 16: Other information

Notification of changes (revised safety data sheet)

Notification of changes: Section 2, 3, 4, 8, 11

Abbreviations and acronyms

Abbreviations and acronyms

Abbr.	Descriptions of the abbreviations used
Acute Tox.	acute toxicity
ADN	European Agreement concerning the International Carriage of Dangerous Goods by Internal Navigation Voies goods on inland waterways)
ADR	European Agreement concerning the International Carriage of Dangerous Goods by Road (European Agreement concerning the International Carriage of Dangerous Goods by Road)
Aquatic Chronic	chronic hazard to the aquatic environment
ATE	acute toxicity assessment
CAS	Chemical Abstracts Service (database for chemical substances and their unique number, the CAS registration number)
catalogue no.	the catalogue number is the identification code used in Part 3 of Annex VI to Regulation (EC) No 1272/2008
CLP	Regulation (EC) No 1272/2008 on classification, labelling and packaging (Classification, Labelling and Packaging of substances and mixtures
CMR	Carcinogenic, Mutagenic or Toxic to Reproduction
DGR	Dangerous Goods Regulations, regulations for the carriage of dangerous goods, see IATA/DGR
DNEL	Derived No-Effect Level
EC No	The EC register (EINECS, ELINCS and the NLP register) is the source for the seven-digit EC number as code number for substances (European Union)
EINECS	European Inventory of Existing Commercial Chemical Substances
ELINCS	European List of Notified Chemical Substances
EmS	Emergency Schedule
Eye Dam.	causes serious eye damage
Eye Irrit.	irritating to eyes
GHS	"Globally Harmonized System of Classification and Labelling of Chemicals", developed by the United Nations
IATA	International Air Transport Association
IATA/DGR	Dangerous Goods Regulations (DGR) for aviation (IATA)
ICAO	International Civil Aviation Organization
IMDG	International Maritime Dangerous Goods Code (IMDG Code)

Abbreviations and acronyms	
Abbr.	**Descriptions of the abbreviations used**
MARPOL	International Convention for the Prevention of Pollution from Ships (abbr. of Marine Pollutant)
NLP	No-Longer Polymer (no longer polymer)
Ox. Liq.	oxidizing liquid
PBT	Persistent, Bioaccumulative and Toxic
PNEC	predicted no-effect concentration
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals (Registration, Evaluation, Authorisation and Restriction of Chemicals) and authorisation and restrictions on chemicals)
RID	Regulations concerning the international carriage of dangerous goods by rail
Skin Corr.	skin corrosive
Skin Irrit.	skin irritating
STOT SE	specific target organ toxicity - single exposure
zPzB	very persistent and very bioaccumulative

Key literature references and data sources

Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures.

Regulation (EC) No 1907/2006 (REACH), amended by 2015/830/EU.
Transport of dangerous goods by road, rail or inland waterway (ADR/RID/ADN).
International Maritime Dangerous Goods Code (IMDG).
Dangerous Goods Regulations (DGR) for aviation (IATA).

Classification procedure

Physical and chemical properties.
Health hazards.
Environmental hazards.
The method for classifying mixtures based on the components of the mixture (sum formula).

List of relevant sentences (code and full text as in chapters 2 and 3) mentioned)

List of relevant sentences (code and full text as mentioned in chapters 2 and 3)	
Code	**Text**
H271	may cause fire or explosion; strong oxidizer
H302	harmful if swallowed
H314	causes serious burns and eye damage
H315	causes skin irritation
H318	causes serious eye damage

Hydrogen peroxide 35 - < 50%

List of relevant sentences (code and full text as mentioned in chapters 2 and 3)	
Code	**Text**
H332	harmful if inhaled
H335	may cause irritation of the respiratory tract
H412	harmful to aquatic life with long lasting effects

Disclaimer

This information is based on the current state of our knowledge.
This ViB has been compiled and is intended exclusively for this product.

BIOMIX - ATM

BIOMIX-ATM is een vloeibaar reinigingsmiddel op basis van enzymen en verwijdert alle atmosferische vervuiling en aanslag op o.a. daken , muren , platen ,bestrating , tegels en grafstenen .
BIOMIX-ATM is veilig voor mens , dier en milieu .
Gemakkelijk in gebruik .Breng de vloeistof aan met een sproeier , gieter of lage druk .
Doe verder niets,de enzymen in BIOMIX-ATM doen het werk .Na korte tijd is de vervuiling verdwener

Voor gebruik BIOMIX -ATM

Na gebruik BIOMIX-ATM

Bewerkt met BIOMIX-ATM

Voor

Tijdens

Na

Links bewerkt met BIOMIX-ATM

Rechts bewerkt met BIOMIX-ATM

Safety data sheet according to 1907/2006/EC, Article 31

date of printing: 09.03.2015 Version number 1 Revision of: 15.11.2014

1 Identification of the substance or mixture and of the company/undertaking

· **Product identification**

· **Trade name: Biomix ATM**

· **Article number:** BIO 5 ·

Relevant identified uses of the substance or mixture and uses advised against No further relevant information available.

· **Application of the substance / the preparation** Cleaning agent

· **Details of the supplier of the safety data sheet**

· **Manufacturer/Supplier:**

NV Bionova

Evangeliestraat 66A
9220 Hamme

Belgium
Tel.: 0032 35 55 43 93 Fax.:
0032 52 55 47 21 VAT: BE
0458.509.397 Email:
info@bionova.be www.bionova.be

· **Intelligence sector:** product safety department

· **Emergency telephone number:**

Bionova NV

During normal opening times: +32(0) 52 55 43 93

2 Identification of the hazards

· **Classification of the substance or mixture**

· **Classification according to Regulation (EC) No 1272/2008** The product is not classified according to the CLP regulation.

Label elements Labelling according **to Regulation (EC) No 1272/2008** Void **Hazard pictograms** Void **Signal word** Void **Hazard statements** Void

Precautionary statements

P102 **Other hazards** Results **of PBT and vPvB assessment** PBT : Not applicable. **vPvB:** Not applicable.

Keep out of reach of children.

3 Composition and information on ingredients

· **Chemical characterization: Mixtures** ·

Description: Mixture of substances listed below with non-hazardous additions.

· **Dangerous components:** CAS:

34590-94-8 EINECS: 252-104-2	(2-methoxymethylethoxy)propanol	1- 5%

· **Regulation (EC) No 648/2004 on detergents / Labelling of contents of** non-ionic surfactants, amphoteric

surfactants	< 5%
enzymes	

4 First aid measures

· **Description of first aid measures** · **General information:** No special measures required.

(Continued on page 2)

Safety data sheet according to 1907/2006/EC, Article 31

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Trade name: Biomix ATM

(Continued from page 1)

· **After inhalation:** Provide fresh air; consult a doctor in case of complaints.
· **After skin contact:** Generally the product does not irritate the skin. · **After eye contact:** Rinse opened eye for several minutes under running water. · **After swallowing:** If symptoms persist consult a doctor. · **Information for doctor:** · **Most important symptoms and effects, both acute and delayed** No further relevant information available.
· **Indication of any immediate medical attention and special treatment needed** No further relevant information available.

5 Fire Fighting Measures

· **Fire extinguishers**
· **Suitable extinguishing media:**
CO2, extinguishing powder or water jet. Fight larger fires with water jet or with alcohol-resistant foam.

Water
· **Special hazards arising from the substance or mixture** No further relevant information available.
· **Advice for firefighters** · **Special protective clothing:** No special measures required.

6 Measures in case of accidental release of the substance or mixture

· **Personal precautions, protective equipment and emergency procedures** High risk of slipping due to leaking/spilling product.
· **Environmental precautions:** Dilute with plenty of water.
Do not allow to enter sewers/surface water/groundwater.
· **Methods and material for containment and cleaning up:** Dilute with plenty of water.
Absorb with liquid-binding material (sand, diatomaceous earth, acid binder, universal binder, sawdust).
· **Reference to other sections** Information on safe handling - see Chapter 7.
Information on personal protective equipment - see Chapter 8.
Salvage information – see Chapter 13.

7 Handling and storage

· **Handling:** ·
Precautions for safe handling No special measures required.

· **Information regarding fire and explosion hazard:** No special measures required.

· **Conditions for safe storage, including any incompatibilities** · **Storage:** · **Requirements for storerooms and containers:** No special requirements.
· **Information about common storage:** Keep away from food and drink.
· **Further information about storage requirements:** None.
· **Specific end use(s)** No further relevant information available.

8 Exposure Controls/Personal Protection

· **Additional information regarding the design of technical installations:** No additional data. See 7.

(Continued on page 3)

Safety data sheet

according to 1907/2006/EC, Article 31

date of printing: 09.03.2015 Version number 1 Revision of: 15.11.2014

Trade name: Biomix ATM

(Continued from page 2)

· **Control parameters**

· **Components with limit values that must be observed with regard to the working area:**
34590-94-8 (2-methoxymethylethoxy)propanol
MAK (NL) Long term value: 300 mg/m³ IOELV (EU) Long term value: 308 mg/m³, 50 ppm skin

· **Additional information:** Lists that were valid at the time of compilation served as a basis.

· **Exposure controls**
· **Personal protective equipment:**
· **General protective and health measures:**
The usual precautions for handling chemicals should be observed.
· **Respiratory protection:** Not necessary.
· **Hand protection:**
The glove material must be impermeable and resistant to the product/substance/preparation.
Due to failed tests no recommendation for glove material can be made for the product/preparation/ the chemical mixture is released.
Select glove material taking into account penetration times, permeation rates and degradation.
· **Glove material**
The choice of a suitable glove depends not only on the material, but also on other quality features and varies from manufacturer to manufacturer. Since the product is made of multiple materials composed, the durability of the glove materials cannot be calculated in advance and must therefore be tested before use.
· **Penetration time of the glove material**
The exact penetration time can be found out from the glove manufacturer; please take this into account.
· **Eye protection:** When pouring, the use of safety glasses is recommended.
· **Body protection:** Wear suitable protective clothing

9 Physical and chemical properties

· **Information on basic physical and chemical properties**	
· **General information**	
· **Prevent:**	
Form:	Liquid
Colour:	Green
· **Smell:**	Characteristic
· **Odour threshold:**	Not exactly.
· **pH value at 20 °C:**	10.5 (dilution 10%)
· **Change of state**	
Melting point/melting range:	Not exactly.
Boiling point/boiling point range:	100 °C
· **Flash point:**	Not usable.
· **Flammability (solid, gaseous):** Not applicable.	
· **Ignition temperature:**	
Decomposition temperature:	Not exactly.
· **Self-ignition:**	The product does not self-ignite.
· **Danger of explosion:**	The product is not explosive.
· **Explosion limits:**	
Lower:	Not exactly.
Upper:	Not exactly.

(Continued on page 4)

Safety data sheet according to 1907/2006/EC, Article 31

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Trade name: Biomix ATM

(Continued from page 3)

· **Vapor pressure:**	Not exactly.
Density at 20 °C:	1.02 g/cm³
· **Relative density**	Not exactly.
· **Vapour density**	Not exactly.
· **Evaporation rate**	Not exactly.
· **Solubility in/miscibility with Water:**	Fully miscible.
· **Partition coefficient (n-octanol/water):** Not determined.	
· **Viscosity**	
Dynamic:	Not exactly.
Kinematic:	Not exactly.
· **Other information**	No further relevant information available.

10 Stability and reactivity

· **Reactivity** ·
Chemical stability · **Thermal**
decomposition / conditions to be avoided: No decomposition if used according to specifications.
· **Possibility of hazardous reactions** No dangerous reactions known.
· **Conditions to avoid** No further relevant information available.
· **Incompatible materials:** No further relevant information available.
· **Hazardous decomposition products:** No hazardous decomposition products known.

11 Toxicological information

· **Information on toxicological effects** · **Acute toxicity:** · **Primary**
irritant effect: · **on the skin:**
No irritating effect. · **on the eye:** No irritating effect.
· **Hypersensitivity:** No hypersensitivity effect known.

12 Ecological information

· **Toxicity** ·
Aquatic toxicity: No further relevant information available.
· **Persistence and degradability** No further relevant information available.
· **Behaviour in environmental compartments:** · **Bioaccumulative potential** No further relevant information available.
· **Mobility in soil** No further relevant information available.
· **Further ecological information:** ·
General information: Water hazard (NL) 11: Slightly harmful to aquatic organisms.
Do not discharge undiluted or in large quantities into groundwater, surface water or sewage system.
· **Results of PBT and vPvB assessment** · **PBT:** Not applicable. · **vPvB:** Not applicable.
· **Other adverse effects** No further relevant information available.

NL

(Continued on page 5)

Safety data sheet
according to 1907/2006/EC, Article 31

date of printing: 09.03.2015 Version number 1 Revision of: 15.11.2014

Trade name: Biomix ATM

(Continued from page 4)

13 Removal Instructions

· **Waste treatment methods**
· **Recommendation:** Small quantities can be disposed of together with household waste.

· **Uncleaned packaging:**
· **Recommendation:** The packaging can be reused or recycled after cleaning.
· **Recommended cleaning agent:** Water, possibly with the addition of cleaning agents.

14 Information regarding transport

· **UN number**	
· **ADR, ADN, IMDG, IATA**	lapses
· **Proper shipping name according to the UN model regulations**	
· **ADR, ADN, IMDG, IATA** expire	
· **Transport hazard class(es)**	
· **ADR, ADN, IMDG, IATA**	
· **class**	lapses
· **Packaging group:**	
· **ADR, IMDG, IATA**	lapses
· **Environmental hazards:**	
· **Marine pollutant:**	No
· **Special precautions for user** Not applicable.	
· **Transport in bulk in accordance with Annex II to MARPOL 73/78 and the IBC Code** Not applicable.	
· **UN "Model Regulation":**	-

15 Regulations

· **Specific safety, health and environmental regulations/legislation for the substance or mixture**

· **SZW list of carcinogenic substances**
none of the ingredients are listed.

· **SZW list of mutagenic substances**
none of the ingredients are listed.

· **NON-exhaustive list of substances toxic to reproduction - Fertility**
none of the ingredients are listed.

· **NON-exhaustive list of substances toxic to reproduction - Development**
none of the ingredients are listed.

· **NON-exhaustive list of substances toxic to reproduction - Breastfeeding**
none of the ingredients are listed.

· **National regulations:**

· **Technical information air:**

Class share in %	
Water	84.6
NK	10.0

· **Water hazard class:** Water hazard (NL) 11: Remediation effort B
· **Danish MAL-CODE** 4-3

(Continued on page 6)

Safety data sheet according to 1907/2006/EC, Article 31

date of printing: 09.03.2015 Version number 1 Revision of: 15.11.2014

Trade name: Biomix ATM

(Continued from page 5)

· **Chemical safety assessment:** A
chemical safety assessment has not been carried out.
A chemical safety assessment has not been carried out.

16 Other information

This information is based on our current state of knowledge. However, it does not describe any guarantee of product properties and does not establish any contractual legal relationship.

· **Abbreviations and acronyms:**
ADR: Accord européen sur le transport des merchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road)
IMDG: International Maritime Code for Dangerous Goods
IATA: International Air Transport Association
GHS: Globally Harmonized System of Classification and Labeling of Chemicals
EINECS: European Inventory of Existing Commercial Chemical Substances
ELINCS: European List of Notified Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
MAL Code: Måleteknisk Arbejdshygiejnisk Luftbehov (Regulation for the labeling concerning inhalation hazards, Denmark)

NL

Biomix® ATM

Manufacturer

Bionova NV

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info@biomix.eu ÿ info@bionova.be
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458 509 397 ÿ HR 605 898
KBC 434-4238571-63 ÿ IBAN BE 40 4344 2385 7163 ÿ BIC KREDBEBB

General description

Biomix® ATM is a liquid environmentally friendly and biological cleaning agent based on enzymes that removes all pollution and deposits of atmospheric origin.
Biomix® ATM is the ideal cleaning agent for all outdoor surfaces.
Apply Biomix® ATM and do **nothing else,** the enzymes and nature will do the work for you.
When nature is allowed to do its work (rain and wind) i.e. “WITHOUT SCRUBBING” and depending on the degree and nature of the pollution/contamination, the maximum result is achieved after just a few weeks.

Areas of application

Biomix® ATM can be used on:

- Flat and sloping roofs: slates, tiles, corrugated iron, thatch, roofing, etc.
- Facades: brick, concrete, plaster, crepi, wood, etc., painted or not
- Terraces/driveways: paving stones, tiles, slabs, tropical hardwood, etc.
- Ornaments/garden statues: terracotta, concrete, plastic, natural stone, bluestone, etc. • Bluestone (bluestone): sills, gravestones, etc. • Garden furniture: teak, plastic, metal, etc.

Caution is advised when applying or splashing the product on certain types of powder coating. Test the product on an inconspicuous area first.

Biomix® ATM

Instructions for use

Biomix®ATM is diluted with water in a ratio of 1:1 to 1:5. Apply the liquid preferably to a dry or slightly damp surface with a sprayer, watering can or low pressure. Do nothing else, the enzymes in Biomix®ATM do the work. After a short time the contamination will be gone.

Do not apply at ambient and substrate temperatures < 8°C and when rain can be expected within 24 hours. Do not apply at high temperatures and in full sun.

Biomix®ATM is a concentrated product that can be used depending on the degree of contamination. are diluted with water:

- **Severe contamination:** dilute 1 L with 1 L of water and apply liberally to the area to be treated surface.
- **Normal soiling:** dilute 1 L with 2 L of water and apply liberally. • **Light soiling:** dilute 1 L with 3 L of water and apply liberally.
- **Preventative:** dilute 1 L with 5 L of water and apply liberally.

Consumption: ± 10m² with 1 litre of diluted product depending on the level of contamination.

Unique features

- Biodegradable: 97% in 14 days (OECD 302B test)
- Environmentally friendly.
- Long-lasting effect.
- Economical in use.
- Works preventively.

User benefits

Biomix® ATM saves labour, the enzymes and nature do the work for you.

Biomix® ATM is economical to use.

Product specifications

Packaging: 1 liter bottle, 5 liter jerry can, 20 liter jerry can, 200 liter PE barrel, 1000 liter IBC.

Appearance: green liquid.

Pieces/box: 12 (bottles) x 1 L and 4 x 5 L.

Boxes/pallet: 1 L bottle: 45 boxes.
5 L jerrycan: 32 boxes.
20L jerrycan: 24 pieces.

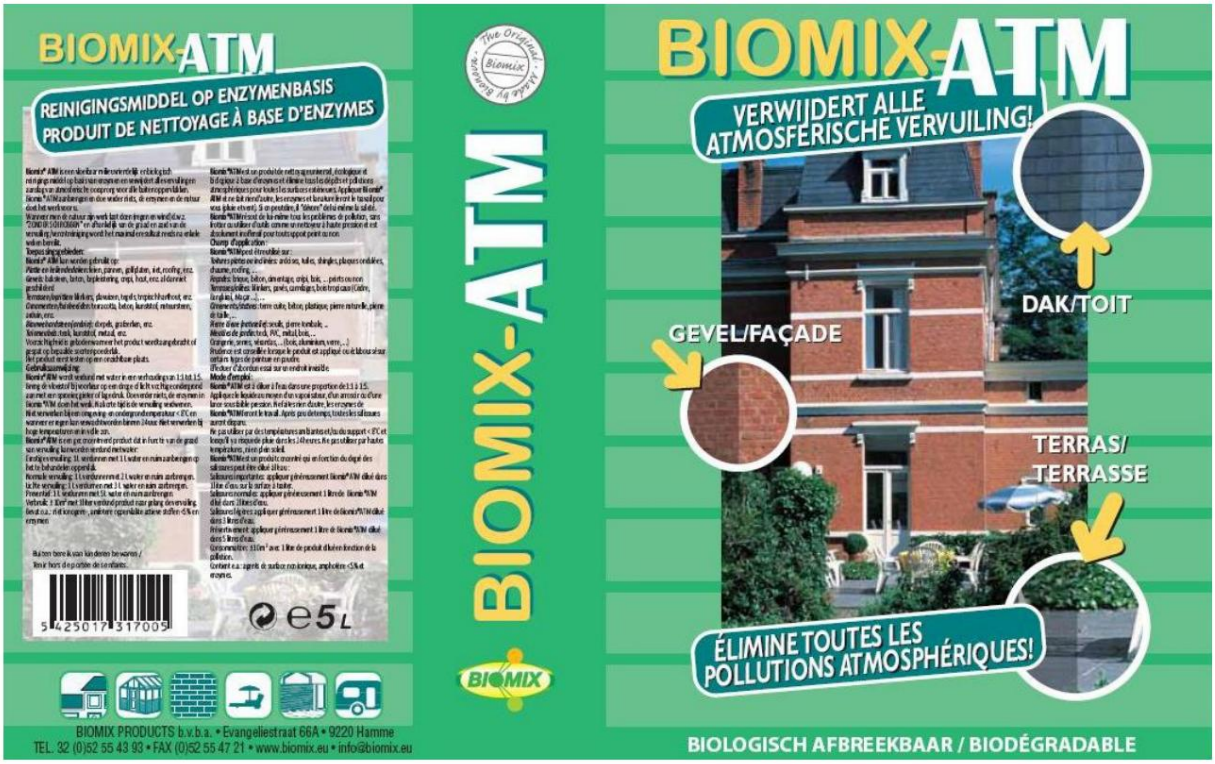
Weight per box: 12 x 1L bottle: 13.35 kg.
4 x 5 L jerrycan: 21.35 kg.

Biomix® ATM

EAN codes: 1 L bottle: 5425017317012
Box 12x1L: 5425017317029
5 L jerrycan: 5425017317005
Box 4x5L: 5425017317043

Shelf life: 3 years. Store in a cool (maximum 20°C) and frost-free place.

Label



OQEMA

Safety data sheet

in accordance with Regulation (EC) No 1907/2006
(REACH)

Hydrogen peroxide 35 - < 50%

Version number: 13.0
Replaces the version of: 18.06.2013 (12)

Revision: 24.08.2016
First version: 17.09.2001

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identification

Trade name — **Hydrogen peroxide 35 - < 50%**

Registration number (REACH) — not relevant (mixture)

CAS number — not relevant (mixture)

1.2 Relevant identified uses of the substance or mixture and uses advised against

Relevant identified uses

Chemical product for various applications
Laboratory chemicals
Metalworking
Oxidizing agent
Bleach
Textile aid
Paper industry

1.3 Details of the supplier of the safety data sheet

OQEMA
Ekkersrijt 1301
5692 AJ Son
The Netherlands

Phone: ++31 (0) 499 - 471325

e-mail (authorized person) — msds-nl@oqema.com

1.4 Emergency telephone number

Poison Control Center

Country	Name	Postcode/city	Telephone	Fax
The Netherlands	National Poisons Information Center (NVIC)		++31 - 30 - 2748888	

As above or next to toxicological information center.
For use exclusively to inform professional caregivers in cases of acute poisoning.

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008 (CLP)

Classification according to GHS				
Section	**Hazard class**	**Category**	**Hazard class and category**	**Danger warning interpretation**
3.1O	acute oral toxicity	4	Acute Tox. 4	H302
3.1I	acute inhalation toxicity	4	Acute Tox. 4	H332
3.2	skin corrosion/irritation	2	Skin Irrit. 2	H315
3.3	serious eye damage/eye irritation	1	Eye Dam. 1	H318
3.8R	specific target organ toxicity in single exposure exposure (respiratory tract irritation)	3	STOT SE 3	H335

see SECTION 16 for full text

Additional information

This mixture does not contain any substances that are assessed as PBT or vPvB.

2.2 Label elements

Labelling according to Regulation (EC) No 1272/2008 (CLP) Labelling:

Signal word danger

Icons

GHS05, GHS07

Hazard statements

H302+H332 Harmful if swallowed or inhaled.
H315 Causes skin irritation.
H318 Causes serious eye damage.
H335 May cause irritation of the respiratory tract.

Safety recommendations

P220 Keep/store away from clothing/flammable materials.
P261 Avoid breathing dust/fume/gas/mist/vapours/spray.
P261 Avoid breathing mist/vapours/spray.
P280 Wear protective gloves/protective clothing/eye protection/face protection.

P302+P352 IF ON SKIN: Wash with plenty of water.
P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes.
minutes; remove contact lenses, if possible; continue rinsing.
P308+P311 IF (possible) exposure: Call a POISON CENTER/doctor.

Hazardous components for labelling hydrogen peroxide

2.3 Other dangers

There is no further information.

Results of PBT and vPvB assessment

This mixture does not contain any substances that are assessed as PBT or vPvB.

SECTION 3: Composition/information on ingredients

3.1 Substances

not relevant (mixture)

3.2 Mixtures

Description of the mixture

Hazardous components according to GHS

Name of the substance	Identification	Wt.%	Classification according to GHS	Icons
hydrogen peroxide	CAS No 7722-84-1 EC No 231-765-0 Catalogue no. 008-003-00-9 REACH reg. no. 01-2119485845-22-XXXX	35 - < 50	Ox. Liq. 1 / H271 Acute Tox. 4 / H302 Acute Tox. 4 / H332 Skin Corr. 1A / H314 Eye Dam. 1 / H318 STOT SE 3 / H335 Aquatic Chronic 3 / H412	

SECTION 4: First aid measures

4.1 Description of first aid measures

General remarks

Remove victim from danger area and lay down.
Remove contaminated clothing immediately.
Do not leave the victim unattended.
In case of doubt or if symptoms persist, consult a doctor.

By inhalation

Provide fresh air.
In case of irregular breathing or respiratory arrest, seek medical advice immediately and administer first aid.
In case of respiratory irritation, consult a physician.

In case of skin contact

Wash with plenty of soap and water.
If skin irritation occurs: consult a doctor.

By eye contact

In case of contact with eyes, rinse immediately with plenty of water and seek medical advice to collect.

Remove contact lenses, if present and easy to do. Continue rinsing.

If swallowed

Rinse mouth - DO NOT induce vomiting.
Seek immediate medical attention.

Information for the doctor

no

4.2 Most important acute and delayed symptoms and effects

Coughing, pain, choking and difficulty breathing.
Headache.
Malaise.

Gastrointestinal complaints.
Skin corrosion/irritation.

Risk of serious damage to eyes.
Risk of blindness.
Pulmonary edema.

4.3 Indication of any immediate medical attention and special treatment required

Later observation of pneumonia or pulmonary edema.
Symptoms may not appear for several hours, so medical observation is recommended for up to 48 hours after the exposure needed.

SECTION 5: Firefighting measures

5.1 Fire extinguishers

Suitable extinguishing agents

water jet, alcohol resistant foam, extinguishing powder, carbon dioxide (CO2)

Unsuitable extinguishing agents

full water jet

5.2 Special hazards arising from the substance or mixture

Hazardous decomposition products: Section 10.
Danger of container bursting.

Spontaneous decomposition of the material.

5.3 Advice for firefighters

In case of fire and/or explosion do not breathe fumes.
Coordinate fire-fighting measures with the environment.
Do not allow extinguishing water to enter drains or surface water.
Collect contaminated extinguishing water separately.
Extinguish with normal precautions from a reasonable distance.

Special protective equipment for firefighters

wear suitable respiratory equipment

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

For persons other than the emergency services

Bringing people to safety.
Ventilate the affected area.
Wear appropriate protective equipment (including personal protective equipment specified in Section 8 of the Safety Data Sheet) to prevent contamination of skin, eyes and personal clothing.

For the emergency services

Wear respiratory protective equipment when exposed to vapours/dusts/aerosols/gases.

6.2 Environmental precautions

Prevent product from entering drains, surface water or groundwater.
Retain and remove contaminated wash water.

6.3 Methods and material for containment and cleaning up

Advice on how to clean up the spilled product

Clean up any spilled/leaked material.
Kieselguhr (diatomite).
Sand.
Universal binder.

Appropriate containment methods

Use of absorbent materials.

Other information relating to the discharge or release

Place in suitable containers for disposal.
Ventilate the affected area.

6.4 Reference to other sections

Personal protective equipment: see section 8.
Incompatible materials: see section 10.
Instructions for disposal: see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling of the substance or mixture

Avoid contact with skin and eyes.
Do not breathe vapours.

Measures to prevent fire and aerosol or dust formation

Use local and general ventilation.

Specific comments/data

No.

Handling incompatible substances and mixtures

Keep away from.
Alkaline products.
Bases.
Organic materials.
Flammable substances.
Reducing agents.
Pulp/paper.

Measures to protect the environment

Avoid release to the environment.

Advice on general occupational hygiene

Do not eat, drink or smoke in work areas.
Wash hands after use.
Preventive skin protection (skin protection creams) is recommended.
Remove contaminated clothing and protective equipment before entering areas where work is being carried out.
eaten.

7.2 Conditions for safe storage, including any incompatibilities

Risk of ignition

No.

Incompatible substances or mixtures

Incompatible materials: see section 10.
Please note advice for storage of chemicals.

Protect from external exposure, such as

heat

Consideration of other advice

Keep away from food, drink and animal feeding stuffs.

Ventilation requirements

Store substances that emit vapours or gases that are hazardous to health in a place where they can be permanently extracted.
Measures to ensure adequate ventilation.

Compatible packaging

Only approved packaging (e.g. according to ADR) may be used.

7.3 Specific end use

No information available.

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Relevant DNELs of components of the mixture

Name of the substance	CAS No	End-point	Threshold value	Protection objective, route of the exposure	Used in	Exposure duration
hydrogen peroxide	7722-84-1	DNEL	1.4 mg/m³	human, via inhalation	(industrial) employees	chronic - lo- bald effects
hydrogen peroxide	7722-84-1	DNEL	3 mg/m³	human, via inhalation	(industrial) employees	acute - local ef- to affect

Relevant PNECs of components of the mixture

Name of the substance	CAS No	End point	Threshold- value	Environmental compa- ments	Exposure- duration
hydrogen peroxide	7722-84-1	PNEC	0.013 mg/l	fresh water	short term (one-time)
hydrogen peroxide	7722-84-1	PNEC	0.013 mg/l	seawater	short term (one-time)
hydrogen peroxide	7722-84-1	PNEC	0.014 mg/l	water	issue with intermediate pose
hydrogen peroxide	7722-84-1	PNEC	4.66 mg/l	sewage treatment ring installations (STP)	short term (one-time)
hydrogen peroxide	7722-84-1	PNEC	0.047 mg/kg	freshwater sediment	short term (one- (malignant)
hydrogen peroxide	7722-84-1	PNEC	0.047 mg/kg	short term (one-time)	marine sediment
hydrogen peroxide	7722-84-1	PNEC	0.002 mg/kg	soil	short term (one-time)

8.2 Exposure Control Measures

Appropriate technical measures

General ventilation.

Individual protection measures (personal protective equipment)

Eye/face protection

Wear eye/face protection.

Protection of the hands

Material	Material thickness	Breakthrough time of the glove material
NBR: acrylonitrile butadiene rubber	ÿ 0.7 mm	>480 minutes (permeation level: 6)
FKM: Fluoroelastomer	ÿ 0.65 mm	>480 minutes (permeation level: 6)

Wear suitable gloves.
Chemical resistant gloves tested according to EN 374 are suitable.
Determine leak tightness/impermeability before use.
When reusing the gloves, clean them before removing and then allow them to air thoroughly.
It is recommended to check the chemical resistance of the above in case of special applications
to check the safety gloves mentioned together with the supplier of the gloves.

Respiratory protection

In case of insufficient ventilation, wear suitable respiratory equipment.
Type: NO-P3 (against nitrous gases and particles, colour code: blue/white).

Control of environmental exposure

Take appropriate measures to prevent environmental contamination.
Prevent product from entering drains, surface water or groundwater.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

Prevent

Physical condition	liquid
Form	liquid
Colour	this information is not available
Smell	light sharp
Odor threshold	this information is not available

Other safety parameters

pH value	1 - 3 (20 °C)
Melting/freezing point	-52 °C
Initial boiling point and boiling range	114 °C
Flashpoint	not applicable

Evaporation rate	this information is not available
Flammability (solid, gas)	not relevant (liquid)
Explosion limits	
Lower Explosive Limit (LEL)	this information is not available
Upper explosion limit (UEL)	this information is not available
Vapor pressure	23 hPa at 20 °C
Density	1.19 g/cm³ at 20 °C
Vapor density	this information is not available
Relative density	this information is not available
Solubility	
Solubility in water	can be mixed in any ratio
Partition coefficient	
n-octanol/water (log KOW)	-1.57
Auto-ignition temperature	this information is not available
Relative self-ignition temperature of solid substances	not relevant (Liquid)
Decomposition temperature	>60 °C
Viscosity	
Kinematic viscosity	this information is not available
Dynamic viscosity	1.2 mPa s at 20 °C
Explosive properties	non-explosive
Oxidizing properties	cannot be classified as oxidizing

9.2 Other information

Surface tension	75.68 N/m (20 °C)

SECTION 10: Stability and reactivity

10.1 Reactivity

The mixture contains (a) reactive substance(s).
Strong oxidizing agents (strong oxidizing).

10.2 Chemical stability

Exothermic decomposition.
Danger of exothermic decomposition at high temperatures, in contact with other substances (such as acids, compounds of heavy metals or amines), friction or impact.

10.3 Possibility of hazardous reactions

Danger of violent reaction, ignition and explosion in contact with flammable or combustible materials.
Dangerous/dangerous reactions with.
Organic matter.
Dust.
Sweeping dirt.
Wood.
Paper and cardboard.
Edible oils and fats.
Heavy metals and their salts.
Bases.

10.4 Conditions to avoid

Keep away from heat.
UV radiation/sunlight.

10.5 Incompatible materials

keep away from acids, bases, salts of heavy metals and reducing substances, away love metal salts

10.6 Hazardous decomposition products

Oxygen.

SECTION 11: Toxicological information

11.1 Information on toxicological effects

No test data are available for the mixture as a whole.

Classification procedure

The method for classifying mixtures based on the components of the mixture (sum formula).

Classification according to GHS (1272/2008/EC, CLP)

Acute toxicity

Harmful if swallowed.
Harmful if inhaled.

Hydrogen peroxide 35 - < 50%

Acute toxicity assessment (ATE) of the components in the mixture

Name of the substance	CAS No	Route of exposure	ATE
hydrogen peroxide	7722-84-1	oral	1,193 mg/kg
hydrogen peroxide	7722-84-1	inhalation: vapour	11 mg/l/4h

Acute toxicity of the components in the mixture

Name of the substance	CAS No	Exposure-ling route	End point	Value	Species
hydrogen peroxide	7722-84-1	oral	LD50	1,193 mg/kg	rat
hydrogen peroxide	7722-84-1	dermal	LD50	>2,000 mg/kg	rabbit

Skin corrosion/irritation

Causes skin irritation.

Serious eye damage/eye irritation

Causes serious eye damage.

Respiratory or skin sensitization

Cannot be classified as sensitizing.

Germ cell mutagenicity

Cannot be classified as a germ cell mutagen (mutagenic).

Carcinogenicity

Not classified as carcinogenic.

Reproductive toxicity

Cannot be classified as a toxic substance for reproduction.

Specific target organ toxicity - single exposure

May cause irritation of the respiratory tract.

Specific target organ toxicity - repeated exposure

Cannot be classified as a specific target organ toxicant (repeated exposure).

Danger of inhalation

Not to be classified as hazardous by aspiration.

SECTION 12: Ecological information

12.1 Toxicity

Aquatic toxicity (acute)

No test data are available for the mixture as a whole.

(Acute) aquatic toxicity of components of the mixture

(Acute) aquatic toxicity of components of the mixture

Name of the substance	CAS No	End point	Value	Species	Exposure-duration of term
hydrogen peroxide	7722-84-1	LC50	16.4 mg/l	fish	96 h
hydrogen peroxide	7722-84-1	ErC50	1.38 mg/l	algae	72 h

Aquatic toxicity (chronic)

No test data are available for the mixture as a whole.

(Chronic) aquatic toxicity of components of the mixture

(Chronic) aquatic toxicity of components of the mixture

Name of the substance	CAS No	End point	Value	Species	Exposure-duration of term
hydrogen peroxide	7722-84-1	EC50	466 mg/l	micro-organisms	30 min
hydrogen peroxide	7722-84-1	NOEC	0.63 mg/l	invertebrate aquatic organisms	21 d
hydrogen peroxide	7722-84-1	LOEC	1.25 mg/l	invertebrate aquatic organisms	21 d

12.2 Persistence and degradability

Biodegradation

The relevant substances of the mixture are readily biodegradable.

Persistence

No data available.

12.3 Bioaccumulation

No data available.

12.4 Mobility in the soil

No data available.

12.5 Results of PBT and vPvB assessment

This mixture does not contain any substances that are assessed as PBT or vPvB.

12.6 Other adverse effects

No data available.

Endocrine disrupting capacity

None of the ingredients are listed.

Comments

Water Hazard Class: 1 (Slightly hazardous to water)

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Dispose of this material and its packaging as hazardous waste.

Information on wastewater discharge

Do not throw waste into the sink.

Waste treatment of containers/packaging

It is hazardous waste; only approved packaging (e.g. according to ADR) may be used.
used.
Contaminated packaging can be treated like the substance itself.

Comments

Please note the relevant national or regional provisions.

SECTION 14: Transport information

14.1 UN number	2014
14.2 Proper shipping name in accordance with the UN model regulations	HYDROGEN PEROXIDE, AQUEOUS SOLUTION
14.3 Transport hazard class(es)	
Class	5.1
Additional hazard/additional hazards	8 (corrosive effects)
14.4 Packaging group	II
14.5 Environmental hazards	not hazardous to the environment, according to the regulations for the transport of dangerous goods

14.6 Special precautions for user

The regulations for dangerous goods (ADR) must also be complied with in the company.

14.7 Transport in bulk according to Annex II of MARPOL and the IBC Code

The cargo is not intended to be transported in bulk.

14.8 Information for each of the UN Regulations

Transport of dangerous goods by road, rail or inland waterway (ADR/RID/ADN)

UN number	2014
Correct shipping name	UN2014, HYDROGEN PEROXIDE, SOLUTION IN WATER, 5.1 (8), II, (E)
Class	5.1
Classification code	OC1
Packaging group	II
Hazard labels	5.1+8

Exempted Quantities (EQ)	E2
Limited Quantities (LQ)	1 L
Transport category	2.
Tunnel restriction code	E
Hazard Identification Number (GEVI)	58

International Maritime Dangerous Goods Code (IMDG)

UN number	2014
Correct shipping name	UN2014, HYDROGEN PEROXIDE, AQUEOUS SOLUTION, 5.1 (8), II
Class	5.1
Additional hazard/additional hazards	8
Packaging group	II
Hazard labels	5.1+8

Special provisions	-
Exempted Quantities (EQ)	E2
Limited Quantities (LQ)	1 L
EmS	FH, SQ

Stowage category	D
Segregation group	16 - Peroxides

International Civil Aviation Organization (ICAO-IATA/DGR)

Transport prohibited.

UN number	2014
Correct shipping name	
Information on the transport document (shipper's declaration)	salvage packaging
Class	5.1
Additional hazard/additional hazards	8
Packaging group	II
Hazard labels	5.1+8

Exempted Quantities (EQ)	E2
Limited Quantities (LQ)	0.5 L

SECTION 15: Regulations

15.1 Specific safety, health and environmental regulations and legislation for the substance or the mixture

Relevant provisions of the European Union (EU)

Restrictions according to REACH, Annex XVII

none of the ingredients are listed

List of substances subject to authorisation (REACH, Annex XIV)

none of the ingredients are listed

Substance of Very High Concern (SVHC)			
Name according to inventory	**CAS No**	**Recorded in**	**Comments**
not mentioned			

Seveso Directive

2012/18/EU (Seveso III)			
No.	**Hazardous substance/hazard categories**	**Threshold values (tonnes) for application of regulations for low-threshold establishments and high-threshold establishments**	**Nuts**
	not awarded		

Hydrogen peroxide 35 - < 50%

Directive 2011/65/EU on the restriction of the use of certain dangerous substances substances in electrical and electronic equipment (RoHS) - Annex II

none of the ingredients are listed

Regulation 166/2006/EC on the establishment of a European register for the Release and Transfer of Pollutants (PRTR)

none of the ingredients are listed

Directive 2000/60/EC establishing a framework for Community action concerning water policy

none of the ingredients are listed

Regulation 98/2013/EU on the marketing and use of precursors for explosives

Explosives precursors subject to restrictions			
Name of the substance	**CAS No**	**Registration type**	**Boundary value the**
hydrogen peroxide	7722-84-1	Appendix I	12% w/w

Legend

Appendix I	Substances which may not be offered to private individuals, either on their own or in mixtures or substances containing the substances mentioned, unless the concentration is equal to or less than the limit values stated below

Störfall-Verordnung - 12. BImSchV (Hazardous Incident Ordinance)

No.	Hazardous substance/hazard categories	Threshold values (tonnes)		Nuts
3	oxidizing	50	200	

National regulations (Netherlands)

General Assessment Methodology for substances and preparations (ABM)

Indication of water hazard	
Category	**Text**
7	toxic to aquatic organisms

Remediation effort **B**

SZW list of CMR effects

none of the ingredients are listed

SECTION 16: Other information

Notification of changes (revised safety data sheet)

Notification of changes: Section 2, 3, 4, 8, 11

Abbreviations and acronyms

Abbreviations and acronyms

Abbr.	Descriptions of the abbreviations used
Acute Tox.	acute toxicity
ADN	European Agreement concerning the International Carriage of Dangerous Goods by Internal Navigation Voies goods on inland waterways)
ADR	European Agreement concerning the International Carriage of Dangerous Goods by Road (European Agreement concerning the International Carriage of Dangerous Goods by Road)
Aquatic Chronic	chronic hazard to the aquatic environment
ATE	acute toxicity assessment
CAS	Chemical Abstracts Service (database for chemical substances and their unique number, the CAS registration number)
catalogue no.	the catalogue number is the identification code used in Part 3 of Annex VI to Regulation (EC) No 1272/2008
CLP	Regulation (EC) No 1272/2008 on classification, labelling and packaging (Classification, Labelling and Packaging of substances and mixtures
CMR	Carcinogenic, Mutagenic or Toxic to Reproduction
DGR	Dangerous Goods Regulations, regulations for the carriage of dangerous goods, see IATA/DGR
DNEL	Derived No-Effect Level
EC No	The EC register (EINECS, ELINCS and the NLP register) is the source for the seven-digit EC number as code number for substances (European Union)
EINECS	European Inventory of Existing Commercial Chemical Substances
ELINCS	European List of Notified Chemical Substances
EmS	Emergency Schedule
Eye Dam.	causes serious eye damage
Eye Irrit.	irritating to eyes
GHS	"Globally Harmonized System of Classification and Labelling of Chemicals", developed by the United Nations
IATA	International Air Transport Association
IATA/DGR	Dangerous Goods Regulations (DGR) for aviation (IATA)
ICAO	International Civil Aviation Organization
IMDG	International Maritime Dangerous Goods Code (IMDG Code)

Netherlands: nl

Abbreviations and acronyms	
Abbr.	**Descriptions of the abbreviations used**
MARPOL	International Convention for the Prevention of Pollution from Ships (abbr. of Marine Pollutant)
NLP	No-Longer Polymer (no longer polymer)
Ox. Liq.	oxidizing liquid
PBT	Persistent, Bioaccumulative and Toxic
PNEC	predicted no-effect concentration
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals (Registration, Evaluation, Authorisation and Restriction of Chemicals) and authorisation and restrictions on chemicals)
RID	Regulations concerning the international carriage of dangerous goods by rail
Skin Corr.	skin corrosive
Skin Irrit.	skin irritating
STOT SE	specific target organ toxicity - single exposure
zPzB	very persistent and very bioaccumulative

Key literature references and data sources

Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures.

Regulation (EC) No 1907/2006 (REACH), amended by 2015/830/EU.
Transport of dangerous goods by road, rail or inland waterway (ADR/RID/ADN).
International Maritime Dangerous Goods Code (IMDG).
Dangerous Goods Regulations (DGR) for aviation (IATA).

Classification procedure

Physical and chemical properties.
Health hazards.
Environmental hazards.
The method for classifying mixtures based on the components of the mixture (sum formula).

List of relevant sentences (code and full text as in chapters 2 and 3) mentioned)

List of relevant sentences (code and full text as mentioned in chapters 2 and 3)	
Code	**Text**
H271	may cause fire or explosion; strong oxidizer
H302	harmful if swallowed
H314	causes serious burns and eye damage
H315	causes skin irritation
H318	causes serious eye damage

Hydrogen peroxide 35 - < 50%

List of relevant sentences (code and full text as mentioned in chapters 2 and 3)	
Code	**Text**
H332	harmful if inhaled
H335	may cause irritation of the respiratory tract
H412	harmful to aquatic life with long lasting effects

Disclaimer

This information is based on the current state of our knowledge.
This ViB has been compiled and is intended exclusively for this product.

BIOMIX - ATM

BIOMIX-ATM is een vloeibaar reinigingsmiddel op basis van enzymen en verwijdert alle atmosferische vervuiling en aanslag op o.a. daken , muren , platen ,bestrating , tegels en grafstenen .
BIOMIX-ATM is veilig voor mens , dier en milieu .
Gemakkelijk in gebruik .Breng de vloeistof aan met een sproeier , gieter of lage druk .
Doe verder niets,de enzymen in BIOMIX-ATM doen het werk .Na korte tijd is de vervuiling verdwene

Voor gebruik BIOMIX -ATM

Na gebruik BIOMIX-ATM

Bewerkt met BIOMIX-ATM

Voor

Tijdens

Na

Links bewerkt met BIOMIX-ATM

Rechts bewerkt met BIOMIX-ATM

Safety data sheet according to 1907/2006/EC, Article 31

date of printing: 09.03.2015 Version number 1 Revision of: 15.11.2014

1 Identification of the substance or mixture and of the company/undertaking

· **Product identification**

· **Trade name: Biomix ATM**

· **Article number:** BIO 5 ·

Relevant identified uses of the substance or mixture and uses advised against No further relevant information available.

· **Application of the substance / the preparation** Cleaning agent

· **Details of the supplier of the safety data sheet**

· **Manufacturer/Supplier:**

NV Bionova

Evangeliestraat 66A
9220 Hamme

Belgium
Tel.: 0032 35 55 43 93 Fax.:
0032 52 55 47 21 VAT: BE
0458.509.397 Email:
info@bionova.be www.bionova.be

· **Intelligence sector:** product safety department

· **Emergency telephone number:**

Bionova NV

During normal opening times: +32(0) 52 55 43 93

2 Identification of the hazards

· **Classification of the substance or mixture** ·

Classification according to Regulation (EC) No 1272/2008 The product is not classified according to the CLP regulation.

Label elements Labelling according **to Regulation (EC) No 1272/2008** Void **Hazard pictograms** Void **Signal word** Void **Hazard statements** Void

Precautionary statements

P102 **Other hazards** Results **of PBT and vPvB assessment** PBT : Not applicable. **vPvB:** Not applicable.

Keep out of reach of children.

3 Composition and information on ingredients

· **Chemical characterization: Mixtures** ·

Description: Mixture of substances listed below with non-hazardous additions.

· **Dangerous components:** CAS:

34590-94-8 EINECS: 252-104-2	(2-methoxymethylethoxy)propanol	1- 5%

· **Regulation (EC) No. 648/2004 on detergents / Labeling of contents**

nonionic surfactants, amphoteric surfactants	< 5%
enzymes	

4 First aid measures

· **Description of first aid measures** · **General information:**

No special measures required.

(Continued on page 2)

Safety data sheet according to 1907/2006/EC, Article 31

date of printing: 09.03.2015 Version number 1 Revision of: 15.11.2014

Trade name: Biomix ATM

(Continued from page 1)

· **After inhalation:** Provide fresh air; consult a doctor in case of complaints.
· **After skin contact:** Generally the product does not irritate the skin. · **After eye contact:** Rinse opened eye for several minutes under running water. · **After swallowing:** If symptoms persist consult a doctor. · **Information for doctor:** · **Most important symptoms and effects, both acute and delayed** No further relevant information available.
· **Indication of any immediate medical attention and special treatment needed** No further relevant information available.

5 Fire Fighting Measures

· **Fire extinguishers**
· **Suitable extinguishing media:**
CO2, extinguishing powder or water jet. Fight larger fires with water jet or with alcohol-resistant foam.

Water
· **Special hazards arising from the substance or mixture** No further relevant information available.
· **Advice for firefighters** · **Special protective clothing:** No special measures required.

6 Measures in case of accidental release of the substance or mixture

· **Personal precautions, protective equipment and emergency procedures** High risk of slipping due to leaking/spilling product.
· **Environmental precautions:** Dilute with plenty of water.
Do not allow to enter sewers/surface water/groundwater.
· **Methods and material for containment and cleaning up:** Dilute with plenty of water.
Absorb with liquid-binding material (sand, diatomaceous earth, acid binder, universal binder, sawdust).
· **Reference to other sections** Information on safe handling - see Chapter 7.
Information on personal protective equipment - see Chapter 8.
Salvage information – see Chapter 13.

7 Handling and storage

· **Handling:** ·
Precautions for safe handling No special measures required.

· **Information regarding fire and explosion hazard:** No special measures required.

· **Conditions for safe storage, including any incompatibilities** · **Storage:** · **Requirements for storerooms and containers:** No special requirements.
· **Information about common storage:** Keep away from food and drink.
· **Further information about storage requirements:** None.
· **Specific end use(s)** No further relevant information available.

8 Exposure Controls/Personal Protection

· **Additional information regarding the design of technical installations:** No additional data. See 7.

(Continued on page 3)

Safety data sheet

according to 1907/2006/EC, Article 31

date of printing: 09.03.2015 Version number 1 Revision of: 15.11.2014

Trade name: Biomix ATM

(Continued from page 2)

· **Control parameters**

· **Components with limit values that must be observed with regard to the working area:**	
34590-94-8 (2-methoxymethylethoxy)propanol	
MAK (NL) Long term value: 300 mg/m³	
IOELV (EU) Long term value: 308 mg/m³, 50 ppm skin	

· **Additional information:** Lists that were valid at the time of compilation served as a basis.

· **Exposure controls**
· **Personal protective equipment:**
· **General protective and health measures:**
The usual precautions for handling chemicals should be observed.
· **Respiratory protection:** Not necessary.
· **Hand protection:**
The glove material must be impermeable and resistant to the product/substance/preparation.
Due to failed tests no recommendation for glove material can be made for the product/preparation/ the chemical mixture is released.
Select glove material taking into account penetration times, permeation rates and degradation.
· **Glove material**
The choice of a suitable glove depends not only on the material, but also on other quality features and varies from manufacturer to manufacturer. Since the product is made of multiple materials composed, the durability of the glove materials cannot be calculated in advance and must therefore be tested before use.
· **Penetration time of the glove material**
The exact penetration time can be found out from the glove manufacturer; please take this into account.
· **Eye protection:** When pouring, the use of safety glasses is recommended.
· **Body protection:** Wear suitable protective clothing

9 Physical and chemical properties

· **Information on basic physical and chemical properties**	
· **General information**	
· **Prevent:**	
Form:	Liquid
Colour:	Green
· **Smell:**	Characteristic
· **Odour threshold:**	Not exactly.
· **pH value at 20 °C:**	10.5 (dilution 10%)
· **Change of state**	
Melting point/melting range:	Not exactly.
Boiling point/boiling point range:	100 °C
· **Flash point:**	Not usable.
· **Flammability (solid, gaseous):**	Not usable.
· **Ignition temperature:**	
Decomposition temperature:	Not exactly.
· **Self-ignition:**	The product does not self-ignite.
· **Danger of explosion:**	The product is not explosive.
· **Explosion limits:**	
Lower:	Not exactly.
Upper:	Not exactly.

(Continued on page 4)

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· **Vapor pressure:**	Not exactly.
Density at 20 °C:	1.02 g/cm³
· **Relative density**	Not exactly.
· **Vapour density**	Not exactly.
· **Evaporation rate**	Not exactly.
· **Solubility in/miscibility with Water:**	Fully miscible.
· **Partition coefficient (n-octanol/water):** Not determined.	
· **Viscosity**	
Dynamic:	Not exactly.
Kinematic:	Not exactly.
· **Other information**	No further relevant information available.

10 Stability and reactivity

· **Reactivity**
· **Chemical stability**
· **Thermal decomposition / conditions to be avoided:** No decomposition if used according to specifications.
· **Possibility of hazardous reactions** No dangerous reactions known.
· **Conditions to avoid** No further relevant information available.
· **Incompatible materials:** No further relevant information available.
· **Hazardous decomposition products:** No hazardous decomposition products known.

11 Toxicological information

· **Information on toxicological effects**
· **Acute toxicity:**
· **Primary condition:**
· **on skin:** No irritating effect.
· **on the eye:** No irritating effect.
· **Hypersensitivity:** No hypersensitivity effect known.

12 Ecological information

· **Toxicity**
· **Aquatic toxicity:** No further relevant information available.
· **Persistence and degradability** No further relevant information available.
· **Behaviour in environmental compartments:**
· **Bioaccumulative potential** No further relevant information available.
· **Mobility in soil** No further relevant information available.
· **Further ecological information:**
· **General information:**
Water hazard (NL) 11: Slightly harmful to aquatic organisms.
Do not discharge undiluted or in large quantities into groundwater, surface water or sewage system.
· **Results of PBT and vPvB assessment**
· **PBT:** Not applicable.
· **vPvB:** Not applicable.
· **Other adverse effects** No further relevant information available.

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13 Removal Instructions

· **Waste treatment methods**
· **Recommendation:** Small quantities can be disposed of together with household waste.

· **Uncleaned packaging:**
· **Recommendation:** The packaging can be reused or recycled after cleaning.
· **Recommended cleaning agent:** Water, possibly with the addition of cleaning agents.

14 Information regarding transport

· **UN number**	
· **ADR, ADN, IMDG, IATA**	lapses
· **Proper shipping name according to the UN model regulations**	
· **ADR, ADN, IMDG, IATA** expire	
· **Transport hazard class(es)**	
· **ADR, ADN, IMDG, IATA**	
· **class**	lapses
· **Packaging group:**	
· **ADR, IMDG, IATA**	lapses
· **Environmental hazards:**	
· **Marine pollutant:** ·	No

Special precautions for user Not applicable.

· **Transport in bulk in accordance with Annex II to MARPOL 73/78 and the IBC Code** Not applicable.

· **UN "Model Regulation":** -

15 Regulations

· **Specific safety, health and environmental regulations/legislation for the substance or mixture**

· **SZW list of carcinogenic substances**
none of the ingredients are listed.

· **SZW list of mutagenic substances**
none of the ingredients are listed.

· **NON-exhaustive list of substances toxic to reproduction - Fertility**
none of the ingredients are listed.

· **NON-exhaustive list of substances toxic to reproduction - Development**
none of the ingredients are listed.

· **NON-exhaustive list of substances toxic to reproduction - Breastfeeding**
none of the ingredients are listed.

· **National regulations:**

· **Technical information air:**

Class share in %	
Water	84.6
NK	10.0

· **Water hazard class:** Water hazard (NL) 11: Remediation effort B
· **Danish MAL-CODE** 4-3

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· **Chemical safety assessment:** A chemical safety assessment has not been carried out.
A chemical safety assessment has not been carried out.

16 Other information

This information is based on our current state of knowledge. However, it does not describe any guarantee of product properties and does not establish any contractual legal relationship.

· **Abbreviations and acronyms:**
ADR: Accord européen sur le transport des merchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road)
IMDG: International Maritime Code for Dangerous Goods
IATA: International Air Transport Association
GHS: Globally Harmonized System of Classification and Labeling of Chemicals
EINECS: European Inventory of Existing Commercial Chemical Substances
ELINCS: European List of Notified Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
MAL Code: Måleteknisk Arbejdshygiejnisk Luftbehov (Regulation for the labeling concerning inhalation hazards, Denmark)

NL

Biomix® ATM

Manufacturer

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General description

Biomix® ATM is a liquid environmentally friendly and biological cleaning agent based on enzymes that removes all pollution and deposits of atmospheric origin.
Biomix® ATM is the ideal cleaning agent for all outdoor surfaces.
Apply Biomix® ATM and do **nothing else,** the enzymes and nature will do the work for you.
When nature is allowed to do its work (rain and wind) i.e. “WITHOUT SCRUBBING” and depending on the degree and nature of the pollution/contamination, the maximum result is achieved after just a few weeks.

Areas of application

Biomix® ATM can be used on:

- Flat and sloping roofs: slates, tiles, corrugated iron, thatch, roofing, etc.
- Facades: brick, concrete, plaster, crepi, wood, etc., painted or not
- Terraces/driveways: paving stones, tiles, slabs, tropical hardwood, etc.
- Ornaments/garden statues: terracotta, concrete, plastic, natural stone, bluestone, etc. • Bluestone (bluestone): sills, gravestones, etc. • Garden furniture: teak, plastic, metal, etc.

Caution is advised when applying or splashing the product on certain types of powder coating. Test the product on an inconspicuous area first.

Biomix® ATM

Instructions for use

Biomix®ATM is diluted with water in a ratio of 1:1 to 1:5. Apply the liquid preferably to a dry or slightly damp surface with a sprayer, watering can or low pressure. Do nothing else, the enzymes in Biomix®ATM do the work. After a short time the contamination will be gone.

Do not apply at ambient and substrate temperatures < 8°C and when rain can be expected within 24 hours. Do not apply at high temperatures and in full sun.

Biomix®ATM is a concentrated product that can be used depending on the degree of contamination. are diluted with water:

- **Severe contamination:** dilute 1 L with 1 L of water and apply liberally to the area to be treated surface.
- **Normal soiling:** dilute 1 L with 2 L of water and apply liberally. • **Light soiling:** dilute 1 L with 3 L of water and apply liberally.
- **Preventative:** dilute 1 L with 5 L of water and apply liberally.

Consumption: ± 10m² with 1 litre of diluted product depending on the level of contamination.

Unique features

- Biodegradable: 97% in 14 days (OECD 302B test)
- Environmentally friendly.
- Long-lasting effect.
- Economical in use.
- Works preventively.

User benefits

Biomix® ATM saves labour, the enzymes and nature do the work for you.

Biomix® ATM is economical to use.

Product specifications

Packaging: 1 liter bottle, 5 liter jerry can, 20 liter jerry can, 200 liter PE barrel, 1000 liter IBC.

Appearance: green liquid.

Pieces/box: 12 (bottles) x 1 L and 4 x 5 L.

Boxes/pallet: 1 L bottle: 45 boxes.
5 L jerrycan: 32 boxes.
20L jerrycan: 24 pieces.

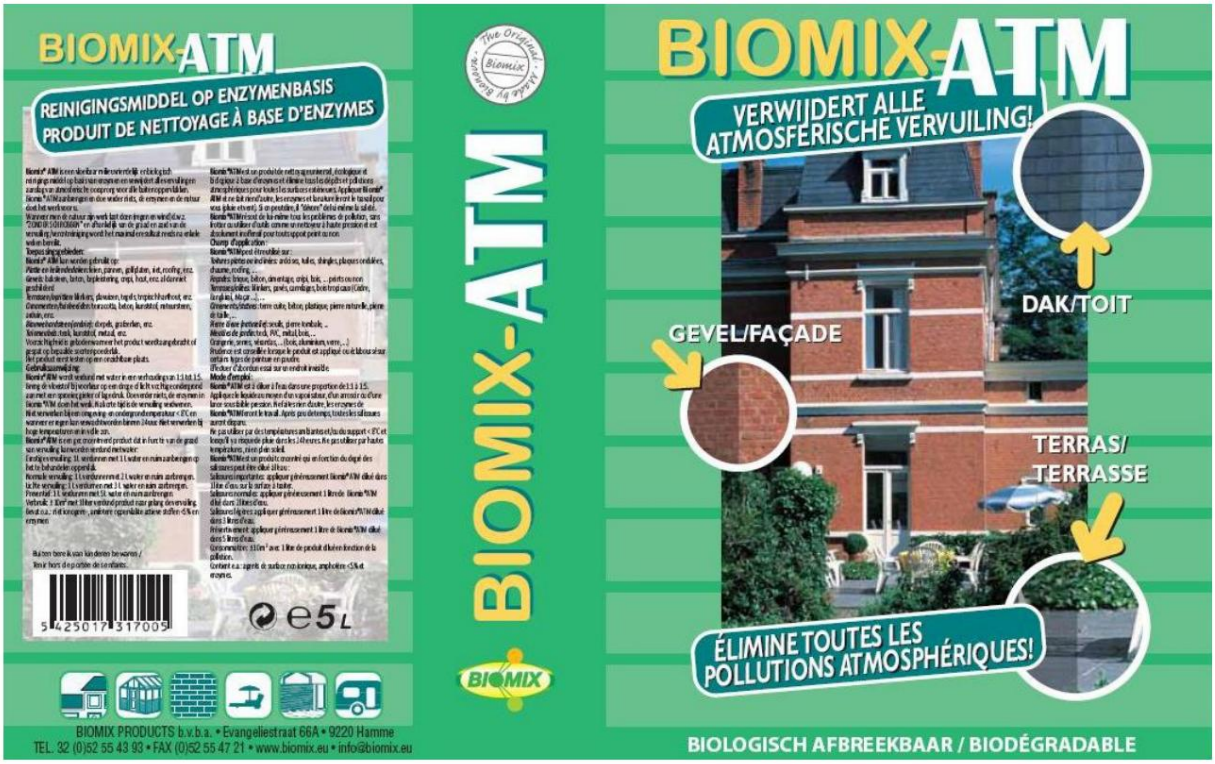
Weight per box: 12 x 1L bottle: 13.35 kg.
4 x 5 L jerrycan: 21.35 kg.

Biomix® ATM

EAN codes: 1 L bottle: 5425017317012
Box 12x1L: 5425017317029
5 L jerrycan: 5425017317005
Box 4x5L: 5425017317043

Shelf life: 3 years. Store in a cool (maximum 20°C) and frost-free place.

Label



Appendix 3 Calculation principles

Appendix 3

Bioguard (1)

Starting point Municipality 2: 1 time per year 20 liters of Bio-Guard (Cent-AlgenBac) agent on 400 liters of water per field in accordance with information from the municipality. The active substance content is derived based on information from the CTGB.

Bioguard (2)

Starting point: 32 times per year. Dosage of 0.1% in accordance with Algencontrol advice and tank capacity of 400 litres of water. These are assumptions partly based on interview with municipality 4.

Biomix ATM Vital

Starting point is a recommended dose of 5 litres every 2 weeks in accordance with the interview with J&E Sports. Concentration is derived on the basis of the Safety Data Sheet in accordance with 1907/2006/EC, Article 31 (see appendix 2).

Hydrogen peroxide

The starting point is a recommended dose of 6 litres 40 times per year in accordance with the interview with municipality 1. The concentration is derived on the basis of the hydrogen peroxide product sheet (see appendix 2)

LCI Algae Des The
starting point is the donation of 10 liters of agent twice a year and the concentration is in accordance with interview with municipality 5. The active substance content is derived partly on the basis of information from the Ctgb.

Table 1 Calculation results indicative inlet concentrations of active substances

	Gegevens	Middel	Werkzame stof	Conc. (%)	Conc. (kg/l)	Conc. g/l	Methode	Verbruik middel per keer per veld (l)	Aantal keer per jaar
1	Gemeente 2	Bioguard	Alkyl(C12-16)dimethylbenzylammoniumchloride	50	0,5	500	Veldspuit	20	1
2	Gemeente 4	Bioguard	Alkyl(C12-16)dimethylbenzylammoniumchloride	0,1	0,001	1	Veldspuit	40	32
3	J&E Sports	Biomix ATM Vitaal	(2-methoxymethylethoxy)propanol	5	0,05	50	Veldspuit	5	20
4	Gemeente 1	Waterstofperoxide 35%	Waterstofperoxide	35	0,35	350	Beregening	6	40
5	Gemeente 5	LCI ALGAE Des	Didecyldimethylammoniumchloride		0,45	450	Veldspuit	10	2

Totaal verbruik middel per jaar per veld (l)	Totaal verbruik werkzame stof per jaar per veld (g)	Oppervlak veld (m2)	Belasting per jaar (g/m2)	Waterverbruik per keer per veld (l)	Aantal keer per jaar
20	10000	5027	2,0	400	1
1280	1280	5027	0,3	400	32
100	5000	5027	1,0	25	20
240	84000	5027	16,7	12000	40
20	9000	5027	1,8	500	2

Totaal waterverbruik per jaar per veld (l)	Opgebrachte waterflux per jaar (l/m2)	Neerslagoverschot per jaar (l/m2)	Totale waterflux per jaar (l/m2)	Concentratie indien alles uitspoelt per jaar per m2(g/l)	Concentratie indien alles uitspoelt per jaar per m2 (mg/l)
400	0,08	300	300,08	0,007	6,6
12800	2,55	300	302,55	0,001	0,8
500	0,10	300	300,10	0,003	3,3
480000	95,48	300	395,48	0,042	42,3
1000	0,20	300	300,20	0,006	6,0

Table 2 Calculation results indicative inlet and outlet concentrations of active substances

	Middel	Werkzame stof	Koc	Organische stof gehalte (%)	Bulkdichtheid grond (kg/dm3)
1	Bioguard	Alkyl(C12-16)dimethylbenzylammoniumchloride	1600000	0,3	1,7
2	Bioguard	Alkyl(C12-16)dimethylbenzylammoniumchloride	1600000	0,3	1,7
3	Biomix ATM Vitaal	(2-methoxymethylethoxy)propanol	10	0,3	1,7
4	Waterstofperoxide 35%	Waterstofperoxide	0,2	0,3	1,7
5	LCI ALGAE Des	Didecyldimethylammoniumchloride	1100000	0,3	1,7

Fractie organische stof	Kd	Kd minerale bodem	Fractie in bodemvocht	Concentratie indien alles uitspoelt per jaar per m2 (mg/l)	Concentratie bodemvocht (mg/l)	Concentratie bodemvocht (ug/l)
0,001764706	2823,52941	48000	2,08329E-05	6,6291	0,0001	0,14
0,001764706	2823,52941	48000	2,08329E-05	0,8416	0,0000	0,02
0,001764706	0,01764706	0,3	0,769230769	3,3143	2,5495	2549,49
0,001764706	0,00035294	0,006	0,994035785	42,2514	41,9994	41999,40
0,001764706	1941,17647	33000	3,03021E-05	5,9638	0,0002	0,18

The Sports and Cultural Technology Industry Association was founded in 2002. The objectives of the industry association is the exchange and development of knowledge and information about the construction and maintenance of outdoor sports facilities and related products (such as grass seeds and fertilizers) and the promotion of the common interests of the members.

The association tries to achieve its goals by organizing regular meetings and conferences and by acting as a discussion partner for governments, sports associations and other institutions. The BSNC wants to actively initiate and stimulate new developments, including by carrying out (or having carried out) research and promotion of standardisation and certification of outdoor sports floors and fields.

The Foundation for Applied Water Management Research (STOWA) is the knowledge centre for regional water management lords in the Netherlands. STOWA develops, gathers and disseminates knowledge that is necessary to meet the tasks that water managers stand for, to be carried out properly. The Foundation for Applied Water Management Research (STOWA) is the knowledge centre for regional water managers in the Netherlands. STOWA develops, collects and disseminates knowledge needed to properly carry out the tasks facing water managers.

Trade association

To play sports

Cultural engineering

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