Draft Assessment Report (DAR)

- public version -

Initial risk assessment provided by the rapporteur Member State United KIngdom for the existing active substance

POTASSIUM HYDROGEN CARBONATE

of the fourth stage of the review programme referred to in Article 8(2) of Council Directive 91/414/EEC

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B.8 ENVIRONMENTAL FATE AND BEHAVIOUR

Potassium bicarbonate dissociates in the presence of water to produce K^+ and HCO_3^-. These substances are naturally occurring in the environment. For example, potassium is an essential plant and microbial nutrient that has a natural cycle in soil, of uptake and utilisation by plants and microbes, followed by release resulting from the decomposition of rotting organisms. In agricultural soils, it is common practice to supplement the natural potassium levels through the application of potash-based fertilisers.

Bicarbonate is a natural product, present in soil pore waters as a result of carbon dioxide liberated from the respiration of soil organisms.

$$CO_{2(g)} \leftrightarrows CO_{2(aq)}$$
$$CO_{2(aq)} + H_2O \leftrightarrows H_2CO_3$$
$$H_2CO_3 \leftrightarrows H^+ + HCO_3^-$$

In regions, typically associated with the production of crops like fruits and vines, surface waters are not acidic and nutrient levels are usually higher. Here bicarbonate levels tend to be much higher as a result of inputs from several readily available sources such as the weathering of limestone rocks by rainfall, which produces large quantities of soluble bicarbonates that enter water either directly, or from run-off.

$$CaCO_3 \leftrightarrows Ca^{2+} + CO_3^{2-}$$
$$CO_3^{2-} + H_2O \leftrightarrows HCO_3^- + OH^-$$

In light of the naturally occurring background levels of potassium and bicarbonate in the environment, the notifier requested a waiver from conducting specific environmental fate studies. This is accepted by the RMS. Therefore since no specific studies are provided, in this section only the predicted environmental concentrations are discussed.

B.8.3 PREDICTED ENVIRONMENTAL CONCENTRATIONS IN SOIL (PEC_S) (Annex IIIA 9.1.3).

Potassium bicarbonate is used in treatments for the control of fungi, such as vine powdery mildew (*Uncinula necator*) and apple scab (*Venturia inaequalis*). Armicarb 85SP mainly inhibits fungus mycelium development. Its mode of action is linked with osmotic pressure, pH and specific bicarbonate/carbonate ion effects. The supported GAP use of potassium bicarbonate formulated as Armicarb 85SP involves spray applications to apple and vine crops. PECs were calculated for the top 5 cm of soil with a bulk density of 1.5 g/cm^3 immediately after the first application.

Materials and methods:

Armicarb 85SP, consists of 85% potassium bicarbonate [active substance], and acts as a contact fungicide. The fungicide is applied in the form of a spray to the leaves & berries of vine crops from BBCH 12 [or BBCH 15 for more robust crops] and to the leaves and fruit of apple crops from the BBCH 10 growth stage. The maximum number of applications is limited to eight. The maximum recommended application rate is 6.0 kg Armicarb 85SP /ha [5.10 kg a.s./ha]. The interval between applications is 10 days. The minimum pre-harvest interval is 1 day. Potassium bicarbonate is soluble in water and will rapidly dissociate to K^+ and HCO_3^-. The initial predicted environmental concentration of potassium and bicarbonate arising in soil from the use of Armicarb 85SP was calculated using the highest rate of application and the input parameters summarised in **Table 8.3-1.** The potassium ion does not degrade, whilst the bicarbonate ion can transform into other common natural products such as carbon dioxide, carbonates and water, which are of no known toxicological, ecotoxicological or environmental significance.

Table 8.3-1. Calculation of initial worst-case PECs for the potassium and bicarbonate ions in soil.

Parameter	K^+	HCO_3^-	$KHCO_3$
% content	39%	61%	85 %
Single spray (g / ha)*	1,989	3,111	5,100
Number of sprays	8	8	8
Total input / season (g / ha)	15,912	24,888	40,800
Crop Interception**	50%	50%	50
Total reaching soil (g/ha)	7,956	12,444	20,400
Initial PEC_{soil} (mg/kg)	*10.6*	*16.6*	*27.2*

* Single spray 6,000 g product /ha = 5,100 g $KHCO_3$/ha
** Assumes applications start at an early crop stage

Findings:

Initial worst case PECs for the potassium and bicarbonate ions in soil arising from the use of Armicarb 85SP at the maximum rate of application and dose level were 10.6 and 16.6 mg/kg respectively. Potassium and bicarbonate ions are not expected to accumulate in soils, as potassium is an essential plant and microbial nutrient that has a natural cycle in soil of uptake and utilisation by plants and microbes. Bicarbonate is a natural product, present in soil pore waters as a result of carbon dioxide liberated from the respiration of soil organisms. At low pH, bicarbonate anions are reduced by free hydrogen ions to produce water and carbon dioxide. In more alkaline soils the bicarbonate can remain as the anion loosely associated with cations, like calcium and magnesium.

Conclusion:

Assuming the application and degradation parameters described, the highest PEC in soil for potassium and bicarbonate ions is 10.6 and 16.6 mg/kg respectively.

B.8.5 IMPACT ON WATER TREATMENT PROCEDURES (Annex IIIA 9.2.2)

No impact on water treatment procedures from the use of Armicarb 85 SP is expected as potassium and bicarbonate are natural products found at background levels which are generally higher than those likely to arise form the use of Armicarb 85SP.

B.8.6 PREDICTED ENVIRONMENTAL CONCENTRATION IN SURFACE WATER AND GROUNDWATER (PEC_{SW}, PEC_{GW}) (Annex IIIA 9.2.1, 9.2.3)

B.8.6.1 Estimation of concentrations in groundwater (PEC_{GW})

Potassium bicarbonate spontaneously dissociates in water to give potassium and bicarbonate ions. The potassium ion is stable and does not degrade. Bicarbonate on the other hand will equilibrate with carbonate and carbonic acid to yield carbon dioxide and water. The potassium and bicarbonate ions can potentially leach through the soil to groundwater resources. However, these ions are not of toxicological relevance. In the event of reaching groundwater it would be impossible to distinguish these ions by analytical means from natural sources of these ions. Given the nature of potassium bicarbonate it is considered inappropriate to use the FOCUS groundwater tools.

B.8.6.2 Estimation of concentrations in surface water (PECsw)

Predicted environmental concentrations of the potassium and bicarbonate ions arising in surface water from the use of Arimcarb 85SP were calculated for the most likely route of entry of the pesticide into surface water, that is spray drift. The initial concentration in surface water as a result of spray drift was calculated for a 30 cm deep-water layer. This is equivalent to a volume of 300 L/m^2 assuming a surface water basin of 30 cm depth, 100 m length and 1 m width. The following formula was used in the calculation:

$$PEC_{ini} = \frac{a\ dr}{V_{SW}\ 1000}$$

where a is the application rate (g/ha), dr is the percentage drift, V_{SW} is the water volume per m^2 and PEC has units of mg/L. The application rate corresponded to a lumped dose of eight applications at the maximum recommended dose rate **[Table 8.6.2-1]**. The initial PEC_{SW} values for different scenarios taking into account the spray drift values published by Rautmann are summarised in **Table 8.6.2-1.** The absolute worst-case concentration of potassium and bicarbonate in surface water resulting from the use of Arimcarb 85SP would arise due to direct overspray giving respective PECs of 5.30 and 8.30 mg/L for a 30 cm deep static water body.

Table 8.6.2-1. PEC of potassium and bicarbonate in surface water arising from the use of Armicarb 85SP on apple and vine crops.

Crop	Buffer Zone (m)	% spray drift*	Potassium PEC_{sw} (mg/L)	Bicarbonate PEC_{sw} (mg/L)	$KHCO_3$ PEC_{sw} (mg/L)
Overspray	0	100	5.30	8.30	13.6
Apples	3	29.2	1.55	2.42	3.97
Vines	3	8.0	0.42	0.66	1.088

*Apples and vines based on 90^{th} percentile spray drift tables produced by Rautmann 2001.

The absolute worse case PECs refer to a static water system and in the case of potassium are comparable to values observed in free flowing rivers and is lower than the WHO drinking water standard of 12 mg/L. In the unlikely event of direct overspray, the concentration of potassium ions arising from the use of active substance will be less in a free flowing river due to dilution effects. In addition, potassium is an essential plant and microbial nutrient that has a natural cycle in soil of uptake and utilisation by plants and microbes. Typical levels of bicarbonate in surface waters adjacent to agricultural land are between 100 to 500 mg/L.[1]

Conclusion:

Assuming the application and degradation parameters described, the highest PEC_{SW} values arising from spray drift for the potassium and bicarbonate ion are 5.3 and 8.30 mg/L respectively. Naturally, occurring levels of these ions in surface water are 100 to 500 mg/L for bicarbonate ions with surface waters adjacent to agricultural land[1] and 0.5-4.0 mg/L [free flowing rivers] for potassium ions.[2]

[1] Meybeck, M., 1979, *Concentrations des eaux fluviales en element majeurs et apports en solution aux oceans.* Rev. Geol. Dyn. Georgr. Phys., v. 21, p. 215-246.

[2] Meybeck, M., 1980, *Pathways of major elements from land to ocean through rivers. Proceedings of the Review and Workshop on River Inputs to Ocean Systems*. Ed. J.-M., Martin, J. D. Burton and D. Eisma, pp. 18-30. Rome: FAO.

8.10 Refereneces Relied On.

Annex point/ reference number	Author(s)	Year	Title Source (where different from company) Company name, Report No., GLP status (where relevant) published or not	Data protection claimed	Owner
	Barak, P	2005	Essential Elements for Plant Growth. University of Wisconsin http://www.soils.wisc.edu/~barak/soilscience326/essentl.htm [03/02/06].		
	Meybeck, M.,	1979	Concentrations des eaux fluviales en element majeurs et apports en solution aux oceans. Rev. Geol. Dyn. Georgr. Phys., v. 21, p. 215-246.		
	Meybeck, M.,	1980,	Pathways of major elements from land to ocean through rivers. Proceedings of the Review and Workshop on River Inputs to Ocean Systems. Ed. J.-M., Martin, J. D. Burton and D. Eisma, pp. 18-30. Rome: FAO		