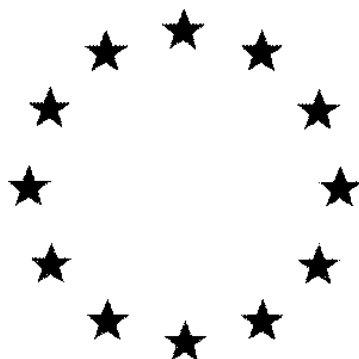


European Commission



**Draft (Renewal) Assessment Report prepared
according to the Commission Regulation (EC) No
1107/2009**

**Daminozide (ISO); 4-(2,2-
dimethylhydrazino)-4-oxobutanoic
acid; *N*-dimethylaminosuccinamic
acid**

Volume 3 – B.6 (PPP) – Alar

Rapporteur Member State: Czech Republic
Co-Rapporteur Member State: Hungary

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B.6 TOXICOLOGY AND METABOLISM

INTRODUCTION

ALAR is a water soluble granule (SG) formulation, containing a nominal 850g/kg, 85% w/w of Daminozide (ISO); 4-(2,2-dimethylhydrazino)-4-oxobutanoic acid; N-dimethylaminosuccinamic acid ('hereafter referred to as 'daminozide'), as active substance. Unsymmetrical Dimethyl Hydrazine (UDMH) is an impurity that is permitted to be present at a maximum concentration of 0.03 g/kg daminozide. The representative uses are as a foliar spray to ornamental flowers and bedding plants. Application to glasshouse plants is made using hand-held equipment or automated gantry sprayers.

This document presents data and information on the metabolism and toxicology of daminozide and is submitted in support of the renewal of approval for daminozide under Regulation (EC) 1107/2009. Most of the data presented here were included in the submission that was made to secure the first inclusion of daminozide in Annex I to Directive 91/414/EEC.

The original submission was determined to be complete and enabled the setting of appropriate reference doses. The evaluation of the original RMS (The Netherlands) is set out in the Monograph of June 1999 and its addenda in June 2002, June 2003 and September 2004. The critical end points relating to this section, for use in risk assessments, were published in the Review Report for daminozide; SANCO/3043/99 final, 15 February 2005.

The RMS for this renewal of daminozide is the Czech Republic. All studies previously relied upon for Annex I listing are briefly summarised below.

For studies that have not been previously reviewed, the following statement will precede each summary:

Previous evaluation	None; submitted for the purpose of AIR III renewal
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ALAR

Pure active substance

content of pure active substance :	851.4 g/kg	(85.14% w/w)
limits : ± 25 g/kg	826.4 – 876.4 g/kg	82.64 – 87.64 % w/w

Technical active substance

content of technical active substance :	860.0 g/kg	(86% w/w)
limits : ± 25 g/kg	835.0 – 885.0 g/kg	83.5 – 88.5 % w/w

at a minimum purity of the technical active substance of	99.0 %.
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The following information is based on the evaluation contained in the Monograph and relevant addenda, together with new data generated to supplement and elaborate the original dossier.

This dossier is submitted to support the renewal of the approval of daminozide under Regulation (EC) 1107/2009. The submission is made in accordance with Commission Regulation (EU) No 844/2012 of 18 September 2012, setting out the provisions necessary for the implementation of the renewal procedure for active substances, as provided for in Regulation (EC) No 1107/2009 of the European Parliament and of the Council concerning the placing of plant protection products on the market.

Dossier for the renewal of daminozide is submitted by the **EU Daminozide Task Force**.

The EU Daminozide Task Force is an equal partnership between:

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All data are jointly owned unless indicated otherwise.

B.6.1 Acute toxicity

The preparation ALAR: The acute oral, dermal, inhalation, skin irritation and skin sensitisation studies were conducted with a previous version of the formulation. The only difference between the formulations is a variation in the wetting agent. The replacement wetting agent has a lower classification; hence the change will not alter the classification, derived from the studies below. A summary of the change in formulation is presented in Document J.

The formulation is of low acute oral, dermal and inhalation toxicity to rats. The formulation is not irritating to rabbit skin or eyes and is not classifiable as a sensitiser to guinea pig skin. In accordance with the criteria set out in EU Regulation (EC) 1272/2008, the test material is not classifiable for acute toxicity, irritancy or skin sensitisation.

Table B.6.1-1: Summary of acute toxicity, irritation and skin sensitisation studies

The results of all the acute toxicity studies performed with the formulation are summarized in the following table:

Type of study	Species	Results	Ref
Acute oral B-Nine® WSG	Rat(M+F)	LD ₅₀ >5000 mg/kg bw	██████████ (1997a)
Acute dermal B-NINE WSG	Rabbit(M+F)	LD ₅₀ >5000 mg/kg bw	██████████ (1997b)
Acute inhalation B-NINE WSG	Rat(M+F)	>4.0 mg/L ⁻¹ (4-hour, nose only exposure, the maximum achievable concentration)	██████████ (1997)
Skin irritation B-NINE WSG	Rabbit(M+F)	Not irritating	██████████ (1997c)
Eye irritation ALAR 85SG	Rabbit (M)	Not irritating	██████████ (2005)
Skin sensitization (Buehler method) B-NINE WSG	Guinea pig (M+F)	Non sensitizing	██████████. (1997d)

B.6.1.1 Oral toxicity

Reference:	CP 7.1.1/01 [REDACTED] (1997a) Acute oral toxicity study with B-Nine® WSG in rats [REDACTED]; Study no. 96-1463 Uniroyal Chemical Company Inc., USA.
Report No.:	A.7.1.2.3
Guideline:	US EPA FIFRA 81-1 (1984) (The study deviated from the current EU Guideline EU 2004/73/EC, B.1.tris (2004) as the limit dose of 5000 mg/kg bw is higher than the current 2000 mg/kg bw limit dose level)
GLP:	Yes
Previous evaluation:	None; submitted for the purpose of AIR III renewal

Executive Summary

A group of five males and five females fasted Sprague Dawley rats were given a single oral dose, by gavage, of B-NINE® WSG at 5000 mg product/kg bw. The test material was administered as a 50%w/v suspension in distilled water. There was no mortality. The principal clinical signs observed were yellow ano-genital staining, excessive salivation, clear nasal discharge and moist rales. All clinical signs were reversible after 7 days. The rat acute oral LD₅₀ values were greater than 5000 mg product/kg bw in both sexes. The test material is therefore not classified for acute oral toxicity. The acute oral LD₅₀ of the EXP 30930 formulation in rats was greater than 2000 mg/kg.

CONCLUSION

The acute oral LD₅₀ of B-NINE® WSG to male and female rats was >5000 mg/kg bw. B NINE® WSG is therefore not classified for acute oral toxicity.

RMS comments	The study is valid for the risk assessment
Endpoint / conclusion	Oral LD ₅₀ is > 5,000 mg/kg bw in the rat. The formulation ALAR 85 SG does not warrant classification for acute oral toxicity.

B.6.1.2 Dermal toxicity

Reference:	CP 7.1.2/01 [REDACTED] (1997b) Acute dermal toxicity study with B-NINE® WSG in rabbits [REDACTED]; Study no. 96-1464 Uniroyal Chemical Company Inc., USA.
Report No.:	Report No: A.7.1.24
Guideline:	US EPA FIFRA 81-2 (1984)
GLP:	Yes
Previous evaluation:	None; submitted for the purpose of AIR III renewal

Executive Summary

A group of five males and five females New Zealand White Rabbits was given a single topical application of 5000 mg/kg bw of B-NINE® WSG to the shaved intact dorsal skin for 24 hours. There was no mortality and no clinical signs were seen during the 14 day observation period. The rabbit acute LD₅₀ value was greater than 5000 mg product/kg bw in both sexes. The test material is therefore not classified for acute dermal toxicity.

CONCLUSION

The acute percutaneous LD₅₀ of B-NINE® WSG to male and female rabbits was >5000 mg product/kg bw. The combined LD₅₀ for males and females was also >5000 mg product/kg bw. B-NINE® WSG is therefore not classified for acute dermal toxicity.

RMS comments	The study is valid for the risk assessment
Endpoint / conclusion	Dermal LD ₅₀ is > 5,000 mg/kg bw in the rabbits. No classification for acute dermal toxicity is required.

B.6.1.3 Inhalation toxicity

Reference:	CP 7.1.3/01 [REDACTED] (1997) An acute (4-hour) inhalation toxicity study of B-NINE® WSG in the rat via nose-only exposure [REDACTED]; Study no. 96-5289 Uniroyal Chemical Company, Inc., UK .
Report No.:	A.7.1.27
Guideline:	US EPA FIFRA 81-3 (1984)
GLP:	Yes
Previous evaluation:	Submitted and evaluated at the time of the first inclusion of daminozide in Annex I of Directive 91/414/EEC

Executive Summary

A group of five males and five females Sprague Dawley rats was exposed to a dust atmosphere generated with the test material. The animals were exposed via the nose to an atmosphere containing a concentration of 4.0 mg/L determined by HPLC. This was the maximum practicably attainable concentration. There were no mortalities. Immediately post-exposure, red nasal discharge, chromodacryorrhea and red exuate in the oral/buccal area were observed. Most animals had recovered by day 4, all animals were recovered by day 9. The rat acute inhalation LC50 value for B-NINE® WSG was >4.0 mg/L⁻¹, the maximum achievable concentration. As no mortality occurred, the test material is not considered to require classification for acute inhalation toxicity.

CONCLUSION

The rate acute (4 hour) nose only inhalation LC50 of B-NINE® WSG was greater than 4.0 mg/L, the maximum achievable concentration. As no mortality occurred, the test material is therefore not classified for acute inhalation toxicity.

RMS comments	The study is valid for the risk assessment
Endpoint / conclusion	Acute inhalation LC50 was > 4.0 mg/L ⁻¹ in the rat (highest attainable test concentration). Classification for acute inhalation toxicity is not required in accordance with Regulation (EC) No 1272/2008 as amended.

B.6.1.4 Skin irritation

Reference:	CP 7.1.4/01 [REDACTED] (1997c) Primary dermal irritation study with B-NINE® WSG in rabbits [REDACTED]; Study no. 94-1465 Uniroyal Chemical Company, Inc, USA
Report No.:	Report No: A.7.1.26
Guideline:	US EPA FIFRA 81-5 (1984)
GLP:	Yes
Previous evaluation:	None; submitted for the purpose of AIR III renewal

Executive summary

A group of three males and three females New Zealand White rabbits were given a single topical application of 0.5 g of B-NINE® WSG for 4 hours. The test material was moistened with 0.9% saline and the applied directly onto intact skin beneath a 6 cm² gauze square. The site was semi-occluded for all exposure period. Irritation was scored 1, 24, 48, and 72 hours after removal of the patches. Scoring was done using Draize system. B-NINE® WSG caused only very slight erythema 1 hour post application in two male rabbits, see Table 6.1.4/01. All signs of irritation had reversed by 24 hours. The test material is not classified for skin irritation.

Table 6.1.4/01 Summary of irritant effects on the skin (Exposure: 4 hours)

Animal/sex		24 hours	48 hours	72 hours	Mean scores
4423/M	Erythema (redness) and Eschar formation	0	0	0	0.0
	Oedema Formation	0	0	0	0.0
4424/F	Erythema (redness) and Eschar formation	0	0	0	0.0
	Oedema Formation	0	0	0	0.0
4425/M	Erythema (redness) and Eschar formation	1	0	0	0.3
	Oedema Formation	0	0	0	0.0
4426/F	Erythema (redness) and Eschar formation	0	0	0	0.0
	Oedema Formation	0	0	0	0.0
4427/M	Erythema (redness) and Eschar formation	1	0	0	0.3
	Oedema Formation	0	0	0	0.0
4428/F	Erythema (redness) and Eschar formation	0	0	0	0.0
	Oedema Formation	0	0	0	0.0

CONCLUSION

B-NINE® WSG was non-irritating to rabbit skin and is therefore not classified as a skin irritant.

RMS comments	The study is valid for the risk assessment. Some details about study design and results were added by RMS.
Endpoint conclusion /	The test substance was not a skin irritant in this study according to the criteria set out in Regulation 1272/2008/EC. The classification is not required.

B.6.1.5 Eye irritation

Reference:	CP 7.1.5/01 [REDACTED] (2005) ALAR 85 SG: Acute eye irritation in the rabbit [REDACTED]
Report No.:	1133/029 Crompton Europe B.V.
Guideline:	OECD 405 (2002), EU 2004/73/EC, B.5 (2004)
GLP:	Yes
Previous evaluation:	None; submitted for the purpose of AIR III renewal

Executive summary

In order to ensure that the test material was not a severe ocular irritant a Rabbit Enucleated Eye test (REET) was performed prior to the *in vivo* test. The results indicated that the test material was unlikely to cause severe ocular irritancy.

Initially, a single rabbit was treated. A single dose (0.1 mL) of ALAR 85 SG was placed in the right lower conjunctival sac of three New Zealand White rabbits. The left eye remained untreated and served as control. After consideration of the ocular responses produced in the first treated animal, two additional animals were treated. In order to minimise pain on application of the test material, one drop of local anaesthetic (Amethocaine hydrochloride 0.5%, Chauvin Pharmaceuticals, Romford, Essex, UK) was instilled into both eyes of these animals 1 to 2 minutes before treatment. Assessment of ocular damage/irritation was made approximately 1 hour and 24, 48 and 72 hours following treatment, according to the numerical evaluation from Draize J. H. (1977). Ocular reactions were assessed up to 7 days post-instillation.

No corneal effects were noted during the study. Iridial inflammation was noted in one treated eye up to 48 hours post instillation. Moderate conjunctival irritation was noted in all treated eyes one hour post instillation. Moderate conjunctival irritation persisted in one treated eye with minimal conjunctival irritation noted in two treated eyes at 24 hours post instillation and minimal conjunctival irritation in all treated eyes 48 hours post instillation. Minimal conjunctival redness persisted in one treated eye 72 hours post instillation. Two treated eyes appeared normal after 72 hours post instillation, the remaining treated eye had recovered by 7 days post instillation. – The mean scores at 24, 48 and 72 hours post instillation for corneal opacity were 0, for iris lesions 0.22 and for redness and chemosis of the conjunctiva were 0.33 and 0.37, respectively. The test material is not classified as an eye irritant.

Table 6.1.5-1: Summary for Irritation Effects on the rabbit eye

Observations 1st rabbit	1h	24h	48h	72h	Mean scores (24-48-72h)
Cornea opacity	0	0	0	0	0.0
Iris	1	1	1	0	0.7
Redness conjunctivae	2	2	1	1	1.3
Chemosis conjunctivae	2	1	0	0	0.3
Observations 2nd rabbit	1h	24h	48h	72h	Mean scores (24-48-72h)
Cornea opacity	0	0	0	0	0.0
Iris	0	0	0	0	0.0
Redness conjunctivae	2	1	1	0	0.7
Chemosis conjunctivae	2	1	0	0	0.3
Observations 3rd rabbit	1h	24h	48h	72h	Mean scores (24-48-72h)
Cornea opacity	0	0	0	0	0.0
Iris	0	0	0	0	0.0
Redness conjunctivae	2	1	1	0	0.7
Chemosis conjunctivae	1	1	0	0	0.3

CONCLUSION

ALAR 85 SG produced slight effects in rabbit eyes but is not classified as an eye irritant.

RMS comments	The study is valid for the risk assessment
Endpoint / conclusion	ALAR 85 SG was proved to have mild irritation effect on the rabbit eye, but not at the level that requires classification. The classification for eye irritation is not required in accordance with the Regulation (EC) No 1272/2008 as amended.

B.6.1.6 Skin sensitization

Reference:	CP 7.1.6/01 [REDACTED]. (1997d) Closed-patch repeated insult dermal sensitization study with B NINE® WSG in guinea pigs (Buehler Method) [REDACTED] Study no. 96-1466 Uniroyal Chemical Company, Inc., USA
Report No.:	A7.1.28
Guideline:	US EPA FIFRA 81-6 (1984)
GLP:	Yes
Previous evaluation:	None; submitted for the purpose of AIR III renewal

Executive summary

B-NINE WSG® was assessed for skin sensitisation potential using guinea pig Buehler skin sensitisation test. Based on preliminary dose range finding, groups of ten male and ten female Hartley guinea pigs were given three topical inductions of the neat preparation as a dry paste with distilled water on days 0, 7 and 14. At challenge (14 days post induction), a single challenge of the neat paste was administered on day 28. A positive control group was conducted in parallel with 2,4-dichloronitrobenzene (DNCB), groups of 10 animals were given 0.1% DNCB for both the induction and challenge. DNCB induced positive reactions for skin sensitisation 100% of animals.

B-NINE WSG® showed no potential for skin sensitisation in any animal. The test material is therefore not classifiable as a skin sensitiser..

CONCLUSION

B-NINE® WSG was not a skin sensitiser in this guinea pig Buehler skin sensitisation test. B NINE® WSG is therefore not classifiable as a skin sensitiser..

RMS comments	The study is valid for the risk assessment
Endpoint / conclusion	The test substance was considered not sensitizing in guinea pigs using the Buehler methodology. The classification for skin sensitisation is not required in accordance with the Regulation (EC) No 1272/2008 as amended.

B.6.1.7 Supplementary studies on the plant protection product

No supplementary studies were performed.

B.6.1.8 Supplementary studies for combinations of plant protection products

No supplementary studies for combinations of plant protection products were conducted

B.6.2 Dermal Absorption

Dermal Absorption

No dermal penetration studies were carried out for the first inclusion of Daminozide. A dermal penetration of 13% (default value) was assumed*(Sanco/3043/99 final, 15 February 2005 from the Review Report)

No data are available regarding the dermal absorption of daminozide from ALAR

For renewal assessment dermal absorption data for ALAR from an *in vitro* dermal absorption study in human and rat skin of the technical material, a solid powder, has been conducted and is considered appropriate for estimating the dermal absorption of daminozide from ALAR in this submission. For the purpose of exposure assessments of ALAR an 850 g/kg SG, values of **0.4%** and **2%** have been derived for the undiluted (solid formulation) and the highest in-use spray dilution, respectively.

Considering that ALAR is an SG formulation, extrapolation of the dermal absorption end-point from the technical material is deemed to be satisfactory. Both materials have a physical solid state containing predominantly daminozide (a nominal 85% for the product and 99.5% for the test material). The co-formulants present in the ALAR are predominantly clay/silica based and the formulation does not contain organic solvents or surfactants which could impact skin penetration.

Considering the critical GAP to be supported, the proposed application rate results in a higher in-use spray dilution than the one tested (i.e. 4250 g a.s/ha, in a max. water volume of 1500 L/ha). However, according to the EFSA guidance on dermal absorption (2012), it is possible to calculate the dermal absorption for this higher dilution pro-rata as 2% (i.e. 1.51% x 0.04 mg/cm²/0.0283 mg/cm², where 0.04 mg/cm² is the skin loading in the dermal absorption study below(B.6.2.2) and 0.0283 mg/cm² is the estimated skin loading for operators using the maximum proposed in-use dilution). Therefore, for the purpose of exposure assessments of ALAR a value of **2%** has been

derived for estimating systemic exposure following contact with in-use spray dilutions

AOEL/ Dermal absorption

The AOEL values adopted for the inclusion of daminozide and UDMH (Sanco/3043/99 final, 15 February 2005 from the Review Report) are **0.16 mg/kg bw/day** and **0.09 µg/kg bw/day** respectively. These AOELs are based on different end points (decreased blood platelet counts for daminozide, liver toxicity and corneal effects for UDMH), hence no combined risk assessment is necessary.

No dermal absorption data have been generated for ALAR since the previous EC review of daminozide. An *in vitro* dermal absorption study in human and rat skin of the technical material, a solid powder has been conducted and considered as appropriate for this submission for daminozide. For the purpose of exposure assessments of ALAR an 850 g/kg SG values of **0.4%** and **2%** have been derived for the undiluted (solid formulation) and the in-use spray dilution, respectively. A dermal absorption value of **0.4%** is used for the worker exposure assessment which is based on a concentration for skin loading appropriate to the predicted levels of worker exposure.

For UDMH, values of **10.7%** (0.15% solution), **20.1%** (1.5% solution) and **24.5%** (15% solution) have previously been agreed (Review Report for Daminozide, SANCO/3043/99). Given that the spray concentrations recommended for ALAR are at a lower concentration of UDMH than the dermal absorption value provides a precautionary value to use for the risk assessment. The 10.7% value for UDMH is assumed for the risk assessment as this is considered the most representative concentration tested (0.15% solution) for in-use spray dilutions

B.6.2.1 Dermal Absorption, *in vivo*

a) Dermal absorption of daminozide

No study available.

b) Dermal absorption of UDMH

Reference:	████████████████████ (1991); Dermal Absorption of ¹⁴ C-UDMH in B-Nine Using Male Sprague-Dawley Rats. ████████████████████ Uniroyal Chemical Company, Inc.
Report No.	A.7.5.1.4
Guideline:	no guideline available
GLP:	Yes
Previous evaluation:	Submitted and evaluated at the time of the first inclusion of daminozide in Annex I of Directive 91/414/EEC

Study design

Dermal absorption of a mixture of ¹⁴C-UDMH (1,1-dimethylhydrazine) and UDMH technical (only in the high dose group), in daminozide formulated as B-NINE®, was examined in rats. The animals were housed individually in glass metabolism cages, equipped with caustic (2N NaOH), acidic (2N HCl), and organic (2:1 ethanol:ethanolamine) sparging columns to collect expired air specimens. UDMH is an impurity (<50 ppm

according to the manufacturer) in technical daminozide. However, the specific activity of the ^{14}C -UDMH precluded testing concentrations less than 1500 ppm UDMH. Therefore, the lowest dose level was set at 1500 ppm (0.15%). The test substance was applied to 24 cm² of shaved dorsal skin covered by a semi-occlusive protective appliance for a period of 0.5, 1, 2, 4, 10 and 24 hours. The applied dose levels were 0.116, 1.13, and 12.5 µg/cm². The protective appliance was comprised, among others, of a triple layer of charcoal impregnated material to complex the volatile ^{14}C -radioactivity. Before sacrifice, residual test material was collected by washing the skin with mild soap and water. Subsequently, radiolabel was determined by LSC in the protective appliance, skin wash gauze pads, urine (including cage rinse), faeces, exhaled air, blood, carcass, non-application and application site skin.

Results

Table 6.2.1/01: Distribution of the administered dose upon a 10 h (and between brackets a 24 h) exposure period

dose	recovered from application site ¹	systemically available ²	bound to dose site skin	potentially absorbed dose ³	total recovery
µg/cm ²	% of dose	% of dose	% of dose	% of dose	% of dose
0.116	88.4 (66.8)	5.8 (19.0)	4.9 (4.6)	10.7 (23.6)	99.1 (90.4)
1.13	71.9 (92.8)	16.2 (9.4)	4.8 (6.2)	21.0 (15.6)	92.9 (108.4)
12.5	65.8 (89.4)	23.3 (18.1)	1.6 (3.2)	24.9 (21.3)	90.7 (110.7)

¹ Percentage of dose recovered from the protective appliance and skin wash gauze pads

² Percentage of dose recovered from urine (including cage rinse), faeces, blood, expired air, carcass, and non-application site skin

³ Percentage of dose systemically available and bound to dose site skin

The average total recovery of radiolabel ranged from 88 to 97%. Due to the complete volatility of the test article under the test conditions and the design of the protective appliance, 20-78% of the dose was recovered from the protective appliance.

Because up to 10% of the applied dose was excreted in urine, it was concluded that urinary excretion is a major route for elimination of ^{14}C -UDMH and/or its metabolites. Excretion of radiolabel in urine increased with time, although for the 24 h termination time period (in the two highest dose groups), the percentage of dose detected in urine decreased from the 10 h time point. No clear evidence of saturation of urinary excretion was found. Radiolabel was eliminated by biliary excretion into the faeces, albeit to a very small extent (<0.3% of the applied dose). In contrast, ^{14}C -UDMH and/or its metabolites were exhaled in expired air at increasing levels with later time points. Based on the extent (up to 8.4%) and rate of excretion, the authors concluded that also pulmonary excretion is a major elimination pathway for ^{14}C -UDMH. No apparent accumulation of the test substance in tissues occurred with time.

In the mid and high dose group, the systemically available dose was higher after 10 h of exposure compared to 24 h. The peak levels at 10 h were attributed to high values of one animal in each dose group, and were not considered to reflect saturation of absorption or elimination.

The potentially absorbed dose after 10 and 24 h of exposure ranged from 10.7 to 24.9% and 15.6 to 23.6%, respectively.

Acceptability

The study was not performed in accordance with the “Draft OECD guideline Percutaneous absorption: *in vivo* method (June 1996)”, because the purity of the nonlabeled UDMH was not indicated. Because unlabeled UDMH was only applied in the high dose group, the study is still considered of relevance for the evaluation of the dermal absorption of UDMH.

Conclusion

Because a considerable amount of radiolabel was recovered from the protective appliance, the actual dermal exposure to the test substance is considered much lower. The *in vivo* dermal absorption of UDMH, an impurity of daminozide, by rat skin under semi-occlusive conditions was found to be in the range of 10.7-24.9%. The major routes of elimination were urinary and pulmonary excretion.

RMS comments	<ul style="list-style-type: none"> The study was not performed in accordance with the “Draft OECD guideline Percutaneous absorption: <i>in vivo</i> method (June 1996)” as mentioned above Study may still of relevance for the evaluation of the dermal absorption of UDMH.(Because unlabeled UDMH was only applied in the high dose group) The values of dermal absorption for UDMH were previously agreed during the first re-evaluation of daminozid and are still relevant: 10.7% at 0.116 µg/cm², 20.1% at 1.13 µg/cm², 24.5 % at 12.5 µg/cm²
Endpoint / conclusion	<ul style="list-style-type: none"> The <i>in vivo</i> dermal absorption of UDMH, an impurity of daminozide, by rat skin under semi-occlusive conditions was found to be in the range of 10.7-24.9%. The major routes of elimination were urinary and pulmonary excretion. The lowest value of 10.7% was used for UDMH in risk assessment of Alar, 850 SG

B.6.2.2 Dermal Absorption, *in vitro***Comparative Dermal Absorption, In Vitro Using Rat And Human Skin Dermal Absorption Of Daminozide**

Reference:	██████████ (2011); Determination of the dermal absorption of daminozide technical in human and rat skin.
Report No.	495333 ██████████ Project 495333 Chemtura Corporation
Guideline:	OECD 428(2004): Skin Absorption: <i>in vitro</i> Method EFSA Guidance on Dermal Absorption (2012).
GLP:	Yes
Previous evaluation	None; submitted for the purpose of AIR III renewal

Executive Summary

The dermal absorption of daminozide technical was investigated using rat and human skin in line with OECD Guideline 428 (2004).

Two groups of four and five human skin discs from at least three donors and two groups of four rat skin discs were exposed to 0.4 mg/cm² and 0.04 mg/cm² daminozide technical for eight hours.

The integrity of the human skin discs was within the acceptability criteria except for two skin discs where the Kp was slightly higher than the cut-off values of $\leq 4.5 \times 10^{-3}$ cm/h. As the absorption profile of these two skin discs was comparable to the other skin discs used for the same concentration, the results of these skin discs were accepted. The integrity of the rat skin discs was within the acceptability criteria of $\leq 15.8 \times 10^{-3}$ cm/h for all skin discs.

The recoveries obtained in the experiments with the low concentration (0.04 mg/cm² skin) are an average of $98 \pm 2.1\%$ for human skin and $99 \pm 1.9\%$ for rat skin. For the high concentration (0.4 mg/cm²) skin, the recoveries obtained were $96.6 \pm 1.9\%$ for human skin and $94.5 \pm 3.6\%$ for rat skin.

The percentage daminozide technical absorbed was higher in rat skin compared to human skin. The high standard deviation of the absorption for rat skin (low and high concentrations) was caused by high absorption in one of the four skin discs at both concentrations. The other three skin discs at each concentration showed a comparable, low absorption. Therefore, the mean absorption for rat skin discs is given for all skin discs (n=4) for the skin discs excluding the one with high absorption (n=3). The standard deviation in absorption for the three skin discs is acceptable.

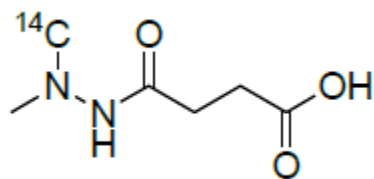
Statistical evaluation of the absorbed dose in rat compared to human skin and the total recovery in rat compared to human skin revealed that there is no statistically significant difference between the results obtained in the rat and human.

I. MATERIAL AND METHODS

A. MATERIALS

1a. Test Material - Radiolabelled [methyl-¹⁴C]-daminozide

Description:	Clear solution in methanol. The structure and site of labelling are shown below.
Lot/Batch:	4028RDB001-1
Radiochemical Purity:	97.3% (determined by HPLC)
Specific Activity:	828.8 MBq/mmol (22.4 mCi/mmol)

**1b. Test Material – Non-Radiolabelled**

Description:	White powder
Lot/Batch:	0811050965
Purity:	99.51%
Stability:	Until 14 May 2012

2. Test System

Frozen dermatomed human skin discs (450-540 µm) and frozen dermatomed rat skin discs (450-570 µm).

Production was performed on fresh skin obtained from plastic surgery (human) or obtained from male Sprague-Dawley rats. Skin samples were stored at ≤15°C.

3. Preparation of dose solutions

An artificial sweat solution was prepared in MQ using the following (and the pH adjusted to 4.7 with NaOH)

- 20 g/L NaCl
- 17.5 g/L NH₄Cl
- 5 g/L acetic acid
- 15 g/L d,l-lactic acid

A high dose solution of daminozide technical fortified with [methyl-¹⁴C]-daminozide was prepared using artificial sweat as a vehicle. A stock solution of approximately 34.5 MBq/mL [methyl-¹⁴C]-daminozide was prepared by dissolving an appropriate amount of [methyl-¹⁴C]-daminozide in artificial sweat. 76.8 mg of daminozide technical was spiked with 223.2 µL of the stock solution to obtain formulations containing approximately 344 mg/mL daminozide technical. To this solution, 1696 µL artificial sweat was added to obtain a solution of 40 mg/mL daminozide technical and 3.91 MBq/mL (determined by LSC). Homogeneity was determined by LSC.

A low dose solution of daminozide technical fortified with [methyl-¹⁴C]-daminozide was prepared using artificial sweat as a vehicle. A stock solution of approximately 25.8 MBq/mL [methyl-¹⁴C]-daminozide was prepared by dissolving an appropriate amount of [methyl-¹⁴C]-daminozide in artificial sweat. 6.22 mg of daminozide technical was spiked with 292.3 µL of the stock solution to obtain formulations containing 26.4 mg/mL daminozide technical. To this solution, 1634 µL artificial sweat was added to obtain a solution of 4 mg/mL daminozide technical and approximately 3.95 MBq/mL (determined by LSC). Homogeneity was determined by LSC.

4. Diffusion cells and receptor fluid

A flow-through peristaltic cell system was used. The skin surface temperature was $32 \pm 1^\circ\text{C}$ at ambient humidity. The receptor fluid was pumped at a flow rate of 1.5 mL/h (human skin) or 1 mL/h (rat skin).

B. STUDY DESIGN AND METHODS

1. Experimental dates

7th December 2010 to 15th January 2011

2. Measurement of skin integrity

Skin membranes were thawed, mounted in the diffusion cell and the skin integrity was tested by permeation of tritiated water. 200 μL saline containing tritiated water (3.7 kBq) was applied to the donor compartment of the flow-through cells. The receptor fluid consisted of saline and was collected every hour up to 3 hours after application. At the end of the experiment, the tritiated water remaining in the donor compartment was removed and the skin dried with cotton swabs. The receptor fluid samples were analysed by LSC.

3. Experimental procedure

The test material was applied at two concentrations in artificial sweat with an application volume of 6.4 μL on each skin. This represents an exposure of 0.4 mg/cm² skin and 0.04 mg/cm² skin for the high and low dose solutions, respectively. The exposure time was 8 hours during which the donor compartment was non-occluded. The receptor fluid consisted of saline. The amount of active substance applied to the skin was 0.256 mg for the highest concentration.

Table 6.2.2/01:

Group	ID of group	No. of skin membranes	Species	Exposure time (h)	Application vol. (per 0.64 cm ² skin)	Amount of a.s. exposed to skin (mg/cm ²)
I	High dose	4	Human	8	6.4 μL	0.4
II	Low dose	4	Human	8	6.4 μL	0.04
III	High dose	4	Rat	8	6.4 μL	0.4
IV	Low dose	4	Rat	8	6.4 μL	0.04

Study design

Aliquots of receptor fluid were collected in glass tubes at the following time intervals: 0-1, 1-2, 2-4, 4-6, 6-8, 8-10, 10-12, 12-16, 16-20 and 20-24 h.

At the end of the exposure, the test material remaining at the application site was collected. The skin was cleaned with five cotton swabs with 3% Teepol in water followed by one dry cotton swab.

After 24 hours of sampling, each skin sample was stripped a maximum of 20 times with D-Squame stripping discs and a D-Squame pressure instrument. Tape stripping was discontinued when the epidermis was disrupted. The skin strips were individually digested in Solvable for at least 4 hours at $60 \pm 1^\circ\text{C}$. 250 μL aliquots of the

digests were neutralised with 125 µL HCl (37%). The fluid in the receptor compartment was collected and the cell was rinsed with ethanol:MQ 1:1 (v:v).

Aliquots of a known volume of all collected samples, including the swab extraction samples, the skin digest, the receptor fluid in the cell and the rinsing solution were analysed by LSC. The stripping extraction samples were analysed by LSC.

Each concentration was tested with at least three human donors.

4. Acceptability of the assay

The determination of the dermal absorption in human and rat skin was considered acceptable if it met the following criteria:

- The human and rat skin discs should have a K_p for water $\leq 4.5 \times 10^{-3}$ cm/h and $\leq 5.8 \times 10^{-3}$ cm/h, respectively. Skin discs with a K_p for water $> 4.5 \times 10^{-3}$ cm/h (human) and $> 15.8 \times 10^{-3}$ cm/h (rat) were evaluated on the basis of their absorption profiles, by comparison to the other skin discs in the same concentration and formation group.
- The total recovery of the test material should be 90-110%. Any deviations from this range should be justified.

5. Calculations and expression of study results

Calculation of skin integrity

The skin permeability coefficient (K_p) for water is expressed as cm/h and calculated as:

$$K_p = J_{ss} / C_v$$

where J_{ss} is the flux at steady state and C_v is the concentration in the vehicle.

Calculation of skin penetration

The following parameters were determined:

- maximum absorption rate or steady state flux J_{ss} ($\mu\text{g}/\text{cm}^2/\text{h}$)

$$J_{ss} = (r / A) * C$$

where r is the slope of the steepest linear portion of the curve where the cumulative radioactivity in the receptor fluid per unit skin area is plotted versus time ($\text{kBq}/\text{cm}^2.\text{h}$), A is the activity of the test solution (kBq/mL) and C is the concentration of the test solution ($\mu\text{g}/\text{mL}$).

- lag time (h): time until absorption is linear in time, determined by visual inspection
- % of total dose that is present in the receptor fluid
- % of total dose that is present on or in the skin following washing

- Absorbed dose (% of dose that is present in the receptor fluid fractions, receptor compartment and in the skin without tape strips 1 & 2)
- Non-absorbed dose (% of the dose that is present in the stratum corneum (tape strips 1-2) and in the donor compartment)
- Total recovery (%)

Statistical evaluation

The absorbed dose and the total recovery observed in rat skin at the two concentrations was compared to human skin at the corresponding concentration and tested for significance using the Student's T-test. $P < 0.05$ was considered statistically significant.

II. RESULTS AND DISCUSSION

Skin integrity test

The permeability coefficients for tritiated water for the human skin discs that have been used are presented in the table below:

Table 6.2.2/02: Skin integrity values (human)

Dose level (mg/cm ² skin)	Exposure (h)	Skin disc (donor number – disc number)			
		K _p value for tritiated water (x10 ⁻³ cm/h)			
0.4	8	2573-02	2529-01	2566-01	2575-01
		2.63	4.12	2.76	3.97
0.04	8	2553-07	2580-01	2545-08	2573-03
		4.33	3.48	5.51*	3.27
		2539-07			
		6.24*			

* K_p value exceeded the criteria ($K_p \leq 4.5 \times 10^{-3}$ cm/h). Data from these samples were reported since the absorption results were comparable with the results of the accepted skin discs at the same concentration.

The permeability coefficients for tritiated water for the rat skin discs that have been used in this study are presented below:

Table 6.2.2/03: Skin integrity values (rat)

Dose level (mg/cm ² skin)	Exposure (h)	Skin disc (donor number – disc number)			
		K _p value for tritiated water (x10 ⁻³ cm/h)			
0.4	8	27021-03	17021-05	27021-08	27021-16
		1.32	13.2	3.42	8.67
0.04	8	27020-03	207021-04	27021-07	27021-12
		3.26	2.81	7.51	1.79

Dermal absorption of daminozide technical

The overall recovery for human skin was $96.6 \pm 1.9\%$ and $98.0 \pm 2.11\%$ for the 0.4 mg/cm² and 0.04 mg/cm² concentrations, respectively. For the rat skin, the overall recovery was $94.5 \pm 3.6\%$ and $99.0 \pm 1.9\%$ for the 0.4 mg/cm² and 0.04 mg/cm² concentrations, respectively.

The high standard deviation of the absorption for rat skin (low and high concentrations) was due to a high absorption in one of the four skin discs at both concentrations. The other three skin discs at each concentration showed a comparable low absorption. Therefore, the mean absorption for rat skin discs is given both for all skin discs (n=4), and also for the skin discs excluding the one with high absorption (n=3). The standard deviation in absorption for the three skin discs is acceptable.

Table 6.2.2/04: Dermal absorption of daminozide technical in human and rat skin

Dose level	0.4 mg/cm ² skin		0.04 mg/cm ² skin	
Dislodgeable dose				
	%	SD	%	SD
Donor chamber	96.25	1.84	96.86	2.29
Skin associated dose				
Tape strips 1&2	0.01	0.01	0.07	0.09
Tape strips 3-x	0.06	0.02	0.29	0.31
Skin preparation	0.04	0.03	0.32	0.46
Absorbed dose				
Receptor fluid	0.24	0.06	0.43	0.16
Receptor chamber	0.0	-	0.01	-
Total recovery	96.60	1.85	97.98	2.07
Absorbed at t_0.5	86.98	5.41	83.86	6.67
Absorption complete?	yes		yes	
Measured absorption	0.28	0.09	0.76	0.58
Relevant absorption estimate	0.426		1.455	
Pro-rata correction*	-		2.06	
Final estimate (rounded)	0.4		2	

Pro-rata correction for the in use dilution: 1.455% *0.04 mg/cm²/0.0283 mg/cm², where 0.04 mg/cm² is the skin loading in the dermal absorption study and 0.0283 mg/cm² is the estimated skin loading for operators using the maximum proposed in-use dilution.

Statistical evaluation of the absorbed dose in rat compared to human, and the total recovery in rat compared to human skin, revealed that there is no statistically significant difference between the results obtained in rats and humans

III. CONCLUSION

The dermal absorption of daminozide technical was investigated using human and rat skin. The percentage absorbed in rat skin was higher when compared to human skin. Statistical evaluation of the absorbed dose in rats, when compared to humans, and the total recovery in rats, when compared to humans, revealed that there is no statistically significant difference between the results obtained in rats and humans.

RMS comments	The study is considered acceptable and valid for overall evaluation.
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	<p>The data from the study were recalculated by RMS according to the new EFSA Guidance on Dermal Absorption (EFSA Journal 2017;15(6):4873). Due to the fact that there is no statistically significant difference between the results obtained in rats and humans, the values from <i>in vitro</i> human study were taken for daminozide in the evaluation of ALAR, SG.</p> <p>The value of 1.455% should be used for pro-rata correction as follows: $1.455\% \times 0.04 \text{ mg/cm}^2 / 0.0283 \text{ mg/cm}^2$, where 0.04 mg/cm² is the skin loading in the dermal absorption study and 0.0283 mg/cm² is the estimated skin loading for operators using the maximum proposed in-use dilution. However this modification had no impact on the conclusion about dermal absorption values for daminozide in evaluation of ALAR, SG.</p>
Endpoint / conclusion	For the purpose of exposure assessments of ALAR 850 SG values of 0.4% was used for the undiluted product and 2% for the in-use spray dilution.

B.6.3 Available toxicological data relating to co-formulants

All information and toxicological data on non-active substances relating to the composition of ALAR are confidential and are available in Volume 4 Annex C ‘Confidential information’.

B.6.4 Exposure data

ALAR is a water soluble granule (SG) formulation, containing a nominal 850 g/kg of daminozide. Beside the active ingredient daminozide, considerations will be given to Unsymmetrical Dimethyl Hydrazine (UDMH), the toxicologically relevant impurity/hydrolysis product/metabolite of daminozide that is permitted to be present at a maximum concentration of 0.03 g/kg daminozide at the product. The representative uses are as a foliar spray to ornamental flowers and bedding plants. The representative critical GAPs for the purposes of the AIR III process are summarised in Table B.6.4-1. Application to glasshouse plants is made using hand-held equipment or automated gantry sprayers.

Table B.6.4-1: Summary of critical use pattern (i.e. worst case)

Crop	Application rate		Spray dilution	Application method	Maximums number of applications	Minimal interval between applications (days)
(outdoor / indoor)	(kg a.s./ha)		(L/ha)			
Outdoor, hand-held equipment						
Ornamentals (outdoor)	daminozide UDMH	4.25 0.000128	500 - 1500	foliar spray using hand-held sprayer	5	7
Indoor, hand-held equipment						
Ornamentals (indoor)	daminozide UDMH	7.65 0.00023	500 - 1500	foliar spray using hand-held sprayer	5	7
Indoor, automated equipment						
Ornamentals (indoor)	daminozide UDMH	7.65 0.00023	500 - 1500	foliar spray using automated gantry sprayer	5	7

AOEL / Dermal absorption

The AOEL values adopted for the inclusion of daminozide and UDMH (Sanco/3043/99 final, 15 February 2005 from the Review Report) are 0.16 mg/kg bw/day and 0.09 µg/kg bw/day respectively, but according new data new AOEL value for daminozide has been suggested as 0.00875 mg/kg bw/day.

No dermal absorption data have been generated for ALAR since the previous EC review of daminozide. An *in vitro* dermal absorption study in human and rat skin of the technical material, a solid powder has been conducted and considered as appropriate for this submission for daminozide (see point B.6.2 above). For the purpose of exposure assessments of ALAR an 850 g/kg SG values of 0.4% and 2% have been derived for the undiluted product (solid formulation) and the spray dilution, respectively. A dermal absorption value of 0.4% is used for the worker exposure assessment which is based on a concentration for skin loading appropriate to the predicted levels of worker exposure.

For UDMH, values of 10.7% (0.15% solution), 20.1% (1.5% solution) and 24.5% (15% solution) have previously been agreed. Given that the spray concentrations recommended for ALAR are at a lower concentration of UDMH than the dermal absorption value provides a precautionary value to use for the risk assessment. The 10.7% value for UDMH is assumed for the risk assessment as this is considered the most representative concentration for proposed use, for the undiluted product and the spray dilution (see point B.6.2 above).

Estimations of exposure to Alar have been assessed pursuant to intended uses as shown above in **Table B.6.4-1** and compared to toxicological reference values (Acceptable Operator Exposure Level) taken into account dermal absorption values appropriate for Alar as shown in **Table B.6.4-2** below.

Table B.6.4-2 EU end-points and end-points used in risk assessment for daminozide and UDMH

End-Point	EU endpoint (Annex I inclusion)		Endpoint used in risk assessment	
	Active Substance			
	Daminozide ¹	UDMH ²	Daminozide ³	UDMH ²
Dermal penetration				
Concentrate:	13%	10.7%	0.4%	10.7%
Spray dilutions:	13%	10.7%	2%	10.7%
Oral absorption	35%	100%	35%	100%
AOEL	0.16 mg/kg bw/day	0.00009 mg/kg bw/day	0.00875 mg/kg bw/day	0.00009 mg/kg bw/day
AAOEL	not relevant	not relevant	not relevant	not relevant

¹ Based on a dermal absorption study conducted with the product Alar (please refer to EU Review Report SANCO/3043/99 final).

² Based on a dermal absorption study conducted with the product B-NINE (please refer to EU Review Report SANCO/3043/99 final).

³ Based on a dermal absorption study conducted with radio-labelled technical daminozide (please refer to study results presented in chapter B.6.2 of this dossier).

B.6.4.1 Operator exposure

In order to evaluate the representative use for the Annex I inclusion renewal of daminozide all relevant data and risk assessments are provided in here and considered adequate.

Operator exposure for daminozide and UDMH was assessed using the following models for outdoor and indoor application:

- German model: Lundehehn, j.-R.; Westphal, D.; Kieczka, H.; Krebs. B.; Locher-Bolz, S; Maasfeld, W.; Pick, E.-D. (1992): Uniform Principles for Safeguarding the Health of Applicators of Plant Protection Products (Uniform Principles for Operator Protection);, Mitteilungen aus der Biologischen Bundesanstalt, Heft 277, Berlin, 1992,
- Revised UK POEM: Estimation of Exposure and Absorption of Pesticides by Spray Operators, Scientific subcommittee on Pesticides and British Agrochemical association Joint Medical Panel Report (UK MAFF), 1986 and the Predictive Operator Exposure Model (POEM) V 7, 1992, 2008 version,
- Dutch greenhouse model for manual up- and downward spraying based on exposure studies in Dutch greenhouses: Golstein Brouwers Y.G.C. van, Marquart J., Hemmen J.J. van, (1996) Assessment of occupational exposure to pesticides in agriculture. Part IV: Protocol for the use of generic exposure data. TNO-report V 96.120. and Snippe R.J., Drooge H.L. van, Schipper H.J., Pater A.J. de, Hemmen J.J. van, (2002). Pesticide exposure assessment for registration purposes. Version 2002. TNO-report V3642
- Southern European Greenhouse model v_2.1 (20101223) with Southern European Greenhouse Model Overview. Members of the European Crop Protection Association. Occupational & Bystander Exposure Expert Group. October 2010 (Revision 9). ECPA, European Crop Protection Association, aisbl 6, Avenue E. Van Nieuwenhuyse, B-1160 Brussels, Belgium.

Regarding the current approach, also the risk assessment using the following model has been carried out:

- EFSA AOEM model has been included in the EFSA Guidance on the Assessment of Exposure for Operators, Workers, Residents and Bystanders in Risk Assessment for Plant Protection Products (EFSA Journal 2014;12(10):3874).

Risk assessment for operator

The critical use patterns have been defined in Table B.6.4-1.

The estimates of total daminozide and UDMH exposure predicted by the models have been calculated as a proportion of the proposed AOEL for both substances, see Table B.6.4-2.. Exposure calculations have been performed without and with personal protective equipment (PPE).

Experimental work has shown that when added to water, a small amount of daminozide hydrolyses to form additional UDMH (Connor J. Hart, 2012). The risk to operators applying prepared spray solutions of daminozide has been considered in the context of these findings.

The results of the exposure calculations for operators are summarized in Table B.6.4-3 below. Details of the calculations are given in Appendix I.

Table B.6.4-3 Estimated operator exposure to daminozide and UDMH in Alar

Model data	Level of PPE	Total absorbed dose (mg/kg bw/day) ¹		% of AOEL ²	Reference Appendix
Hand held application outdoors					
5 kg Alar/ha corresponding to 4.25 kg of daminozide per ha, spray volume 500 L per ha					
UK POEM - 0.8 ha/day - 70 kg operator	M/L: Gloves and RPE (FFP3) Appl: Gloves and Impermeable coveralls	daminozide	0.0606	692	B.6.4.1-16
		UDMH	0.0000056	62	B.6.4.1-17
EFSA AOEM - manual hand held - 4 ha/day - 60 kg operator	M/L and Appl.: Gloves, workwear, RPE (FP2)	daminozide	0.0344	392.60	B.6.4.1-18
		UDMH	0.015959	17,732.23	B.6.4.1-19
EFSA AOEM - manual knapsack - 1 ha/day - 60 kg operator	M/L and Appl.: Gloves, workwear, RPE (FP2)	daminozide	0.0087	99.11	B.6.4.1-20
		UDMH	0.016072	17,857.63	B.6.4.1-21
Hand held application indoor					
9 kg Alar/ha corresponding to 7.65 kg of daminozide per ha, spray volume 500 L per ha					
Dutch Greenhouse Model - 1 ha/day - 70 kg operator	M/L and Appl.: Gloves, Coverall, RPE (FP2)	daminozide	0.0546	624	B.6.4.1-7
		UDMH	0.000051	57	B.6.4.1-8
Southern European Greenhouse Model Low crops - 1 ha/day - 70 kg operator	M/L: Gloves Appl.: Gloves, RPE (FPP2), Coverall	daminozide	0.0062	70.7	B.6.4.1-9
		UDMH	0.000002	2.3	
Southern European Greenhouse Model High crops - 1 ha/day - 70 kg operator	M/L: Gloves, RPE (A1P2) Appl.: Gloves, RPE (A1P2), Headgear, Impervious clothing	daminozide	0.0074	84.1	
		UDMH	0.000007	7.7	
Gantry application indoors					
9 kg Alar/ha corresponding to 7.65 kg of daminozide per ha, spray volume 500 L per ha					
UK POEM mix/loading - 1 ha/day - 70 kg operator	No PPE	daminozide	0.0064	73	B.6.4.1-10
		UDMH	0.000002	2.41	B.6.4.1-11
German Model mix/loading - 1 ha/day - 70 kg operator	No PPE	daminozide	0.0017	20	B.6.4.1-12
		UDMH	0.000001	0.8	B.6.4.1-13
EFSA AOEM mix/loading - 10 ha/day - 60 kg operator	M/L: Gloves, Workwear, RPE (FPP1)	daminozide	0.0014	16.54	B.6.4.1-24
		UDMH	0.00003	33.87	B.6.4.1-25

¹⁾ Systemic exposure based on dermal absorption for the respective uses as indicated in Table B.6.4-2.

²⁾ Based on a systemic AOEL as indicated in Table B.6.4-2.

Conclusion

Operator exposure and risk evaluations were performed for applications of ALAR to outdoor ornamentals by means of the UK POEM model and EFSA AOEM model. Estimates of exposure for use on protected ornamentals were predicted using the Dutch model for manual application in glasshouses and also the ECPA Southern European Greenhouse model. Mixing and loading data taken from the German model, UK POEM and EFSA AOEM were also used to predict levels of exposure for automated gantry application to protected crops. The worst-case in terms of application rates and water volumes were chosen as input parameters in the modelling for the demonstration of uses for the product ALAR.

Based on UK POEM exposure model the assessment for outdoor hand held application shows unacceptable risk to daminozide for operator even with high level of PPE use. This conclusion is supported by EFSA AOEM.

For UDMH the assessment according the EFSA AOEM model shows that levels of exposure for spray operators applying ALAR to outdoor ornamentals using automated hand held sprayers are not within the AOEL with the use of PPE. Nevertheless using EFSA AOEM calculator it could be indicated unrealistically high level of exposure for low-content substances and more data should be provided in this case.

For indoor hand held application based on Southern European Greenhouse model there is no unacceptable risk concluded for operator with high level of PPE. But according Dutch Greenhouse model the risk can be indicated for daminozide.

Predicted exposures for operators during mix and loading are within the AOEL even when no PPE is worn. Nevertheless using EFSA AOEM calculator it can be indicated risk for UDMH exposure and more data should be provided in this case.

B.6.4.1.1 Estimation of operator exposure without personal protective equipment

Regarding the intended use of Alar to ornamentals outdoor and indoor both, following exposure scenarios has been considered:

- Outdoor hand held application
- Indoor hand held application into low and high crop
- Indoor gantry sprayer application

Content of UDMH

UDMH is an impurity of the active substance present up to a maximum of 30 mg/kg technical material. Experimental work has shown that when daminozide is added to water, a small amount of the active substance hydrolyses to form additional UDMH (Connor J. Hart, 2012, see Volume 3 – Annex B.6 (AS)). The risk to operators applying prepared spray solutions of daminozide has been considered in the context of these findings.

The study has taken measurement of the presence of UDMH over a storage period lasting up to 24 hours. A stock solution of 3.75364 g (3750 ppm) daminozide in 1 litre of tap water was prepared and the amount of UDMH presented in the solution was measured at 2, 4, 6 and 24 hours. Results of the study are presented in Table B.6.4.1.1-1 below.

Table B.6.4.1.1-1: Increase in UDMH content measured over 24 hours

Time interval (hours)	UDMH (mg/L)	Mean UDMH (mg/L)
0	0.035	0.043
	0.051	
1	0.15	0.16
	0.17	
2	0.35	0.36
	0.37	
4	0.65	0.67
	0.68	
6	1.04	1.1
	1.07	
24	3.7	3.7
	3.72	

In terms of risk assessment a typical application may take four hours from the time the product is added to the spray tank to the end of spraying. Allowing for a mechanical breakdown which could delay the application of the prepared spray solution, a longer period is possible. However this scenario would not be representative of a repeat exposure situation. For risk assessment purposes the value determined after four hours is considered to be suitably representative.

Daminozide in ALAR can be applied at a maximum rate of 7.65 kg a.s./ha. The UDMH impurity is present in the technical material up to a maximum concentration of 30 mg/kg daminozide. Thus 4.25 kg a.s./ha and 7.65 kg a.s./ha ALAR may contain up to 0.1275g and 0.23 g UDMH respectively.

Using the available data from the spray tank study, i.e. 3.75 g daminozide produced 0.67 mg UDMH over 4 hours, for an application rate of 4.25 kg daminozide/ha the total UDMH applied/ha, taking into account the amount of UDMH from manufacturing (127.5 mg UDMH) and the additional UDMH produced through hydrolysis of daminozide over a 4 hour period (759 mg – calculated from 3.75 g daminozide producing 0.67 mg UDMH over 4 hours) is 887 mg UDMH.

The predicted amount of UDMH in the spray solution is 0.0018 g UDMH per L spray solution (assuming the minimum water volume of 500 L water/ha is applied) for the outdoor use. This parameter is used for the UK POEM assessment which considers the spray solution concentration. The amount of UDMH in the spray tank per kg Daminozide applied is 208.7 mg UDMH (i.e. 887 mg UDMH divided by 4.25 kg a.s./ha.)

For the summary of UDMH content see table B.6.4.1.1-2.

Table B.6.4.1.1-2: Summary of UDMH content after 4h

Daminozide content (g/ha)	UDMH from manufacturing (g/ha)	UDMH produced through hydrolysis (g/ha)	total amount of UDMH (g/ha)
4,250	0.1275	0.759	0.887
7,650	0.23	1.365	1.595

Levels of exposure for spray operators are predicted on this basis. The exposure assessment considers both outdoor and protected uses.

The results of the exposure estimations for Daminozide and UDMH taking into account the above mentioned input parameters and assuming that no personal protective equipment (PPE) is worn are presented in Table B.6.4.1.1-3 below. Detailed exposure calculations are provided in the Appendix 1 to this section.

Table B.6.4.1.1-3: Summary of predicted exposures for operators applying ALAR to protected and outdoor crops without using PPE

Model data	Level of PPE	Total absorbed dose (mg/kg bw/day) ¹		% of AOEL ²	Reference Appendix
Hand held application outdoors to low crops					
5 kg Alar/ha corresponding to 4.25 kg of daminozide per ha, spray volume 500 L per ha					
UK POEM - 0.8 ha/day - 70 kg operator	No PPE	daminozide	0.2986	3413	B.6.4.1-1
		UDMH	0.000466	518	B.6.4.1-2
EFSA AOEM - manual hand held - 4 ha/day - 60 kg operator	No PPE	daminozide	0.0467	533.32	B.6.4.1-3
		UDMH	0.019232	21,368.88	B.6.4.1-4
EFSA AOEM - manual knapsack - 1 ha/day - 60 kg operator	No PPE	daminozide	0.0141	160.98	B.6.4.1-5
		UDMH	0.036488	40,542.37	B.6.4.1-6
Hand held application indoor					
9 kg Alar/ha corresponding to 7.65 kg of daminozide per ha, spray volume 500 L per ha					
Dutch Greenhouse Model - 1 ha/day - 70 kg operator	No PPE	daminozide	0.5464	6,245	B.6.4.1-7
		UDMH	0.000510	567	B.6.4.1-8
Southern European Greenhouse Model Low crops - 1 ha/day - 70 kg operator	No PPE	daminozide	0.0642	734.0	B.6.4.1-9
		UDMH	0.00003	34.2	
Southern European Greenhouse Model High crops - 1 ha/day - 70 kg operator	No PPE	daminozide	0.1706	1,949.8	
		UDMH	0.00013	140.2	

Gantry application indoors					
9 kg Alar/ha corresponding to 7.65 kg of daminozide per ha, spray volume 500 L per ha					
UK POEM mix/loading - 1 ha/day - 70 kg operator	No PPE	daminozide	0.0064	73	B.6.4.1-10
		UDMH	0.000002	2.41	B.6.4.1-11
German Model mix/loading - 1 ha/day - 70 kg operator	No PPE	daminozide	0.0017	20	B.6.4.1-12
		UDMH	0.000001	0.8	B.6.4.1-13
EFSA AOEM mix/loading - 10 ha/day - 60 kg operator	No PPE	daminozide	0.0056	63.95	B.6.4.1-14
		UDMH	0.0001	142.49	B.6.4.1-15

¹⁾ Systemic exposure based on dermal absorption for the respective uses as indicated in Table B.6.4-2.

²⁾ Based on a systemic AOEL as indicated in Table B.6.4-2.

B.6.4.1.2 Estimation of operator exposure using personal protective equipment

Assessment of systemic exposure of unprotected operators indicates that levels of exposure to daminozide and UDMH from the proposed use of ALAR are above the AOEL for hand-held application according to UK POEM and EFSA AOEM, the NL glasshouse and the Southern European Glasshouse Model (high crop scenario). Exposure assessment for operators wearing personal protective equipment is therefore considered for these scenarios appropriate.

The results of the exposure estimations when personal protective equipments (PPE) are worn are presented in Table B.6.4.1.2-1 below. Detailed exposure calculations are provided in the Appendix 1 to this section.

Table B.6.4.1.2-1: Summary of predicted exposures for operators applying ALAR to protected and outdoor crops using PPE

Model data	Level of PPE	Total absorbed dose (mg/kg bw/day) ¹		% of AOEL ²	Reference Appendix
Hand held application outdoors to low crops					
5 kg Alar/ha corresponding to 4.25 kg of daminozide per ha, spray volume 500 L per ha					
UK POEM - 0.8 ha/day - 70 kg operator	M/L: Gloves and RPE (FFP3) Appl: Gloves and Impermeable coveralls	daminozide	0.0606	692	B.6.4.1-16
		UDMH	0.0000056	62	B.6.4.1-17
EFSA AOEM - manual hand held - 4 ha/day - 60 kg operator	M/L and Appl.: Gloves, workwear, RPE (FP2)	daminozide	0.0344	392.60	B.6.4.1-18
		UDMH	0.015959	17,732.23	B.6.4.1-19
EFSA AOEM - manual knapsack - 1 ha/day - 60 kg operator	M/L and Appl.: Gloves, workwear, RPE (FP2)	daminozide	0.0087	99.11	B.6.4.1-20
		UDMH	0.016072	17,857.63	B.6.4.1-21
Hand held application indoor					

9 kg Alar/ha corresponding to 7.65 kg of daminozide per ha, spray volume 500 L per ha					
Dutch Greenhouse Model - 1 ha/day - 70 kg operator	M/L and Appl.: Gloves, Coverall, RPE (FP2)	daminozide	0.0546	624	B.6.4.1-7
		UDMH	0.000051	57	B.6.4.1-8
Southern European Greenhouse Model Low crops - 1 ha/day - 70 kg operator	M/L: Gloves Appl.: Gloves, RPE (FPP2), Coverall	daminozide	0.0062	70.7	B.6.4.1-9
		UDMH	0.000002	2.3	
Southern European Greenhouse Model High crops - 1 ha/day - 70 kg operator	M/L: Gloves, RPE (A1P2) Appl.: Gloves, RPE (A1P2), Headgear, Impervious clothing	daminozide	0.0074	84.1	
		UDMH	0.000007	7.7	
Gantry application indoors					
9 kg Alar/ha corresponding to 7.65 kg of daminozide per ha, spray volume 500 L per ha					
UK POEM mix/loading - 1 ha/day - 70 kg operator	M/L: Gloves, Workwear	daminozide	0.0039	45	B.6.4.1-22
		UDMH	0.0000001	0.16	B.6.4.1-23
German Model mix/loading - 1 ha/day - 70 kg operator EFSA AOEM mix/loading - 10 ha/day - 60 kg operator	M/L: Gloves	daminozide	0.0009	10.1	B.6.4.1-12
		UDMH	0.000000	0.04	B.6.4.1-13
	M/L: Gloves, Workwear, RPE (FP2)	daminozide	0.0014	16.54	B.6.4.1-24
		UDMH	0.00003	33.87	B.6.4.1-25

¹⁾ Systemic exposure based on dermal absorption for the respective uses as indicated in Table B.6.4-2.

²⁾ Based on a systemic AOEL as indicated in Table B.6.4-2.

B.6.4.1.3 Measurement of operator exposure

The risk assessments using the German BBA model, UK POEM, NL and EFSA AOEM model indicate that the health-based limit value (AOEL) for daminozide and UDMH will be exceeded under practical conditions of use when outdoor using hand-held sprayers even with appropriate PPE. Studies to provide field data on operator exposure to ALAR were not carried out.

RMS comments to the operator exposure:

Estimated operator exposure to daminozide and UDMH was recalculated taken into account dermal absorption (DA) and AOEL proposed during renewal process. As the new proposed AOEL value for daminozide is more critical, unacceptable health risk is concluded for outdoor application. For indoor hand held application based on Southern European Greenhouse model there is no unacceptable risk concluded for operator with high level of PPE.

Using Gantry sprayer exposure estimations according to UK POEM, EFSA AOEM model and German model are acceptable.

B.6.4.2 Bystander and Resident exposure

Estimations of bystander and residential exposure have been undertaken for ALAR using the critical uses (Table B.6.4-1), the German guidance paper¹.

Regarding the current approach, also the risk assessment using the EFSA Guidance² has been carried out for a comparison.

Outdoor application by hand-held sprayers represents a worst case for bystanders and residents. Indoor application has not been conducted as greenhouses are closed areas where there is no assumption of bystander's or resident's occurrence.

Systemic exposure for bystanders and residents for daminozide and UDMH was calculated assuming dermal absorption of 2% and 10.7% for daminozide and UDMH respectively. The estimations of exposure were compared to the AOEL of 0.00875 mg/kg bw/day for daminozide and 0.09 µg/kg bw/day for UDMH.

In order to estimate bystander and residential exposure, it was taken into account total UDMH content after 4h.

German model:

It is conservatively assumed that the spray deposit on the foliar surfaces (dislodgeable foliar residues) do not completely decline between the applications. This follows the recommendations given in the German guidance paper in which it is recommended to assume a decay of the dislodgeable foliar residue (DFR) of 50% between successive applications. Consequently, for several potential applications it is recommended that an accumulated application rate of maximum 2 applications should be used (explanation: 100% from the final application plus 50% from the second last application plus 25% from the application before etc. will never result in values > 200%). Therefore, according to German exposure model the worst case for residents is given by a maximum total dose of 8.5 kg a.s./ha.

The vapour pressure for daminozide is 1.27×10^{-5} Pa at 21.6°C and therefore considered as semi-volatile according German guidance. UDMH is a more volatile compound and an assessment is given for this route of exposure based on an 8 hour Time Weighted Average (TWA) value of 8.5×10^{-5} mg/m³ which was measured in a commercial greenhouse over an 8 hour period following an application of Daminozide to Chrysanthemums (see CP B.6.4.3.2). This value therefore provides a precautionary first tier assessment.

EFSA AOEM model:

According to the EFSA Guidance (EFSA Journal 2014;12(10):3874) for plant protection products that do not have significant acute toxicity no bystander risk assessment is required as due to exposure determination by longer duration it is covered by resident risk assessment.

For the assessment by EFSA AOEM model proposed GAP was used with DFR and DT₅₀ values from the DFR study (see B.6.4.3.2)

A summary of the estimated bystander/resident exposure to daminozide and UDMH using the German approach and the EFSA AOEM model is presented in Table B.6.4.2-1, B.6.4.2-2 and B.6.4.2-3, respectively.

¹ Guidance for Exposure and Risk Evaluation for Bystanders and Residents exposed to Plant Protection Products during and after Application; S. Martin *et al.*; J. Verbr. Lebensm. 3 (2008): 272 – 281, 1661-5751/08/030272-10 DOI 10.1007/s00003-008-0361-5, ©Birkhäuser Verlag, Basel, 2008

² EFSA Guidance on the Assessment of Exposure for Operators, Workers, Residents and Bystanders in Risk Assessment for Plant Protection Products (EFSA Journal 2014;12(10):3874).

Bystander assessment

Table B.6.4.2-1 German model: Summary of bystander exposure during outdoor application of Alar

	Active ingredient	Route of exposure	Estimated bystander exposure	% of AOEL	Reference Appendix
			(mg/kg bw/day)		
German model					
5 kg Alar/ha corresponding to 4.25 kg of daminozide per ha, spray volume 500 L per ha, buffer strip 10m					
adult (60 kg)	daminozide	dermal and inhalation exposure	0.0063	72.16	B.6.4.2-1 B.6.4.2-2
	UDMH		0.000002	1.88	
child (16.15 kg)	daminozide		0.0129	147.70	
	UDMH		0.000003	3.32	

Resident Assessment

Table B.6.4.2-2 German model: Summary of resident exposure during outdoor application of Alar

	Active ingredient	Route of exposure	Estimated bystander exposure	% of AOEL	Reference Appendix
			(mg/kg bw/day)		
German model					
2x 5 kg Alar/ha corresponding to 8.5 kg of daminozide per ha, spray volume 500 L per ha, buffer strip 10m					
adult (60 kg)	daminozide	dermal exposure and inhalation exposure to vapour	0.0003	3.72	B.6.4.2-3 B.6.4.2-4
	UDMH		0.000024	26.14	
child (16.15 kg)	daminozide	dermal exposure and inhalation exposure to vapour, oral exposure (hand to mouth, object to mouth)	0.0007	7.89	
	UDMH		0.000044	48.75	

Table B.6.4.2-3 EFSA AOEM model: Summary of residential exposure during outdoor application of Alar

	Active ingredient	Route of exposure	Estimated bystander exposure	% of aAOEL	Reference Appendix
			(mg/kg bw/day)		
EFSA AOEM model					
2x 5 kg Alar/ha corresponding to 8.5 kg of daminozide per ha, spray volume 500 L per ha, buffer strip 10m					
child (10 kg)	daminozide	spray drift	0.0249	285.05	B.6.4.2-5 B.6.4.2-6
	UDMH		0.000027	29.53	
	daminozide	vapour	0.0011	12.23	
	UDMH		0.001070	1188.89	
	daminozide	surface deposits	0.0021	24.09	
	UDMH		0.000001	0.70	

	daminozide	entry into treated crops	0.0533	608.75	
	UDMH		0.000000	0	
	daminozide	all pathways	0.0618	705.90	
	UDMH		0.001088	1208.89	
adult (60 kg)	daminozide	spray drift	0.0138	152.89	
	UDMH		0.000015	16.30	
	daminozide	vapour	0.0002	2.63	
	UDMH		0.000230	255.56	
	daminozide	surface deposits	0.0005	5.71	
	UDMH		0.0000002	0.22	
	daminozide	entry into treated crops	0.0296	338.20	
	UDMH		0.000000	0	
	daminozide	all pathways	0.0330	377.14	
	UDMH		0.000240	266.39	

Conclusion

Estimated outdoor bystander and resident exposure to daminozide and UDMH was recalculated taken into account dermal absorption (DA) and AOEL proposed during renewal process. As the newly proposed AOEL value for daminozide is more critical unacceptable health risk to daminozide is concluded for bystander – child according to German approach.

According the EFSA AOEM residents exposure estimation is unacceptable for daminozide and UDMH both.

According to the EFSA Guidance (EFSA Journal 2014;12(10):3874) for plant protection products that do not have significant acute toxicity no bystander risk assessment is required as due to exposure determination by longer duration it is covered by resident risk assessment.

As there is bystander and resident unacceptable risk indicated, the representative outdoor use to ornamentals cannot be approved.

Indoor application has not been conducted as greenhouses are closed areas where there is no assumption of bystander's or resident's occurrence.

B.6.4.3 Worker Exposure

Estimations of worker exposure have been undertaken for ALAR using the critical uses (Table B.6.4-1). The re-entry scenario considered is for workers handling ornamental plants, including containerised plants and small plants in trays. The worst case is given by the protected crop scenario.

Considering the protected crop scenario the inhalation exposure for worker has to be calculated.

Risk assessment for worker

The worker risk assessment presented has been based according to the EU requirements on the following models:

- German Re-entry Worker model with parameters taken from the EUROPOEM II Worker re-entry report: Hoernicke E. et al. (1998): Details in the instructions for use on the protection of persons carrying out successive work with crops which have been treated with plant protection products. Nachrichtenbl. Deut.

Pflanzenschutzd. 50, 267-267; in conjunction with: Krevs et al. (2000): Uniform principals for ensuring health protection for workers when re-entering treated crops following the application of plant protection products. Nachrichtenbl. Deut. Pflanzenschutzd. 52, 5-9.

- EFSA AOEM model has been included in the EFSA Guidance on the Assessment of Exposure for Operators, Workers, Residents and Bystanders in Risk Assessment for Plant Protection Products (EFSA Journal 2014;12(10):3874).

German model:

It is conservatively assumed that the spray deposit on the foliar surfaces (dislodgeable foliar residues) do not completely decline between the applications. This follows the recommendations given in the German guidance paper in which it is recommended to assume a decay of the dislodgeable foliar residue (DFR) of 50% between successive applications. Consequently, for several potential applications it is recommended that an accumulated application rate of maximum 2 applications should be used (explanation: 100% from the final application plus 50% from the second last application plus 25% from the application before etc. will never result in values > 200%). Therefore, according to German exposure model the worst case for workers is given by a maximum total dose of 8.5 kg a.s./ha.

Systemic exposure of worker for daminozide and UDMH was calculated assuming corresponding dermal absorption and was compared to the AOEL (see Table B.6.4-2).

In order to provide worker exposure, it was taken into account total UDMH content after 4h as the worst case for the first tier as the content after longer time of hydrolysis is not needed due to rapid substance degradation.

A summary of the estimated worker exposure to daminozide and UDMH using the German approach and the EFSA AOEM model is presented in Table B.6.4.3-1.

Table B.6.4.3-1 Estimated worker exposure to daminozide and UDMH in Alar to ornamental plants					
Model data	Level of PPE	Total absorbed dose (mg/kg bw/day) ¹		% of AOEL ²	Reference Appendix
Handling ornamentals plants, indoor					
2 x 9 kg Alar/ha corresponding to 38.25 kg of daminozide per ha					
German model - TC 5000 - working time 8h - 60 kg operator	Gloves and RPE	daminozide	0.0124	141.2	B.6.4.3-7 B.6.4.3-8
		UDMH	0.000072	80.5	
EFSA AOEM - working time 8h - 60 kg operator	Gloves	daminozide	0.1114	1,273.2	B.6.4.3-9 B.6.4.3-10
		UDMH	0.000086	95.86	

¹⁾ Systemic exposure based on dermal absorption for the respective uses as indicated in Table B.6.4-2.

²⁾ Based on a systemic AOEL as indicated in Table B.6.4-2.

Conclusion

In conclusion, there is an unacceptable risk anticipated for persons entering crops where ALAR was applied in the manner proposed.

B.6.4.3.1 Estimation of Worker Exposure

The following parameters were used in the re-entry worker assessment:

- Application rate: for a maximum total dose of two treatments is 15.3 kg (2 x 7.65 kg of daminozide/ha and 0.0032 kg (2 x 0.0016 kg of UDMH/ha (for indoor applications)
- Dermal absorption: 0.4% for *Daminozide and 10,7% for UDMH
 *As recommended in current EFSA guidance, in deciding which dermal absorption value to assume for the risk assessment the dose density on the area of exposed skin may be taken into account. The predicted exposures for daminozide for workers handling ornamentals (Appendix 7.2.3.1-1 and 7.2.3.1-2) show, as expected, that a significant portion of the total dermal exposure occurs on the workers hands. The predicted hand exposure is 3672 mg/person. The surface area for adult hands is an uncovered area of 820 cm². Assuming a total surface area for both palms of 820 cm² the resulting skin loading is 4478 µg/cm². This skin loading is closest to the 400 µg daminozide/cm² concentration tested, from which the dermal absorption value of 0.4% was derived (see CP 7.3)
- Body weight: 60 kg

The following parameters from the EFSA Journal 2014;12(10):3874 were used in the assessment:

- DFR: 3 µg a.s./cm² /kg a.s. applied
- TC: 5000 cm²/hr for handling larger ornamental plants assuming arm, body and legs covered. Whilst the TC value for handling smaller plants in trays will be lower than 5000 cm²/hr, use of this TC provides a risk envelope for all worker scenarios. TC 1400 cm²/hr assuming covered body and gloves
- The product is applied into a greenhouse. As pesticide droplets may remain airborne after the treatment when re-entering, levels of inhalation exposure have been predicted using the following inhalation task specific factors:
 Cutting 0.1 (mg a.s./hr)/(kg/ha)
 Sorting/bundling 0.01(mg a.s./hr)/(kg/ha)
 using RPE FP1 25% reduction of inhalation exposure can be assumed
- Working time: A total working time of 8 hours is assumed for handling activities.

A precautionary assessment is given as a Tier 1 assessment. This assumes that the maximum total dose is applied to the crop (7.65 kg daminozide x 2 treatments) and that there is no decline in dislodgeable foliar residues from any of the two treatments at the time of re-entry (minimum interval between treatments is 7 days for protected crops). The use of protective gloves by workers is also considered, which reduce dermal exposure to the hands by 90%³.

The results of the exposure calculations for workers are summarized in Table B.6.4.3.1-1. Full calculations are given in Appendix I.

³ EFSA (European Food Safety Authority), 2014. Guidance on the assessment of exposure of operators, workers, residents and bystanders in risk assessment for plant protection products. EFSA Journal 2014;12(10):3874, 55 pp., doi:10.2903/j.efsa.2014.3874

Table B.6.4.3.1-1 Estimated worker exposure to daminozide and UDMH in Alar to ornamental plants

Model data	Level of PPE	Total absorbed dose (mg/kg bw/day) ¹		% of AOEL ²	Reference Appendix
Handling ornamentals plants, indoor					
5x 9 kg Alar/ha corresponding to 38.25 kg of daminozide per ha					
German model - TC 5000 - working time 8h - 60 kg operator	No PPE	daminozide	0.142800	1,632	B.6.4.3-1
		UDMH	0.000687	763.2	B.6.4.3-2
	Gloves and RPE	daminozide	0.0393	450	B.6.4.3-1
		UDMH	0.000192	213.6	B.6.4.3-2
EFSA AOEM - working time 8h - 60 kg operator	No PPE	daminozide	0.3293	3,763.06	B.6.4.3-3
		UDMH	0.001289	1,432.0	B.6.4.3-4
	Gloves	daminozide	0.1656	1,893	B.6.4.3-3
		UDMH	0.000376	417.97	B.6.4.3-4

¹) Systemic exposure based on dermal absorption for the respective uses as indicated in Table B 6.4-2.

²) Based on a systemic AOEL as indicated in Table B 6.4-2.

Conclusion

In conclusion, there is unacceptable risk anticipated for persons entering crops where ALAR was applied in the manner proposed even with suitable protective gloves. Further refinement is needed.

B.6.4.3.2 Measurement of worker exposure (Dislodgeable Foliar Residues)

As the levels of exposure predicted for re-entry workers are above the AOEL for daminozide and UDMH further estimates of exposure are given which consider the use of dislodgeable foliar residues data.

The following report is used to support the assessment:

Reference:	van der Jagt, K.E, Ravensberg J.C., de Wold J.M. and Links I.H.M., 2002; Dislodgeable foliar residue determination of daminozide, UDMH and NDMA and air monitoring of UDMH, NDMA and formaldehyde following indoor treatment of ornamental plants with Alar® 64 SP
Report No.:	V3876
Guideline:	Not stated but the study design broadly follows the US Environmental Protection Agency office of prevention, pesticides and toxic substances (OPTS) Occupational and Residential Exposure Test Guidelines. Foliar Dislodgeable Residue Dissipation Series 875
GLP:	Yes

Previous evaluation:	Daminozide addendum Vol. 3 June 2002
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Executive Summary

A study was conducted to quantify the magnitude and decline of dislodgeable foliar residues (DFR) of daminozide, N,N-dimethylhydrazine (UDMH) and N-nitrosodimethylamine (NDMA) following indoor treatment of ornamental plants with a soluble powder formulation of daminozide (Alar® 64 SP) containing 64.7% w/w daminozide. In addition, the magnitude and decline of airborne residues of UDMH, NDMA and formaldehyde were also quantified.

The product was applied to Chrysanthemum plants in a commercial glasshouse in the Netherlands in 2001. Two treatments of daminozide were applied, the second treatment was applied at 4.6 kg a.s/ha with a 6 day interval between treatments.

Dislodgeable foliar residue sampling took place pre and post treatment on the day of application and on days 1, 2, 3, 5, 10 and 14 post-treatment. Stationary air sampling for UDMH, NDMA and formaldehyde took place pre and post treatment on the day of application and on days 1, 2, 3 and 5 post-treatment on the day of application.

The DFR of daminozide on Chrysanthemums declined from 6597 ng/cm² just after the second treatment to 372 ng/cm² 14 days after treatment. The degradation product UDMH also showed a decline in foliar residues, from 1.5 ng/cm² just after the second treatment to 0.2 ng/cm² 14 days later. The highest air concentration of UDMH (191 ng/m³) was recorded 6 to 8 hours post treatment. All other air measurements of UDMH were either below the LOD (45 ng/m³) or between the LOD and the LOQ (107 ng/m³).

Test Material:	Alar 64 SP
Description:	Soluble Powder (SP)
Lot/Batch Number:	SI 7938
Purity:	Not stated. Product contains 64.7% Daminozide
Stability of test compound:	Stable for the duration of the study

Study Design and Methods

A study was conducted to quantify the magnitude and decline of dislodgeable foliar residues (DFR) of daminozide, N,N-dimethylhydrazine (UDMH) and N-nitrosodimethylamine (NDMA) following indoor treatment of ornamental plants with a soluble powder formulation of daminozide (Alar® 64 SP) containing 64.7% w/w daminozide. In addition, the magnitude and decline of airborne residues of UDMH, NDMA and formaldehyde were also quantified. The study, performed in 2001, was conducted in accordance with the requirements of Good Laboratory Practice (GLP).

The product was applied to Chrysanthemum plants in a commercial glasshouse in the Netherlands in 2001. The volume of the greenhouse was 41400 m³. One bed of 1.4 m by 30 m stocked with Chrysanthemum flowers was treated. Two treatments of daminozide were applied, the second treatment was applied at 4.6 kg a.s./ha with a 6 day interval between treatments. Applications were achieved using hand-held sprayers connected to a mobile (200 L) tank.

Dislodgeable foliar residue sampling took place pre and post treatment on the day of application and on days 1, 2, 3, 5, 10 and 14 post-treatment. Stationary air sampling for UDMH, NDMA and formaldehyde took place pre and post treatment on the day of application and on days 1, 2, 3 and 5 post-treatment on the day of application. Leaf samples, taken at 2/3 plant height, were collected from randomly selected plants. None were taken from the borders of the bed. Twelve leaves were picked to give one leaf sample. Leaf surface area was determined using a method based upon a decrease in light intensity with increasing leaf surface area. The average area of 12 leaves was determined to be 550 cm².

Dislodging of DFR from samples was performed within 12 hours of sample collection. Dislodging of leaf samples was achieved using demineralised water containing a dislodging solution (Triton x-100). Samples were shaken for 30 minutes, the dislodging solution was then removed, new solution added and the process repeated. Containers containing the leaves were then rinsed with demineralised water and all extracts combined. Analysis of the DFR extracts was performed using liquid chromatography with tandem mass spectrometry (LC-MS/MS).

Stationary air samples were taken at two locations in the selected bed, at a height of approximately 1 metre which was just above the top of the plants. One sampler was located in the centre of the bed the other at the perimeter. UDMH in air was trapped using two serially connected impingers, each filled with 0.1 M HCl solution. Sampling pumps were operated at a flow rate of 2 L/minute. Four sequential 2 hour samples were collected on the day of application whilst a single 2 hour sample was taken on other days.

For analysis of the UDMH air samples ascorbic acid and sodium hydroxide was added to the 0.1 molar hydrochloric acid taken from the air collection impingers. For analysis of UDMH in DFR solution, the DFR solution was first acidified with fuming hydrochloric acid. Ascorbic acid and sodium hydroxide were then added to the acidified solution. After the addition of 2-nitrobenzaldehyde containers were shaken and kept in a water bath for 2 hours at 30°C. Iso-octane was added to the warm solution and samples were shaken. The iso-octane layer was removed and centrifuged before 3 mL of the solution was concentrated under nitrogen. The volume was adjusted with further iso-octane and ITSD (chlorpyrifos 10 mg/L in iso-octane) added.

Calibration samples were prepared by addition of 1,1-dimethylhydrazine in 0.05 M HCl to either DFR solution or 0.1 molar HCl. Calibration samples were treated identically to the validation and study samples.

Extracts were analysed by GC-NPD on a CP-Sil-19-CB column (25 mL, 0.25 mm i.d., 0.2 µm film).

Results

Temperatures in the greenhouse, where the DFR and air samples were taken ranged from 18.3°C to 24.4°C over the course of the study. Relative humidity ranged from 61.2% to 83.2%. Meteorological conditions in a 'cutting greenhouse' where the blank and field control samples for air sampling were taken were similar.

Variability of the analytical method was within acceptable levels. Field recovery samples prepared to determine the potential loss of UDMH during air sampling showed levels of recovery between 77.8% and 94.9%. Therefore no adjustment for field recovery for these samples was required.

The DFR of Daminozide on Chrysanthemums declined from 6597 ng/cm² just after the second treatment to 372 ng/cm² 14 days after treatment. The DFR measured just before the second application was made (360 ng/cm²) showed there was minimal accumulation of DFR from the first application. Using the application rate for the

second application (4.6 kg a.s./ha) the DFR of Daminozide measured immediately after the second application was made is $1.434 \mu\text{g}/\text{cm}^2/\text{kg}$ a.s. applied.

The degradation product UDMH also showed a decline in foliar residues, from $1.5 \text{ ng}/\text{cm}^2$ just after the second treatment to $0.2 \text{ ng}/\text{cm}^2$ 14 days later. The DFR measured just before the second application was made ($0.2 \text{ ng}/\text{cm}^2$) confirmed minimal accumulation of DFR from the first application. The DFR of UDMH measured immediately after the second application was made is $3.3 \times 10^{-4} \mu\text{g}/\text{cm}^2/\text{kg}$ Daminozide applied.

Table B.6.4.3.2-1: Dislodgeable foliar residues of daminozide and UDMH following application of daminozide to glasshouse Chrysanthemums

Sampling date	Sample	Leaf surface area (cm^2)	Daminozide DFR (ng/cm^2)	UDMH DFR (ng/cm^2)
Day 0	Pre-treatment (a)	574.64	360	0.2
	Post-treatment (b)	615.04	6597	1.5
Day 1		621.06	4977	1.0
Day 2		642.24	3905	1.0
Day 3		625.01	3411	0.9
Day 5		599.22	699	0.4
Day 10		607.46	409	0.1
Day 14		616.16	372	0.2

(a) Sample from test bed prior to second application

(b) Sample taken after leaves were dry, approximately 2:40 hours after application

Figure B.6.4.3.2-1: Half-life calculation for daminozide DFR on Chrysanthemums leaves.

DT_{50} on foliage = 2.37 days

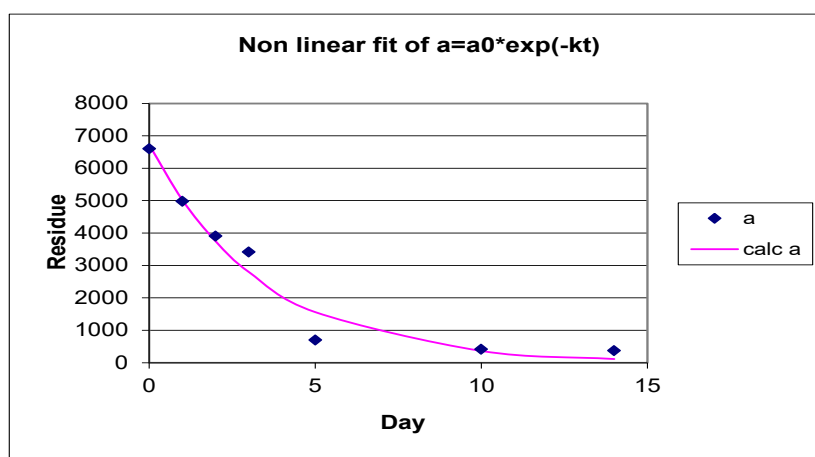
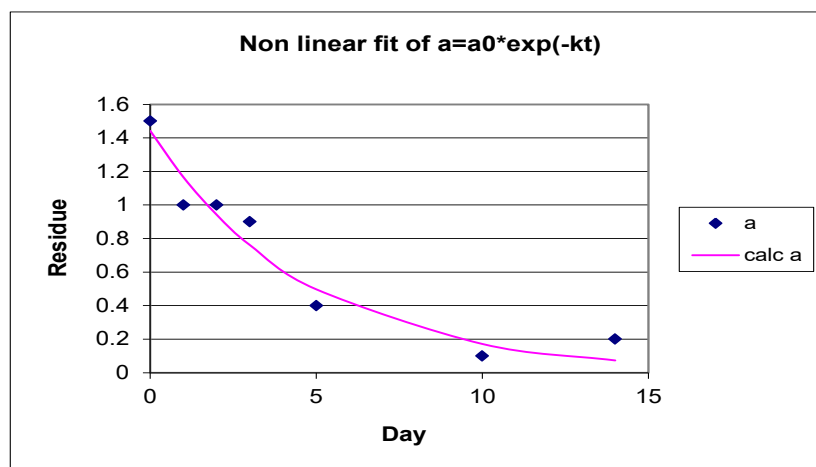


Figure B.6.4.3.2-1: Half-life calculation for UDMH DFR on Chrysanthemums leaves.

DT₅₀ on foliage = 3.25 days



The highest air concentration of UDMH (191 ng/m³) was recorded 6 to 8 hours post treatment. All other air measurements of UDMH were below the LOD (45 ng/m³) or between the LOD and the LOQ (107 ng/m³). For the eight hour period of monitoring on the day of the second application the calculated time weighted average (TWA) value is 85 ng/m³.

Table B.6.4.3.2-2: Average air concentrations of UDMH following application of Daminozide to glasshouse Chrysanthemums

Sampling date	Sample	Calculated air concentration (ng/m ³)
Day 0	Pre-treatment	45(a)
	0-2 h Post-treatment	43(a)
	2-4 h Post-treatment	51(b)
	4-6 h Post-treatment	54(b)
	6-8 h Post-treatment	191
Day 1		44(a)
Day 2		42(a)
Day 3		44(a)
Day 5		43(a)

(a) <LOD (107 ng/L equals 45 ng/m³ with a sampled volume of 240L)

(b) <LOQ (256 ng/L equals 107 ng/m³ with a sampled volume of 240L)

Risk Assessment

Exposure is predicted for workers handling ornamentals assuming a maximum individual dose of 7.65 kg daminozide/ha (3.83 x 10⁻³ kg UDMH/ha), 5 treatments, a 7 day interval between treatments and no pre-harvest interval. Initial DFR after treatment is calculated from the exposure study measurements which are 1.434 µg/cm² and 3.3 x 10⁻⁴ µg/cm² for Daminozide and UDMH respectively for each kg of Daminozide which is applied. To allow consideration of the dissipation of daminozide and UDMH DFR between treatments the total DFR is calculated assuming a half-life (DT₅₀) of 2.37 days for daminozide and 3.25 days for UDMH on treated foliage.

RMS comments	The study is valid for evaluating. At the study 4.6 kg daminozide./ha was applied onto one bed of 1.4 m by 30 m in a greenhouse . The volume of the greenhouse
--------------	--

	<p>was 41400 m3. Rapid degradation of the parent active substance daminozide and metabolite UDMH both has been demonstrated. DT50 values have been set based on DFR decrease in time. Initial DFR after 2nd application can be used instead of default value for the risk assessment refinement.</p> <p>The highest average air concentration of UDMH was measured 6-8h after application. Considering application conditions, suggested TWA value can be used for calculation refinement of outdoor uses only.</p>									
Endpoint / conclusion	<p>For the purpose of exposure assessments of ALAR followed values can be used:</p> <table><tr><td></td><td>DT50 [days]</td><td>DFR [µg/cm2/kg daminozide]</td></tr><tr><td>daminozide</td><td>2.37</td><td>1.434</td></tr><tr><td>UDMH</td><td>3.25</td><td>0.00033</td></tr></table>		DT50 [days]	DFR [µg/cm2/kg daminozide]	daminozide	2.37	1.434	UDMH	3.25	0.00033
	DT50 [days]	DFR [µg/cm2/kg daminozide]								
daminozide	2.37	1.434								
UDMH	3.25	0.00033								

Considered short DT₅₀ value for both substances, for refinement instead of number of applications Multiple Application Factor (MAF) can be used (EFSA Journal 2014;12(10):3874). According the critical GAP 5 applications with 7 days interval between applications, estimated number of applications is 1.15 for daminozide and 1.3 for UDMH.

The predicted exposures are summarised below at Table B.6.4.3.2-3. Full calculations are given in Appendix I.

Table B.6.4.3.2-3 Estimated worker exposure to daminozide and UDMH in Alar to ornamental plants

Model data	Level of PPE	Total absorbed dose (mg/kg bw/day) ¹		% of AOEL ²	Reference Appendix
Handling ornamentals plants, indoor					
5x 9 kg Alar/ha corresponding to 5x 7.65 kg of daminozide per ha and 5x1.595 g of UDMH per ha					
German model - TC 5000 - working time 8h - 60 kg operator	No PPE	daminozide	0.0454	518.5	B.6.4.3-7
		UDMH	0.00026	290.8	B.6.4.3-8
	Gloves and RPE	daminozide	0.0124	141.2	B.6.4.3-7
		UDMH	0.00007 2	80.5	B.6.4.3-8
EFSA AOEM - working time 8h - 60 kg operator	No PPE	daminozide	0.1356	1,549.6	B.6.4.3-9
		UDMH	0.00025 3	281.62	B.6.4.3-10
	Gloves	daminozide	0.1114	1,273.2	B.6.4.3-9
		UDMH	0.00008 6	95.86	B.6.4.3-10

¹⁾ Systemic exposure based on dermal absorption for the respective uses as indicated in Table B.

²⁾ Based on a systemic AOEL as indicated in Table B.

The risk assessment performed has been undertaken for protected crops as this scenario has a higher maximum individual dose and maximum total dose than the outdoor uses. As DFR dissipation data generated for a protected

crop are expected to be a worst case for outdoor crops the half-life values used for the dissipation of daminozide and UDMH DFR in the risk assessment are expected to be precautionary values for ornamental crops grown outdoors. The worker exposure assessment for the use of ALAR on protected crops therefore provides a suitable risk envelope for use on outdoor grown ornamentals.

Conclusion

In conclusion, there is unacceptable risk anticipated for persons entering crops where ALAR was applied in the manner proposed

RMS comments and conclusion:

Estimated indoor worker exposure to daminozide and UDMH was recalculated taken into account dermal absorption (DA) and AOEL proposed during renewal process. As the newly proposed AOEL value for daminozide is more critical unacceptable health risk to daminozide is concluded for worker according to German and EFSA approach both.

As a further refinement a re-entry interval could be set, but as there is no harmonised approach the refinement was not carried out and could be done on national level.

B.6.5 Summary of operator, bystander/resident and worker exposure

The operator, bystander/resident and worker exposure and risk assessment are summarized in Volume 1, level 2.

Comments by the RMS:

Based on evaluation given by calculation method safe use of product Alar cannot be guaranteed.

B.6.6 References relied on**Toxicological studies on the Plant Protection Product (Annex IIIA, Point 7)****New studies**

Data point	Author(s)	Year	Title Company Report No. Source (where different from company) GLP or GEP status Published or not	Vertebrate study Y/N	Data protection claimed Y/N	Justification if data protection is claimed	Owner
CP 7.1.1/01	██████████	1997a	Acute oral toxicity study with B-Nine® WSG in rats ██████████, ██████ Report No. 96-1463 GLP Unpublished	Y	Y	New study for AIR 3 dossier	Arysta LifeScience Great Britain Ltd
CP 7.1.2/01	██████████	1997b	Acute dermal toxicity study with B-Nine® WSG in rabbits ██████████. Report No. 96-1464 GLP Unpublished	Y	Y	New study for AIR 3 dossier	Arysta LifeScience Great Britain Ltd
CP 7.1.4/01	██████████	1997c	Primary dermal irritation study with B-Nine® WSG in rabbits ██████████. Report No. 94-1465 GLP Unpublished	Y	Y	New study for AIR 3 dossier	Arysta LifeScience Great Britain Ltd
CP 7.1.5/01	██████████	2005	ALAR 85 SG: acute eye irritation in the rabbit ██████████. Report No. 1133/029 GLP Unpublished	Y	Y	New study for AIR 3 dossier	Arysta LifeScience Great Britain Ltd
CP 7.1.6/01	██████████	1997d	Closed-patch repeated dose insult dermal sensitization study with B-Nine® WSG in guinea pigs (Buehler Method) ██████████. Report No. 94-1466 GLP Unpublished	Y	Y	New study for AIR 3 dossier	Arysta LifeScience Great Britain Ltd
CP 7.3/01	██████████	2011	Determination of the dermal absorption of daminozide technical in human and rat skin ██████████ Report No. 495333 GLP Unpublished	N	Y	New study for AIR 3 dossier	Arysta LifeScience Great Britain Ltd

Studies relied upon for the first inclusion of daminozide in Annex I to Directive 91/414/EEC and for renewal of approval under Regulation (EC) No 1107/2009

Data point	Author(s)	Year	Title Company Report No. Source (where different from company) GLP or GEP status Published or not	Vertebrate study Y/N	Data protection claimed Y/N	Justification if data protection is claimed	Owner
CP 7.1.3/01	██████████	1997	An acute (4-hour) inhalation toxicity study of B-Nine® WSG in the rat via nose-only exposure ██████████, ██████. Report No. 96-5289 GLP Unpublished	Y	N	Not applicable	Arysta LifeScience Great Britain Ltd
CP 7.2.3.2/01	van der Jagt, K.E., Ravensberg, J.C., de Wold, J.M., Links, I.H.M.	2002	Dislodgeable foliar residue determination of daminozide, UDMH and NDMA and air monitoring of UDMH, NDMA and formaldehyde following indoor treatment of ornamental plants with Alar® 64 SP TNO Nutrition and Research. Report No. V3876 GLP Unpublished	N	N	Not applicable	Uniroyal Chemical Company, Inc.
CP 7.3	██████████ ████	1991	Dermal Absorption of 14C-UDMH in B-Nine Using Male Sprague-Dawley Rats. ██ Report No. A.7.5.1.4 GLP	Y	N	Not applicable	Uniroyal Chemical Company, Inc.

APPENDIX 1

Daminozide

OPERATOR, BYSTANDER/RESIDENT AND WORKER EXPOSURE ASSESSMENT

Appendix B.6.4.1-1: Hand held application outdoors to low crops, UK POEM: daminozide – no PPE
THE UK PREDICTIVE OPERATOR EXPOSURE MODEL (POEM) WITH GERMAN MODEL MIX/LOAD DATA (75th PERCENTILE)

Application method	Hand-held sprayer (15 l tank): hydraulic nozzles. Outdoor, low level target		
Product	Alar	Active substance	daminozide
Formulation type	WG or SG	a.s. concentration	850 mg/g
Dermal absorption from product	0,4 %	Dermal absorption from spray	2 %
PPE during mix/loading	None	PPE during application	None
Dose	5 kg product/ha	Work rate/day	0,8 ha
Application volume	500 l/ha	Duration of spraying	6 h
AOEL _{system}	0,00875 mg/kg bw/day	Total exposure (result):	3413 % AOEL

DERMAL EXPOSURE DURING MIXING AND LOADING

Hand contamination/kg a.s.	171,4 mg/kg a.s.
Hand contamination/day	582,76 mg/day
Protective clothing	None
Transmission to skin	100 %
Dermal exposure to a.s.	582,76 mg/day

INHALATION EXPOSURE DURING MIXING AND LOADING

Inhalation exposure/kg a.s.	0,0628 mg/kg a.s.
Inhalation exposure/day	0,21352 mg/day
RPE	None
Transmission through RPE	100 %
Inhalation exposure to a.s.	0,21352 mg/day

DERMAL EXPOSURE DURING SPRAY APPLICATION

Application technique	Hand-held sprayer (15 l tank): hydraulic nozzles. Outdoor, low level target		
Application volume	500 spray/ha		
Volume of surface contamination	50 ml/h		
Distribution	Hands	Trunk	Legs
	25%	25%	50%
Clothing	None	Permeable	Permeable
Penetration	100%	20%	18%
Dermal exposure	10	2,5	4,5 ml/h
Duration of exposure	6 h		
Total dermal exposure to spray	102 ml/day		
Concentration of a.s. in spray sol	8,5 mg/ml		
Dermal exposure to a.s.	867 mg/day		

INHALATION EXPOSURE DURING SPRAYING

Inhalation exposure to spray	0,02 ml/h
Duration of exposure	6 h
Concentration of a.s. in spray	8,5 mg/ml
Inhalation exposure to a.s.	1,02 mg/day
Percent absorbed	100 %
Absorbed dose	1,02 mg/day

ABSORBED DOSE

	Mix/load	Application	
Dermal exposure to a.s.	582,76 mg/day		867 mg/day
Percent absorbed	0,4 %		2 %
Absorbed dose (dermal route)	2,33104 mg/day		17,34 mg/day
Inhalation exposure to a.s.	0,21352 mg/day		1,02 mg/day
Absorbed dose	2,54456 mg/day		18,36 mg/day

PREDICTED EXPOSURE

Total absorbed dose	20,90456 mg/day
Operator body weight	70 kg
Operator exposure	0,298636571 mg/kg bw/day

Appendix B.6.4.1-2: Hand held application outdoors to low crops, UK POEM: UDMH – no PPE
THE UK PREDICTIVE OPERATOR EXPOSURE MODEL (POEM) WITH GERMAN MODEL MIX/LOAD DATA (75th PERCENTILE)

Application method	Hand-held sprayer (15 l tank): hydraulic nozzles. Outdoor, low level target		
Product	Alar	Active substance	UDMH
Formulation type	WG or SG	a.s. concentration	0,177 mg/g
Dermal absorption from product	10,7 %	Dermal absorption from spray	10,7 %
PPE during mix/loading	None	PPE during application	None
Dose	5 kg product/ha	Work rate/day	0,8 ha
Application volume	500 l/ha	Duration of spraying	6 h
AOEL _{syst.}	0,00009 mg/kg bw/day	Total exposure (result):	518 % AOEL

DERMAL EXPOSURE DURING MIXING AND LOADING

Hand contamination/kg a.s.	171,4 mg/kg a.s.
Hand contamination/day	0,12162544 mg/day
Protective clothing	None
Transmission to skin	100 %
Dermal exposure to a.s.	0,12162544 mg/day

INHALATION EXPOSURE DURING MIXING AND LOADING

Inhalation exposure/kg a.s.	0,0628 mg/kg a.s.
Inhalation exposure/day	4,45629E-05 mg/day
RPE	None
Transmission through RPE	100 %
Inhalation exposure to a.s.	4,45629E-05 mg/day

DERMAL EXPOSURE DURING SPRAY APPLICATION

Application technique	Hand-held sprayer (15 l tank): hydraulic nozzles. Outdoor, low level target		
Application volume	500 spray/ha		
Volume of surface contamination	50 ml/h		
Distribution	Hands	Trunk	Legs
	25%	25%	50%
Clothing	None	Permeable	Permeable
Penetration	100%	20%	18%
Dermal exposure	10	2,5	4,5 ml/h
Duration of exposure	6 h		
Total dermal exposure to spray	102 ml/day		
Concentration of a.s. in spray soluti	0,001774 mg/ml		
Dermal exposure to a.s.	0,180948 mg/day		

INHALATION EXPOSURE DURING SPRAYING

Inhalation exposure to spray	0,02 ml/h
Duration of exposure	6 h
Concentration of a.s. in spray	0,001774 mg/ml
Inhalation exposure to a.s.	0,00021288 mg/day
Percent absorbed	100 %
Absorbed dose	0,00021288 mg/day

ABSORBED DOSE

	Mix/load	Application
Dermal exposure to a.s.	0,12162544 mg/day	0,180948 mg/day
Percent absorbed	10,7 %	10,7 %
Absorbed dose (dermal route)	0,013013922 mg/day	0,019361436 mg/day
Inhalation exposure to a.s.	4,45629E-05 mg/day	0,00021288 mg/day
Absorbed dose	0,013058485 mg/day	0,019574316 mg/day

PREDICTED EXPOSURE

Total absorbed dose	0,032632801 mg/day
Operator body weight	70 kg
Operator exposure	0,000466183 mg/kg bw/day

Appendix B.6.4.1-3: Hand held application outdoors to low crops, EFSA AOEM (manual hand-held): daminozide – no PPE

Exposure assessment

Substance	Daminozide	Formulation = Wettable granules, soluble granules	Application rate-4,25 kg a.s. /ha	Spray dilution = 8,5 g a.s./l	Vapour pressure = low volatile substances having a vapour pressure of
Scenario	Ornamentals / Outdoor / Downward spraying / Manual-Hand held			Buffer = 2-3	Number applications = 5, Application interval = 7 days
Percentage Absorption	Dermal for product = 0,4	Dermal for in use dilution = 2	Oral = 100	Inhalation = 100	
RVNAS	0,00875 mg/kg bw/day		RVAAS	mg/kg bw/day	
DFR	3 µg a.s./cm ² per kg a.s./ha		DT50	30 days	

Operator Model		Mixing, loading and application AOEM			
Potential exposure	Longer term systemic exposure mg/kg bw/day	0,3493	% of RVNAS	3992,50%	
	Acute systemic exposure mg/kg bw/day	0,5497	% of RVAAS		
Mixing and Loading	Gloves = No	Clothing = Work wear - arms, body and legs covered	RPE = None	Soluble bags = No	
Application	Gloves = No	Clothing = Work wear - arms, body and legs covered	RPE = None	Closed cabin = No	
Exposure (including PPE options above)	Longer term systemic exposure mg/kg bw/day	0,0467	% of RVNAS	533,32%	
	Acute systemic exposure mg/kg bw/day	0,2663	% of RVAAS		

Appendix B.6.4.1-4: Hand held application outdoors to low crops, EFSA AOEM (manual hand-held): UDMH – no PPE

Exposure assessment

Substance	UDMH	Formulation = Wettable granules, soluble granules	Application rate- 0,000887 kg a.s. /ha	Spray dilution = 0,001774 g a.s./l	Vapour pressure = low volatile substances having a vapour pressure of
Scenario	Ornamentals / Outdoor / Downward spraying / Manual-Hand held			Buffer = 2-3	Number applications = 5, Application interval = 7 days
Percentage Absorption	Dermal for product = 10,7	Dermal for in use dilution = 10,7	Oral = 100	Inhalation = 100	
RVNAS	0,00009 mg/kg bw/day		RVAAS	mg/kg bw/day	
DFR	3 µg a.s./cm ² per kg a.s./ha		DT50	30 days	

Operator Model		Mixing, loading and application AOEM			
Potential exposure	Longer term systemic exposure mg/kg bw/day	0,1619	% of RVNAS	179864,20%	
	Acute systemic exposure mg/kg bw/day	0,2619	% of RVAAS		
Mixing and Loading	Gloves = No	Clothing = Work wear - arms, body and legs covered	RPE = None	Soluble bags = No	
Application	Gloves = No	Clothing = Work wear - arms, body and legs covered	RPE = None	Closed cabin = No	
Exposure (including PPE options above)	Longer term systemic exposure mg/kg bw/day	0,0192	% of RVNAS	21368,88%	
	Acute systemic exposure mg/kg bw/day	0,1237	% of RVAAS		

Appendix B.6.4.1-5: Hand held application outdoors to low crops, EFSA AOEM (manual knapsack): daminozide – no PPE
Exposure assessment

Substance	Daminozide	Formulation = Wettable granules, soluble granules	Application rate-4,25 kg a.s./ha	Spray dilution = 8,5 g a.s./l	Vapour pressure = low volatile substances having a vapour pressure of
Scenario	Ornamentals / Outdoor / Downward spraying / Manual-Knapsack			Buffer = 2-3	Number applications = 5, Application interval = 7 days
Percentage Absorption	Dermal for product = 0,4	Dermal for in use dilution = 2	Oral = 100	Inhalation = 100	
RVNAS	0,00875 mg/kg bw/day		RVAAS	mg/kg bw/day	
DFR	3 µg a.s./cm ² per kg a.s./ha		DT50	30 days	

Operator Model		Mixing, loading and application AOEM			
Potential exposure	Longer term systemic exposure mg/kg bw/day	0,0898	% of RVNAS	1025,77%	
	Acute systemic exposure mg/kg bw/day	0,1413	% of RVAAS		
Mixing and Loading	Gloves = No	Clothing = Work wear - arms, body and legs covered	RPE = None	Soluble bags = No	
Application	Gloves = No	Clothing = Work wear - arms, body and legs covered	RPE = None	Closed cabin = No	
Exposure (including PPE options above)	Longer term systemic exposure mg/kg bw/day	0,0141	% of RVNAS	160,98%	
	Acute systemic exposure mg/kg bw/day	0,0705	% of RVAAS		

Appendix B.6.4.1-6: Hand held application outdoors to low crops, EFSA AOEM (manual knapsack): UDMH – no PPE

Exposure assessment

Substance	UDMH	Formulation = Wettable granules, soluble granules	Application rate- 0,000887 kg a.s. /ha	Spray dilution = 0,001774 g a.s./l	Vapour pressure = low volatile substances having a vapour pressure of
Scenario	Ornamentals / Outdoor / Downward spraying / Manual-Knapsack			Buffer = 2-3	Number applications = 5, Application interval = 7 days
Percentage Absorption	Dermal for product = 10,7	Dermal for in use dilution = 10,7	Oral = 100	Inhalation = 100	
RVNAS	0,00009 mg/kg bw/day		RVAAS	mg/kg bw/day	
DFR	3 µg a.s./cm ² per kg a.s./ha		DT50	30 days	

Operator Model		Mixing, loading and application AOEM			
Potential exposure	Longer term systemic exposure mg/kg bw/day	0,1805	% of RVNAS	200533,13%	
	Acute systemic exposure mg/kg bw/day	0,3033	% of RVAAS		
Mixing and Loading	Gloves = No	Clothing = Work wear - arms, body and legs covered	RPE = None	Soluble bags = No	
Application	Gloves = No	Clothing = Work wear - arms, body and legs covered	RPE = None	Closed cabin = No	
Exposure (including PPE options above)	Longer term systemic exposure mg/kg bw/day	0,0365	% of RVNAS	40542,37%	
	Acute systemic exposure mg/kg bw/day	0,1659	% of RVAAS		

Appendix B.6.4.1-7: Hand held indoor application, Dutch Greenhouse model: daminozide

OPERATOR EXPOSURE			DUTCH GREENHOUSE MODEL	
form	Alar		Application including mixing and loading	
a.s.	daminozide			
Parameter		Value	Unit	References, comments
MANUAL SPRAYING in greenhouses				
AR	Application rate	7,65	kg a.s./ha	summary of intended uses
A	Area treated	1	ha/ day	Dutch model
Inhalation Exposure				
SV	Surrogate Exposure Value	1	mg a.s./ kg a.s.	without PPE For dusting see note* (Dutch model)
Inhalation Exposure (without PPE)		7,65	mg a.s./ day	IE = SV x AR x A
Inhalation Exposure (with PPE)				
PPE-factor		10		with PPE Non-powered mask filtertype 2 (most conservative): 10; more advanced RPE: see note** (Dutch model)
Inhalation Exposure (with PPE)		0,765	mg a.s./ day	IE(PPE) = (1/PPE factor) x IE
Dermal Exposure				
SV	Surrogate Exposure Value	200	mg a.s./ kg a.s.	without PPE For dusting see note* (Dutch model)
Dermal Exposure		1530	mg a.s./ day	DE = SV x AR x A
Dermal Exposure (with PPE)				
PPE-factor		10		with PPE Gloves + coverall: 10 (Dutch model)
Dermal Exposure (with PPE)		153	mg a.s./ day	DE(PPE) = (1/PPE-factor) x DE
Internal exposure				
IA	Inhalation Absorption	100	%	
DA	Dermal Absorption	2	%	
AOEL		0,6125	mg a.s./ day	based on 70 kg bw
		Without PPE	With PPE	
Internal exposure		[mg a.s. / day]	[mg a.s. / day]	
Inhalation		7,6500	0,7650	IE(int) = IE x (IA/100)
Dermal		30,6000	3,0600	DE(int) = DE x (DA/100)
Total		38,2500	3,8250	sum
% AOEL				
Inhalation		1249	125	%AOEL = 100 x IE(int) / AOEL
Dermal		4996	500	%AOEL = 100 x DE(int) / AOEL
Total		6245	624	sum

Appendix B.6.4.1-8: Hand held indoor application, Dutch Greenhouse model: UDMH

OPERATOR EXPOSURE			DUTCH GREENHOUSE MODEL	
form	Alar		Application including mixing and loading	
a.s.	daminozide			
Parameter		Value	Unit	References, comments
MANUAL SPRAYING in greenhouses				
AR	Application rate	0,001595	kg a.s./ha	summary of intended uses
A	Area treated	1	ha/ day	Dutch model
Inhalation Exposure			without PPE	
SV	Surrogate Exposure Value	1	mg a.s./ kg a.s.	For dusting see note* (Dutch model)
Inhalation Exposure (without PPE)		0,001595	mg a.s./ day	IE = SV x AR x A
Inhalation Exposure (with PPE)			with PPE	
	PPE-factor	10		Non-powered mask filtertype 2 (most conservative): 10; more advanced RPE: see note** (Dutch model)
Inhalation Exposure (with PPE)		0,0001595	mg a.s./ day	IE(PPE) = (1/PPE factor) x IE
Dermal Exposure			without PPE	
SV	Surrogate Exposure Value	200	mg a.s./ kg a.s.	For dusting see note* (Dutch model)
Dermal Exposure		0,319	mg a.s./ day	DE = SV x AR x A
Dermal Exposure (with PPE)			with PPE	
	PPE-factor	10		Gloves + coverall: 10 (Dutch model)
Dermal Exposure (with PPE)		0,0319	mg a.s./ day	DE(PPE) = (1/PPE-factor) x DE
Internal exposure				
IA	Inhalation Absorption	100	%	
DA	Dermal Absorption	10,7	%	
	AOEL	0,0063	mg a.s./ day	based on 70 kg bw
		Without PPE	With PPE	
	Internal exposure	[mg a.s. / day]	[mg a.s. / day]	
	Inhalation	0,0016	0,0002	IE(int) = IE x (IA/100)
	Dermal	0,0341	0,0034	DE(int) = DE x (DA/100)
	Total	0,0357	0,0036	sum
	% AOEL			
	Inhalation	25	3	%AOEL = 100 x IE(int) / AOEL
	Dermal	542	54	%AOEL = 100 x DE(int) / AOEL
	Total	567	57	sum

Appendix B.6.4.1-9: Hand held indoor application, Southern European Greenhouse Model

Data entry screen & summary calculation sheet

GREENHOUSE MODEL v_2.1

Product:	Alar	75th percentile			
Formulation:	WG				
Body weight [kg]:	70				
Active substance(s):	daminozide	UDMH	Na-2-WG	Substance 4	Add substance
Concentration [g/l or kg]:	850	0	0	0	
Inhalation absorption [%]	100	100	100	0	
Dermal absorption [%]					Remove substance
Concentrate:	0,4	10,7	4,21	0,0	
Dilution:	2,0	10,7	20,48	0,0	
AOEL [mg/kg bw/day]	0,0088	0,0001	0,0007	0,0	

Scenario 1:	Low crop, standard				
Application rate [l or kg product/ha]:	9,0				
Dose [kg a.s./ha]:	7,65	0,0016	0,0007	0,0	Add application scenario
Work rate [ha/day]:	1,00				
PPE during application:					
PPE during mix/loading:	Respiration:	Mask FFP2			
Respiration:	None	Hands:	Gloves	Remove application scenario	
Hands:	Gloves	Head:	None		
Body:		Coverall			

Scenario 2:	High crop, standard				
Application rate [l or kg product/ha]:	9,0				
Dose [kg a.s./ha]:	7,65	0,0016	0,0007	0,0	
Work rate [ha/day]:	1,00				
PPE during application:					
PPE during mix/loading:	Respiration:	Mask A1P2			
Respiration:	Mask A1P2	Hands:	Gloves		
Hands:	Gloves	Head:	Headgear		
Body:		Impervious clothing			

Summary

Predicted systemic exposure as a percentage of the AOEL: Greenhouse Model

75th percentile

Active substance	Protection	Systemic exposure [mg/kg bw/day]	AOEL [mg/kg bw/day]	% of AOEL
Low crop, standard				
daminozide	None	0,06423	0,0088	734,0
	With	0,006183		70,7
UDMH	None	0,00003	0,0001	34,2
	With	0,000002		2,3
High crop, standard				
daminozide	None	0,1706	0,0088	1949,8
	With	0,007356		84,1
UDMH	None	0,00013	0,0001	140,2
	With	0,000007		7,7

Appendix B.6.4.1-10: Gantry indoor application, UK POEM M/L: daminozide – no PPE

THE UK PREDICTIVE OPERATOR EXPOSURE MODEL (POEM) WITH GERMAN MODEL MIX/LOAD DATA (75th PERCENTILE)

Application method	Tractor-mounted/trailed boom sprayer: hydraulic nozzles		
Product	Alar	Active substance	daminozide
Formulation type	WG or SG	a.s. concentration	850 mg/g
Dermal absorption from product	0,4 %	Dermal absorption from spray	0 %
PPE during mix/loading	None	PPE during application	None
Dose	9 kg product/ha	Work rate/day	1 ha
Application volume	500 l/ha	Duration of spraying	6 h
AOEL ₃₇₅	0,00875 mg/kg bw/day	Total exposure (result):	73 % AOEL

DERMAL EXPOSURE DURING MIXING AND LOADING

Hand contamination/kg a.s.	5,72 mg/kg a.s.
Hand contamination/day	43,758 mg/day
Protective clothing	None
Transmission to skin	100 %
Dermal exposure to a.s.	43,758 mg/day

INHALATION EXPOSURE DURING MIXING AND LOADING

Inhalation exposure/kg a.s.	0,0358 mg/kg a.s.
Inhalation exposure/day	0,27387 mg/day
RPE	None
Transmission through RPE	100 %
Inhalation exposure to a.s.	0,27387 mg/day

DERMAL EXPOSURE DURING SPRAY APPLICATION

Application technique	Tractor-mounted/trailed boom sprayer: hydraulic nozzles		
Application volume	500 spray/ha		
Volume of surface contamination	10 ml/h		
Distribution	Hands	Trunk	Legs
	65%	10%	25%
Clothing	None	Permeable	Permeable
Penetration	100%	5%	15%
Dermal exposure	6,5	0,05	0,375 ml/h
Duration of exposure	6 h		
Total dermal exposure to spray	41,55 ml/day		
Concentration of a.s. in spray sol	15,3 mg/ml		
Dermal exposure to a.s.	635,715 mg/day		

INHALATION EXPOSURE DURING SPRAYING

Inhalation exposure to spray	0,01 ml/h
Duration of exposure	6 h
Concentration of a.s. in spray	15,3 mg/ml
Inhalation exposure to a.s.	0,918 mg/day
Percent absorbed	100 %
Absorbed dose	0,918 mg/day

ABSORBED DOSE

	Mix/load	Application	
Dermal exposure to a.s.	43,758 mg/day		mg/day
Percent absorbed	0,4 %		%
Absorbed dose (dermal route)	0,175032 mg/day		mg/day
Inhalation exposure to a.s.	0,27387 mg/day		mg/day
Absorbed dose	0,448902 mg/day		mg/day

PREDICTED EXPOSURE

Total absorbed dose	0,448902 mg/day
Operator body weight	70 kg
Operator exposure	0,006412886 mg/kg bw/day

Appendix B.6.4.1-11: Gantry indoor application, UK POEM M/L: UDMH – no PPE.
THE UK PREDICTIVE OPERATOR EXPOSURE MODEL (POEM) WITH GERMAN MODEL MIX/LOAD DATA (75th PERCENTILE)

Application method	Tractor-mounted/trailed boom sprayer: hydraulic nozzles		
Product	Alar	Active substance	UDMH
Formulation type	WG or SG	a.s. concentration	0,026 mg/g
Dermal absorption from product	10,7 %	Dermal absorption from spray	0 %
PPE during mix/loading	None	PPE during application	None
Dose	9 kg product/ha	Work rate/day	1 ha
Application volume	500 l/ha	Duration of spraying	6 h
AOEL _{syst.}	0,00009 mg/kg bw/day	Total exposure (result):	2,41 % AOEL

DERMAL EXPOSURE DURING MIXING AND LOADING

Hand contamination/kg a.s.	5,72 mg/kg a.s.
Hand contamination/day	0,00133848 mg/day
Protective clothing	None
Transmission to skin	100 %
Dermal exposure to a.s.	0,00133848 mg/day

INHALATION EXPOSURE DURING MIXING AND LOADING

Inhalation exposure/kg a.s.	0,0358 mg/kg a.s.
Inhalation exposure/day	8,3772E-06 mg/day
RPE	None
Transmission through RPE	100 %
Inhalation exposure to a.s.	8,3772E-06 mg/day

DERMAL EXPOSURE DURING SPRAY APPLICATION

Application technique	Tractor-mounted/trailed boom sprayer: hydraulic nozzles		
Application volume	500 spray/ha		
Volume of surface contamination	10 ml/h		
Distribution	Hands	Trunk	Legs
	65%	10%	25%
Clothing	None	Permeable	Permeable
Penetration	100%	5%	15%
Dermal exposure	6,5	0,05	0,375 ml/h
Duration of exposure	6 h		
Total dermal exposure to spray	ml/day		
Concentration of a.s. in spray solution	mg/ml		
Dermal exposure to a.s.	mg/day		

INHALATION EXPOSURE DURING SPRAYING

Inhalation exposure to spray	0,01 ml/h
Duration of exposure	6 h
Concentration of a.s. in spray	0 mg/ml
Inhalation exposure to a.s.	0 mg/day
Percent absorbed	100 %
Absorbed dose	0 mg/day

ABSORBED DOSE

	Mix/load	Application	
Dermal exposure to a.s.	0,00133848 mg/day		mg/day
Percent absorbed	10,7 %		%
Absorbed dose (dermal route)	0,000143217 mg/day		mg/day
Inhalation exposure to a.s.	8,3772E-06 mg/day		mg/day
Absorbed dose	0,000151595 mg/day		mg/day

PREDICTED EXPOSURE

Total absorbed dose	0,000151595 mg/day
Operator body weight	70 kg
Operator exposure	2,16564E-06 mg/kg bw/day

Appendix B.6.4.1-12: Gantry indoor application, German model M/L: daminozide

Estimation of operator exposure (acc. to the German model)

Active substance (a.s.)	Daminozide			
Product	Alar			
Intended use(s)	ornamentals			
Type of preparation	Field Crops, Tractor Mounted (FCTM) ▼			
	Water soluble or dispersible granules (WG) ▼			
Application rate (AR)	7,65	kg a.s./ha		
Treated area per day (A)	1	ha/d		
Systemic AOEL	0,00875	mg/kg bw/d		
Dermal absorption (DA)	0,4	% for mixing/loading (m/l)		
		% for application (appl.)		
Inhalation absorption (IA)	100	%		
Body weight (BW)	70	kg		

Personal protective equipment:	BVL code	Reduction factor	to lower:	
Particle filtering half mask (m/l) ¹⁾	ST1102	0,08	I _M	<input type="checkbox"/>
Half mask with combined filter (m/l) ¹⁾	ST2102	0,02	I _M	<input type="checkbox"/>
Particle filtering half mask (appl.) ¹⁾	ST1203	0,08	I _A	<input type="checkbox"/>
		0,8	D _{A(C)}	
Half mask with combined filter (appl.) ¹⁾	ST2202	0,02	I _A	<input type="checkbox"/>
		0,8	D _{A(C)}	
Protective gloves (m/l) ²⁾	SS110	0,01	D _{M(H)}	<input checked="" type="checkbox"/>
Protective gloves (appl.) ²⁾	SS120	0,01	D _{A(H)}	<input type="checkbox"/>
Protective garment + sturdy footwear (appl.) ²⁾	SS2202	0,05	D _{A(B)}	<input type="checkbox"/>
Broad-brimmed headgear (appl.) ²⁾	SS420	0,5	D _{A(C)}	<input type="checkbox"/>
Hood and visor (appl.) ²⁾	SS520	0,05	D _{A(C)}	<input type="checkbox"/>

¹⁾ DIN EN 149 (2001), ²⁾ BVL (2006) Guidelines for requirements concerning personal protective equipment in plant protection

Estimated inhalation exposure:	Personal protective equipment (PPE)	Factor
I _M	no PPE	1
I _A	no PPE	1

Estimated dermal exposure:	Personal protective equipment (PPE)	Factor
D _{M(H)}	SS110	0,01
D _{A(H)}	no PPE	1
D _{A(C)}	no PPE	1
D _{A(B)}	no PPE	1

Input parameters considered for the estimation of operator exposure:

Formulation type:	Water soluble or dispersible	Application technique:	Field Crops, Tractor Mounted (FCTM)
Application rate (AR):	7,65 kg	Dermal hands m/l ($D_{M(H)}$):	2 mg/person/kg a.s.
Area treated per day (A):	1 ha	Dermal hands appl. ($D_{A(H)}$):	0,38 mg/person/kg a.s.
Dermal absorption (DA):	0,4 % (concentr.) % (dilution)	Dermal body appl. ($D_{A(B)}$):	1,6 mg/person/kg a.s.
Inhalation absorption (IA):	100 %	Dermal head appl. ($D_{A(C)}$):	0,06 mg/person/kg a.s.
Body weight (BW):	70 kg/person	Inhalation m/l (I_M):	0,008 mg/person/kg a.s.
AOEL	0,00875 mg/kg bw/d	Inhalation appl. (I_A):	0,001 mg/person/kg a.s.

Operator exposure towards Daminozide				
Without PPE			With PPE	
Operators: Systemic dermal exposure after application in ornamentals				
Dermal exposure during mixing/loading				
Hands			Hands	
$SDE_{OM(H)} = (D_{M(H)} \times AR \times A \times DA) / BW$			$SDE_{OM(H)} = (D_{M(H)} \times AR \times A \times PPE^1 \times DA) / BW$	
$(2 \times 7,65 \times 1 \times 0,4\%) / 70$			$(2 \times 7,65 \times 1 \times 0,01 \times 0,4\%) / 70$	
External dermal exposure	15,3	mg/person	External dermal exposure	0,153 mg/person
External dermal exposure	0,2185714	mg/kg bw/d	External dermal exposure	0,0021857 mg/kg bw/d
Systemic dermal exposure	0,000874	mg/kg bw/d	Systemic dermal exposure	0,000009 mg/kg bw/d
Dermal exposure during application				
Hands			Hands	
$SDE_{OA(H)} = (D_{A(H)} \times AR \times A \times DA) / BW$			$SDE_{OA(H)} = (D_{A(H)} \times AR \times A \times PPE^1 \times DA) / BW$	
$(0,38 \times 7,65 \times 1 \times 0\%) / 70$			$(0,38 \times 7,65 \times 1 \times 1 \times 0\%) / 70$	
External dermal exposure		mg/person	External dermal exposure	mg/person
External dermal exposure		mg/kg bw/d	External dermal exposure	mg/kg bw/d
Systemic dermal exposure		mg/kg bw/d	Systemic dermal exposure	mg/kg bw/d
Body			Body	
$SDE_{OA(B)} = (D_{A(B)} \times AR \times A \times DA) / BW$			$SDE_{OA(B)} = (D_{A(B)} \times AR \times A \times PPE^2 \times DA) / BW$	
$(1,6 \times 7,65 \times 1 \times 0\%) / 70$			$(1,6 \times 7,65 \times 1 \times 1 \times 0\%) / 70$	
External dermal exposure		mg/person	External dermal exposure	mg/person
External dermal exposure		mg/kg bw/d	External dermal exposure	mg/kg bw/d
Systemic dermal exposure		mg/kg bw/d	Systemic dermal exposure	mg/kg bw/d
Head			Head	
$SDE_{OA(C)} = (D_{A(C)} \times AR \times A \times DA) / BW$			$SDE_{OA(C)} = (D_{A(C)} \times AR \times A \times PPE^3 \times DA) / BW$	
$(0,06 \times 7,65 \times 1 \times 0\%) / 70$			$(0,06 \times 7,65 \times 1 \times 1 \times 0\%) / 70$	
External dermal exposure		mg/person	External dermal exposure	mg/person
External dermal exposure		mg/kg bw/d	External dermal exposure	mg/kg bw/d
Systemic dermal exposure		mg/kg bw/d	Systemic dermal exposure	mg/kg bw/d
Total systemic dermal exposure: $SDE_O = SDE_{OM(H)} + SDE_{OA(H)} + SDE_{OA(B)} + SDE_{OA(C)}$			Total systemic dermal exposure: $SDE_O = SDE_{OM(H)} + SDE_{OA(H)} + SDE_{OA(B)} + SDE_{OA(C)}$	
Total external dermal exposure	15,3	mg/person	Total external dermal exposure	0,153 mg/person
Total external dermal exposure	0,2185714	mg/kg bw/d	Total external dermal exposure	0,0021857 mg/kg bw/d
Total systemic dermal exposure	0,00087	mg/kg bw/d	Total systemic dermal exposure	8,7E-06 mg/kg bw/d

Operators: Systemic inhalation exposure after application in ornamentals					
Inhalation exposure during mixing/loading					
$SIE_{OM} = (I_M \times AR \times A \times IA) / BW$			$SIE_{OM} = (I_M \times AR \times A \times PPE^4 \times IA) / BW$		
$(0,008 \times 7,65 \times 1 \times 100\%) / 70$			$(0,008 \times 7,65 \times 1 \times 1 \times 100\%) / 70$		
External inhalation exposure	0,0612	mg/person	External inhalation exposure	0,0612	mg/person
External inhalation exposure	0,0008743	mg/kg bw/d	External inhalation exposure	0,0008743	mg/kg bw/d
Systemic inhalation exposure	0,000874	mg/kg bw/d	Systemic inhalation exposure	0,000874	mg/kg bw/d
Inhalation exposure during application					
$SIE_{OA} = (I_A \times AR \times A \times IA) / BW$			$SIE_{OA} = (I_A \times AR \times A \times PPE^4 \times IA) / BW$		
$(0,001 \times 7,65 \times 1 \times 100\%) / 70$			$(0,001 \times 7,65 \times 1 \times 1 \times 100\%) / 70$		
External inhalation exposure		mg/person	External inhalation exposure		mg/person
External inhalation exposure		mg/kg bw/d	External inhalation exposure		mg/kg bw/d
Systemic inhalation exposure		mg/kg bw/d	Systemic inhalation exposure		mg/kg bw/d
Total systemic inhalation exposure: $SIE_O = SIE_{OM} + SIE_{OA}$			Total systemic inhalation exposure: $SIE_O = SIE_{OM} + SIE_{OA}$		
Total external inhalation exposure	0,061200	mg/person	Total external inhalation exposure	0,061200	mg/person
Total external inhalation exposure	0,000874	mg/kg bw/d	Total external inhalation exposure	0,000874	mg/kg bw/d
Total systemic inhalation exposure	0,000874	mg/kg bw/d	Total systemic inhalation exposure	0,000874	mg/kg bw/d
Total systemic exposure: $SE_O = SDE_O + SIE_O$			Total systemic exposure: $SE_O = SDE_O + SIE_O$		
Total systemic exposure	0,12240	mg/person	Total systemic exposure	0,06181	mg/person
Total systemic exposure	0,001749	mg/kg bw/d	Total systemic exposure	0,000883	mg/kg bw/d
% of AOEL	20,0	%	% of AOEL	10,1	%

Appendix B.6.4.1-13: Gantry indoor application, German model M/L: UDMH

Estimation of operator exposure (acc. to the German model)				
Active substance (a.s.)	UDMH -M/L			
Product	Alar			
Intended use(s)	ornamentals			
Type of preparation	Field Crops, Tractor Mounted (FCTM) ▾			
	Water soluble or dispersible granules (WG) ▾			
Application rate (AR)	0,00023	kg a.s./ha		
Treated area per day (A)	1	ha/d		
Systemic AOEL	0,00009	mg/kg bw/d		
Dermal absorption (DA)	10,7	% for mixing/loading (m/l)		
		% for application (appl.)		
Inhalation absorption (IA)	100	%		
Body weight (BW)	70	kg		
Personal protective equipment:	BVL code	Reduction factor	to lower:	
Particle filtering half mask (m/l) ¹⁾	ST1102	0,08	I _M	<input type="checkbox"/>
Half mask with combined filter (m/l)	ST2102	0,02	I _M	<input type="checkbox"/>
Particle filtering half mask (appl.) ¹⁾	ST1203	0,08	I _A	<input type="checkbox"/>
		0,8	D _{A(C)}	
Half mask with combined filter (appl.) ¹⁾	ST2202	0,02	I _A	<input type="checkbox"/>
		0,8	D _{A(C)}	
Protective gloves (m/l) ²⁾	SS110	0,01	D _{M(H)}	<input checked="" type="checkbox"/>
Protective gloves (appl.) ²⁾	SS120	0,01	D _{A(H)}	<input type="checkbox"/>
Protective garment + sturdy footwear (appl.) ²⁾	SS2202	0,05	D _{A(B)}	<input type="checkbox"/>
Broad-brimmed headgear (appl.) ²⁾	SS420	0,5	D _{A(C)}	<input type="checkbox"/>
Hood and visor (appl.) ²⁾	SS520	0,05	D _{A(C)}	<input type="checkbox"/>
¹⁾ DIN EN 149 (2001), ²⁾ BVL (2005) Guidelines for requirements concerning personal protective equipment in plant protection				
Estimated inhalation exposure:	Personal protective equipment (PPE)		Factor	
I _M	no PPE		1	
I _A	no PPE		1	
Estimated dermal exposure:	Personal protective equipment (PPE)		Factor	
D _{M(H)}	SS110		0,01	
D _{A(H)}	no PPE		1	
D _{A(C)}	no PPE		1	
D _{A(B)}	no PPE		1	

Estimation of operator exposure: German model

Input parameters considered for the estimation of operator exposure:

Formulation type:	Water soluble or	Application technique:	Field Crops, Tractor Mounted (FCTM)
Application rate (AR):	0,00023 kg		
Area treated per day (A):	1 ha	Dermal hands m/l ($D_{M(H)}$):	2 mg/person/kg
Dermal absorption (DA):	10,7 % (concentr.)	Dermal hands appl. ($D_{A(H)}$):	0,38 mg/person/kg
	% (dilution)	Dermal body appl. ($D_{A(B)}$):	1,6 mg/person/kg
Inhalation absorption (IA):	100 %	Dermal head appl. ($D_{A(C)}$):	0,06 mg/person/kg
Body weight (BW):	70 kg/person	Inhalation m/l (I_M):	0,008 mg/person/kg
AOEL	0,00009 mg/kg bw/d	Inhalation appl. (I_A):	0,001 mg/person/kg

Operator exposure towards UDMH -ML

Without PPE				With PPE			
Operators: Systemic dermal exposure after application in ornamentals							
Dermal exposure during mixing/loading							
Hands				Hands			
$SDE_{O(MH)} = (D_{M(H)} \times AR \times A \times DA) / BW$				$SDE_{O(MH)} = (D_{M(H)} \times AR \times A \times PPE^{-1} \times DA) / BW$			
$(2 \times 0,00023 \times 1 \times 10,7\%) / 70$				$(2 \times 0,00023 \times 1 \times 0,01 \times 10,7\%) / 70$			
External dermal exposure	0,00046	mg/person		External dermal exposure	4,6E-06	mg/person	
External dermal exposure	6,57E-06	mg/kg bw/d		External dermal exposure	6,57E-08	mg/kg bw/d	
Systemic dermal exposure	0,000001	mg/kg bw/d		Systemic dermal exposure	0,000000	mg/kg bw/d	
Dermal exposure during application							
Hands				Hands			
$SDE_{O(AH)} = (D_{A(H)} \times AR \times A \times DA) / BW$				$SDE_{O(AH)} = (D_{A(H)} \times AR \times A \times PPE^{-1} \times DA) / BW$			
$(0,38 \times 0,00023 \times 1 \times 0\%) / 70$				$(0,38 \times 0,00023 \times 1 \times 1 \times 0\%) / 70$			
External dermal exposure		mg/person		External dermal exposure		mg/person	
External dermal exposure		mg/kg bw/d		External dermal exposure		mg/kg bw/d	
Systemic dermal exposure		mg/kg bw/d		Systemic dermal exposure		mg/kg bw/d	
Body				Body			
$SDE_{O(AB)} = (D_{A(B)} \times AR \times A \times DA) / BW$				$SDE_{O(AB)} = (D_{A(B)} \times AR \times A \times PPE^{-1} \times DA) / BW$			
$(1,6 \times 0,00023 \times 1 \times 0\%) / 70$				$(1,6 \times 0,00023 \times 1 \times 1 \times 0\%) / 70$			
External dermal exposure		mg/person		External dermal exposure		mg/person	
External dermal exposure		mg/kg bw/d		External dermal exposure		mg/kg bw/d	
Systemic dermal exposure		mg/kg bw/d		Systemic dermal exposure		mg/kg bw/d	
Head				Head			
$SDE_{O(AC)} = (D_{A(C)} \times AR \times A \times DA) / BW$				$SDE_{O(AC)} = (D_{A(C)} \times AR \times A \times PPE^{-1} \times DA) / BW$			
$(0,06 \times 0,00023 \times 1 \times 0\%) / 70$				$(0,06 \times 0,00023 \times 1 \times 1 \times 0\%) / 70$			
External dermal exposure		mg/person		External dermal exposure		mg/person	
External dermal exposure		mg/kg bw/d		External dermal exposure		mg/kg bw/d	
Systemic dermal exposure		mg/kg bw/d		Systemic dermal exposure		mg/kg bw/d	
Total systemic dermal exposure: $SDE_O = SDE_{O(MH)} + SDE_{O(AH)} + SDE_{O(AB)} + SDE_{O(AC)}$				Total systemic dermal exposure: $SDE_O = SDE_{O(MH)} + SDE_{O(AH)} + SDE_{O(AB)} + SDE_{O(AC)}$			
Total external dermal exposure	0,00046	mg/person		Total external dermal exposure	4,6E-06	mg/person	
Total external dermal exposure	6,57E-06	mg/kg bw/d		Total external dermal exposure	6,57E-08	mg/kg bw/d	
Total systemic dermal exposure	7,03E-07	mg/kg bw/d		Total systemic dermal exposure	7,03E-09	mg/kg bw/d	

Operators: Systemic inhalation exposure after application in ornamentals					
Inhalation exposure during mixing/loading					
SIE _{OM} = (I _M x AR x A x IA) / BW			SIE _{OM} = (I _M x AR x A x PPE ⁻⁴ x IA) / BW		
(0,008 x 0,00023 x 1 x 100%) / 70			(0,008 x 0,00023 x 1 x 1 x 100%) / 70		
External inhalation exposure	1,84E-06	mg/person	External inhalation exposure	1,84E-06	mg/person
External inhalation exposure	2,63E-08	mg/kg bw/d	External inhalation exposure	2,63E-08	mg/kg bw/d
Systemic inhalation	0,000000	mg/kg bw/d	Systemic inhalation	0,000000	mg/kg bw/d
Inhalation exposure during application					
SIE _{OA} = (I _A x AR x A x IA) / BW			SIE _{OA} = (I _A x AR x A x PPE ⁻⁴ x IA) / BW		
(0,001 x 0,00023 x 1 x 100%) / 70			(0,001 x 0,00023 x 1 x 1 x 100%) / 70		
External inhalation exposure		mg/person	External inhalation exposure		mg/person
External inhalation exposure		mg/kg bw/d	External inhalation exposure		mg/kg bw/d
Systemic inhalation		mg/kg bw/d	Systemic inhalation		mg/kg bw/d
Total systemic inhalation exposure: SIE _O = SIE _{OM} +			Total systemic inhalation exposure: SIE _O = SIE _{OM} +		
Total external inhalation exposure	0,000002	mg/person	Total external inhalation exposure	0,000002	mg/person
Total external inhalation exposure	0,000000	mg/kg bw/d	Total external inhalation exposure	0,000000	mg/kg bw/d
Total systemic inhalation exposure	0,000000	mg/kg bw/d	Total systemic inhalation exposure	0,000000	mg/kg bw/d
Total systemic exposure: SE _O = SDE _O + SIE _O			Total systemic exposure: SE _O = SDE _O + SIE _O		
Total systemic exposure	0,000005	mg/person	Total systemic exposure	0,000000	mg/person
Total systemic exposure	0,000001	mg/kg bw/d	Total systemic exposure	0,000000	mg/kg bw/d
% of AOEL	0,8	%	% of AOEL	0,04	%

Appendix B.6.4.1-14: Gantry indoor application, EFSA AOEM model M/L: daminozide – no PPE**Exposure assessment**

Substance	Daminozide	Formulation = Wettable granules, soluble granules	Application rate-7,65 kg a.s. /ha	Spray dilution = 15,3 g a.s./l	Vapour pressure = low volatile substances having a vapour pressure of
Scenario	Ornamentals / Outdoor / Downward spraying / Manual-Knapsack			Buffer = 5	Number applications = 5, Application interval = 7 days
Percentage Absorption	Dermal for product = 0,4	Dermal for in use dilution = 0	Oral = 100	Inhalation = 100	
RVNAS	0,00875 mg/kg bw/day		RVAAS	mg/kg bw/day	
DFR	3 µg a.s./cm2 per kg a.s./ha		DT50	30 days	

Operator Model		Mixing, loading and application AOEM			
Potential exposure	Longer term systemic exposure mg/kg bw/day		0,0078	% of RVNAS	89,58%
	Acute systemic exposure mg/kg bw/day		0,0140	% of RVAAS	
Mixing and Loading	Gloves = No		Clothing = Work wear - arms, body and legs covered	RPE = None	Soluble bags = No
Application	Gloves = No		Clothing = Work wear - arms, body and legs covered	RPE = None	Closed cabin = No
Exposure (including PPE options above)	Longer term systemic exposure mg/kg bw/day		0,0076	% of RVNAS	86,55%
	Acute systemic exposure mg/kg bw/day		0,0131	% of RVAAS	

Substance	Daminozide	Formulation = Wettable granules, soluble granules	Application rate-7,65 kg a.s. /ha	Spray dilution = 15,3 g a.s./l	Vapour pressure = low volatile substances having a vapour pressure of
Scenario	Ornamentals / Outdoor / Downward spraying / Vehicle-mounted			Buffer = 5	Number applications = 5, Application interval = 7 days
Percentage Absorption	Dermal for product = 0,4	Dermal for in use dilution = 0	Oral = 100	Inhalation = 100	
RVNAS	0,00875 mg/kg bw/day		RVAAS	mg/kg bw/day	
DFR	3 µg a.s./cm2 per kg a.s./ha		DT50	30 days	

Operator Model		Mixing, loading and application AOEM			
Potential exposure	Longer term systemic exposure mg/kg bw/day		0,0073	% of RVNAS	83,13%
	Acute systemic exposure mg/kg bw/day		0,0294	% of RVAAS	
Mixing and Loading	Gloves = No		Clothing = Work wear - arms, body and legs covered	RPE = None	Soluble bags = No
Application	Gloves = No		Clothing = Work wear - arms, body and legs covered	RPE = None	Closed cabin = No
Exposure (including PPE options above)	Longer term systemic exposure mg/kg bw/day		0,0056	% of RVNAS	63,95%
	Acute systemic exposure mg/kg bw/day		0,0259	% of RVAAS	

Appendix B.6.4.1-15: Gantry indoor application, EFSA AOEM model M/L: UDMH – no PPE**Exposure assessment**

Substance	UDMH	Formulation = Wettable granules, soluble granules	Application rate- 0,00023 kg a.s. /ha	Spray dilution = 0,00046 g a.s./l	Vapour pressure = low volatile substances having a vapour pressure of
Scenario	Ornamentals / Outdoor / Upward spraying / Manual-Knapsack			Buffer = 5	Number applications = 5, Application interval = 7 days
Percentage Absorption	Dermal for product = 10,7	Dermal for in use dilution = 0	Oral = 100	Inhalation = 100	
RVNAS	0,00009 mg/kg bw/day		RVAAS	mg/kg bw/day	
DFR	3 µg a.s./cm2 per kg a.s./ha		DT50	30 days	

Operator Model		Mixing, loading and application AOEM			
Potential exposure	Longer term systemic exposure mg/kg bw/day		0,0188	% of RVNAS	20879,58%
	Acute systemic exposure mg/kg bw/day		0,0509	% of RVAAS	
Mixing and Loading	Gloves = No		Clothing = Work wear - arms, body and legs covered	RPE = None	Soluble bags = No
Application	Gloves = No		Clothing = Work wear - arms, body and legs covered	RPE = None	Closed cabin = No
Exposure (including PPE options above)	Longer term systemic exposure mg/kg bw/day		0,0174	% of RVNAS	19337,99%
	Acute systemic exposure mg/kg bw/day		0,0461	% of RVAAS	

Substance	UDMH	Formulation = Wettable granules, soluble granules	Application rate- 0,00023 kg a.s. /ha	Spray dilution = 0,00046 g a.s./l	Vapour pressure = low volatile substances having a vapour pressure of
Scenario	Ornamentals / Outdoor / Downward spraying / Vehicle-mounted			Buffer = 2-3	Number applications = 5, Application interval = 7 days
Percentage Absorption	Dermal for product = 10,7	Dermal for in use dilution = 0	Oral = 100	Inhalation = 100	
RVNAS	0,00009 mg/kg bw/day		RVAAS	mg/kg bw/day	
DFR	3 µg a.s./cm2 per kg a.s./ha		DT50	30 days	

Operator Model		Mixing, loading and application AOEM			
Potential exposure	Longer term systemic exposure mg/kg bw/day		0,0002	% of RVNAS	176,53%
	Acute systemic exposure mg/kg bw/day		0,0088	% of RVAAS	
Mixing and Loading	Gloves = No		Clothing = Work wear - arms, body and legs covered	RPE = None	Soluble bags = No
Application	Gloves = No		Clothing = Work wear - arms, body and legs covered	RPE = None	Closed cabin = No
Exposure (including PPE options above)	Longer term systemic exposure mg/kg bw/day		0,0001	% of RVNAS	142,49%
	Acute systemic exposure mg/kg bw/day		0,0039	% of RVAAS	

Appendix B.6.4.1-16: Hand held application outdoors to low crops, UK POEM: daminozide – with PPE
THE UK PREDICTIVE OPERATOR EXPOSURE MODEL (POEM) WITH GERMAN MODEL MIX/LOAD DATA (75th PERCENTILE)

Application method	Hand-held sprayer (15 l tank): hydraulic nozzles. Outdoor, low level target		
Product	Alar	Active substance	daminozide
Formulation type	WG or SG	a.s. concentration	850 mg/g
Dermal absorption from product	0,4 %	Dermal absorption from spray	2 %
PPE during mix/loading	Gloves and RPE (FFP3)	PPE during application	Gloves and impermeable coverall
Dose	5 kg product/ha	Work rate/day	0,8 ha
Application volume	500 l/ha	Duration of spraying	6 h
AOEL _{syst.}	0,00875 mg/kg bw/day	Total exposure (result):	692 % AOEL

DERMAL EXPOSURE DURING MIXING AND LOADING

Hand contamination/kg a.s.	171,4 mg/kg a.s.
Hand contamination/day	582,76 mg/day
Protective clothing	Gloves
Transmission to skin	1 %
Dermal exposure to a.s.	5,8276 mg/day

INHALATION EXPOSURE DURING MIXING AND LOADING

Inhalation exposure/kg a.s.	0,0628 mg/kg a.s.
Inhalation exposure/day	0,21352 mg/day
RPE	RPE (FFP3)
Transmission through RPE	5 %
Inhalation exposure to a.s.	0,010676 mg/day

DERMAL EXPOSURE DURING SPRAY APPLICATION

Application technique	Hand-held sprayer (15 l tank): hydraulic nozzles. Outdoor, low level target		
Application volume	500 spray/ha		
Volume of surface contamination	50 ml/h		
Distribution	Hands	Trunk	Legs
	25%	25%	50%
Clothing	Gloves	Impermeable	Impermeable
Penetration	10%	5%	5%
Dermal exposure	1,25	0,625	1,25 ml/h
Duration of exposure	6 h		
Total dermal exposure to spray	18,75 ml/day		
Concentration of a.s. in spray solution	8,5 mg/ml		
Dermal exposure to a.s.	159,375 mg/day		

INHALATION EXPOSURE DURING SPRAYING

Inhalation exposure to spray	0,02 ml/h
Duration of exposure	6 h
Concentration of a.s. in spray	8,5 mg/ml
Inhalation exposure to a.s.	1,02 mg/day
Percent absorbed	100 %
Absorbed dose	1,02 mg/day

ABSORBED DOSE

	Mix/load	Application
Dermal exposure to a.s.	5,8276 mg/day	159,375 mg/day
Percent absorbed	0,4 %	2 %
Absorbed dose (dermal route)	0,0233104 mg/day	3,1875 mg/day
Inhalation exposure to a.s.	0,010676 mg/day	1,02 mg/day
Absorbed dose	0,0339864 mg/day	4,2075 mg/day

PREDICTED EXPOSURE

Total absorbed dose	4,2414864 mg/day
Operator body weight	70 kg
Operator exposure	0,060592663 mg/kg bw/day

Appendix B.6.4.1-17: Hand held application outdoors to low crops, UK POEM: UDMH – with PPE

THE UK PREDICTIVE OPERATOR EXPOSURE MODEL (POEM) WITH GERMAN MODEL MIX/LOAD DATA (75th PERCENTILE)

Application method	Hand-held sprayer (15 l tank): hydraulic nozzles. Outdoor, low level target		
Product	Alar	Active substance	UDMH
Formulation type	WG or SG	a.s. concentration	0,177 mg/g
Dermal absorption from product	10,7 %	Dermal absorption from spray	10,7 %
PPE during mix/loading	Gloves and RPE (FFP3)	PPE during application	Gloves and impermeable coverall
Dose	5 kg product/ha	Work rate/day	0,8 ha
Application volume	500 l/ha	Duration of spraying	6 h
AOEL _{sys.}	0,00009 mg/kg bw/day	Total exposure (result):	62 % AOEL

DERMAL EXPOSURE DURING MIXING AND LOADING

Hand contamination/kg a.s.	171,4 mg/kg a.s.
Hand contamination/day	0,12162544 mg/day
Protective clothing	Gloves
Transmission to skin	1 %
Dermal exposure to a.s.	0,001216254 mg/day

INHALATION EXPOSURE DURING MIXING AND LOADING

Inhalation exposure/kg a.s.	0,0628 mg/kg a.s.
Inhalation exposure/day	4,45629E-05 mg/day
RPE	RPE (FFP3)
Transmission through RPE	5 %
Inhalation exposure to a.s.	2,22814E-06 mg/day

DERMAL EXPOSURE DURING SPRAY APPLICATION

Application technique	Hand-held sprayer (15 l tank): hydraulic nozzles. Outdoor, low level target		
Application volume	500 spray/ha		
Volume of surface contamination	50 ml/h		
Distribution	Hands	Trunk	Legs
	25%	25%	50%
Clothing	Gloves	Impermeable	Impermeable
Penetration	10%	5%	5%
Dermal exposure	1,25	0,625	1,25 ml/h
Duration of exposure	6 h		
Total dermal exposure to spray	18,75 ml/day		
Concentration of a.s. in spray solution	0,001774 mg/ml		
Dermal exposure to a.s.	0,0332625 mg/day		

INHALATION EXPOSURE DURING SPRAYING

Inhalation exposure to spray	0,02 ml/h
Duration of exposure	6 h
Concentration of a.s. in spray	0,001774 mg/ml
Inhalation exposure to a.s.	0,00021288 mg/day
Percent absorbed	100 %
Absorbed dose	0,00021288 mg/day

ABSORBED DOSE

	Mix/load	Application
Dermal exposure to a.s.	0,001216254 mg/day	0,0332625 mg/day
Percent absorbed	10,7 %	10,7 %
Absorbed dose (dermal route)	0,000130139 mg/day	0,003559088 mg/day
Inhalation exposure to a.s.	2,22814E-06 mg/day	0,00021288 mg/day
Absorbed dose	0,000132367 mg/day	0,003771968 mg/day

PREDICTED EXPOSURE

Total absorbed dose	0,003904335 mg/day
Operator body weight	70 kg
Operator exposure	5,57762E-05 mg/kg bw/day

Appendix B.6.4.1-18: Hand held application outdoors to low crops, EFSA AOEM (manual hand-held): daminozide – with PPE
Exposure assessment

Substance	Daminozide	Formulation = Wettable granules, soluble granules	Application rate-4,25 kg a.s. /ha	Spray dilution = 8,5 g a.s./l	Vapour pressure = low volatile substances having a vapour pressure of
Scenario	Ornamentals / Outdoor / Downward spraying / Manual-Hand held			Buffer = 2-3	Number applications = 5, Application interval = 7 days
Percentage Absorption	Dermal for product = 0,4	Dermal for in use dilution = 2	Oral = 100	Inhalation = 100	
RVNAS	0,00875 mg/kg bw/day		RVAAS	mg/kg bw/day	
DFR	3 µg a.s./cm2 per kg a.s./ha		DT50	30 days	

Operator Model					
Mixing, loading and application AOEM					
Potential exposure	Longer term systemic exposure mg/kg bw/day		0,3493	% of RVNAS	3992,50%
	Acute systemic exposure mg/kg bw/day		0,5497	% of RVAAS	
Mixing and Loading	Gloves = Yes		Clothing = Work wear - arms, body and legs covered	RPE = FP2, P2 and similar	Soluble bags = No
Application	Gloves = Yes		Clothing = Work wear - arms, body and legs covered	RPE = FP2, P2 and similar	Closed cabin = No
Exposure (including PPE options above)	Longer term systemic exposure mg/kg bw/day		0,0344	% of RVNAS	392,60%
	Acute systemic exposure mg/kg bw/day		0,2381	% of RVAAS	

Appendix B.6.4.1-19: Hand held application outdoors to low crops, EFSA AOEM (manual hand-held): UDMH – with PPE

Exposure assessment

Substance	UDMH	Formulation = Wettable granules, soluble granules	Application rate- 0,000887 kg a.s. /ha	Spray dilution = 0,001774 g a.s./l	Vapour pressure = low volatile substances having a vapour pressure of
Scenario	Ornamentals / Outdoor / Downward spraying / Manual-Hand held			Buffer = 2-3	Number applications = 5, Application interval = 7 days
Percentage Absorption	Dermal for product = 10,7	Dermal for in use dilution = 10,7	Oral = 100	Inhalation = 100	
RVNAS	0,00009 mg/kg bw/day		RVAAS	mg/kg bw/day	
DFR	3 µg a.s./cm ² per kg a.s./ha		DT50	30 days	

Operator Model		Mixing, loading and application AOEM			
Potential exposure	Longer term systemic exposure mg/kg bw/day		0,1619	% of RVNAS	179864,20%
	Acute systemic exposure mg/kg bw/day		0,2619	% of RVAAS	
Mixing and Loading	Gloves = Yes		Clothing = Work wear - arms, body and legs covered	RPE = FP2, P2 and similar	Soluble bags = No
Application	Gloves = Yes		Clothing = Work wear - arms, body and legs covered	RPE = FP2, P2 and similar	Closed cabin = No
Exposure (including PPE options above)	Longer term systemic exposure mg/kg bw/day		0,0160	% of RVNAS	17732,23%
	Acute systemic exposure mg/kg bw/day		0,1123	% of RVAAS	

Appendix B.6.4.1-20: Hand held application outdoors to low crops, EFSA AOEM (manual knapsack): daminozide – with PPE
Exposure assessment

Substance	Daminozide	Formulation = Wettable granules, soluble granules	Application rate-4,25 kg a.s. /ha	Spray dilution = 8,5 g a.s./l	Vapour pressure = low volatile substances having a vapour pressure of
Scenario	Ornamentals / Outdoor / Downward spraying / Manual-Knapsack			Buffer = 2-3	Number applications = 5, Application interval = 7 days
Percentage Absorption	Dermal for product = 0,4	Dermal for in use dilution = 2	Oral = 100	Inhalation = 100	
RVNAS	0,00875 mg/kg bw/day		RVAAS	mg/kg bw/day	
DFR	3 µg a.s./cm ² per kg a.s./ha		DT50	30 days	

Operator Model		Mixing, loading and application AOEM			
Potential exposure	Longer term systemic exposure mg/kg bw/day		0,0898	% of RVNAS	1025,77%
	Acute systemic exposure mg/kg bw/day		0,1413	% of RVAAS	
Mixing and Loading	Gloves = Yes		Clothing = Work wear - arms, body and legs covered	RPE = FP2, P2 and similar	Soluble bags = No
Application	Gloves = Yes		Clothing = Work wear - arms, body and legs covered	RPE = FP2, P2 and similar	Closed cabin = No
Exposure (including PPE options above)	Longer term systemic exposure mg/kg bw/day		0,0087	% of RVNAS	99,11%
	Acute systemic exposure mg/kg bw/day		0,0595	% of RVAAS	

Appendix B.6.4.1-21: Hand held application outdoors to low crops, EFSA AOEM (manual knapsack): UDMH – with PPE

Exposure assessment

Substance	UDMH	Formulation = Wettable granules, soluble granules	Application rate- 0,000887 kg a.s. /ha	Spray dilution = 0,001774 g a.s./l	Vapour pressure = low volatile substances having a vapour pressure of
Scenario	Ornamentals / Outdoor / Downward spraying / Manual-Knapsack			Buffer = 2-3	Number applications = 5, Application interval = 7 days
Percentage Absorption	Dermal for product = 10,7	Dermal for in use dilution = 10,7	Oral = 100	Inhalation = 100	
RVNAS	0,00009 mg/kg bw/day		RVAAS	mg/kg bw/day	
DFR	3 µg a.s./cm ² per kg a.s./ha		DT50	30 days	

Operator Model		Mixing, loading and application AOEM			
Potential exposure	Longer term systemic exposure mg/kg bw/day	0,1805	% of RVNAS	200533,13%	
	Acute systemic exposure mg/kg bw/day	0,3033	% of RVAAS		
Mixing and Loading	Gloves = Yes	Clothing = Work wear - arms, body and legs covered	RPE = FP2, P2 and similar	Soluble bags = No	
Application	Gloves = Yes	Clothing = Work wear - arms, body and legs covered	RPE = FP2, P2 and similar	Closed cabin = No	
Exposure (including PPE options above)	Longer term systemic exposure mg/kg bw/day	0,0161	% of RVNAS	17857,63%	
	Acute systemic exposure mg/kg bw/day	0,1124	% of RVAAS		

Appendix B.6.4.1-22: Gantry indoor application, UK POEM M/L: daminozide – with PPE**THE UK PREDICTIVE OPERATOR EXPOSURE MODEL (POEM) WITH GERMAN MODEL MIX/LOAD DATA (75th PERCENTILE)**

Application method	Tractor-mounted/trailed boom sprayer: hydraulic nozzles		
Product	Alar	Active substance	daminozide
Formulation type	WG or SG	a.s. concentration	850 mg/g
Dermal absorption from product	0,4 %	Dermal absorption from spray	0 %
PPE during mix/loading	Gloves	PPE during application	None
Dose	9 kg product/ha	Work rate/day	1 ha
Application volume	500 l/ha	Duration of spraying	6 h
AOEL _{syst.}	0,00875 mg/kg bw/day	Total exposure (result):	45 % AOEL

DERMAL EXPOSURE DURING MIXING AND LOADING

Hand contamination/kg a.s.	5,72 mg/kg a.s.
Hand contamination/day	43,758 mg/day
Protective clothing	Gloves
Transmission to skin	1 %
Dermal exposure to a.s.	0,43758 mg/day

INHALATION EXPOSURE DURING MIXING AND LOADING

Inhalation exposure/kg a.s.	0,0358 mg/kg a.s.
Inhalation exposure/day	0,27387 mg/day
RPE	None
Transmission through RPE	100 %
Inhalation exposure to a.s.	0,27387 mg/day

DERMAL EXPOSURE DURING SPRAY APPLICATION

Application technique	Tractor-mounted/trailed boom sprayer: hydraulic nozzles		
Application volume	500 spray/ha		
Volume of surface contamination	10 ml/h		
Distribution	Hands	Trunk	Legs
	65%	10%	25%
Clothing	None	Permeable	Permeable
Penetration	100%	5%	15%
Dermal exposure	6,5	0,05	0,375 ml/h
Duration of exposure	6 h		
Total dermal exposure to spray	41,55 ml/day		
Concentration of a.s. in spray soluti	15,3 mg/ml		
Dermal exposure to a.s.	635,715 mg/day		

INHALATION EXPOSURE DURING SPRAYING

Inhalation exposure to spray	0,01 ml/h
Duration of exposure	6 h
Concentration of a.s. in spray	15,3 mg/ml
Inhalation exposure to a.s.	0,918 mg/day
Percent absorbed	100 %
Absorbed dose	0,918 mg/day

ABSORBED DOSE

	Mix/load	Application
Dermal exposure to a.s.	0,43758 mg/day	mg/day
Percent absorbed	0,4 %	%
Absorbed dose (dermal route)	0,00175032 mg/day	mg/day
Inhalation exposure to a.s.	0,27387 mg/day	mg/day
Absorbed dose	0,27562032 mg/day	mg/day

PREDICTED EXPOSURE

Total absorbed dose	0,27562032 mg/day
Operator body weight	70 kg
Operator exposure	0,003937433 mg/kg bw/day

Appendix B.6.4.1-23: Gantry indoor application, UK POEM M/L: UDMH – with PPE
THE UK PREDICTIVE OPERATOR EXPOSURE MODEL (POEM) WITH GERMAN MODEL MIX/LOAD DATA (75th PERCENTILE)

Application method	Tractor-mounted/trailed boom sprayer: hydraulic nozzles		
Product	Alar	Active substance	UDMH
Formulation type	WG or SG	a.s. concentration	0,026 mg/g
Dermal absorption from product	10,7 %	Dermal absorption from spray	0 %
PPE during mix/loading	Gloves	PPE during application	None
Dose	9 kg product/ha	Work rate/day	1 ha
Application volume	500 l/ha	Duration of spraying	6 h
AOEL _{syst.}	0,00009 mg/kg bw/day	Total exposure (result):	0,16 % AOEL

DERMAL EXPOSURE DURING MIXING AND LOADING

Hand contamination/kg a.s.	5,72 mg/kg a.s.
Hand contamination/day	0,00133848 mg/day
Protective clothing	Gloves
Transmission to skin	1 %
Dermal exposure to a.s.	1,33848E-05 mg/day

INHALATION EXPOSURE DURING MIXING AND LOADING

Inhalation exposure/kg a.s.	0,0358 mg/kg a.s.
Inhalation exposure/day	8,3772E-06 mg/day
RPE	None
Transmission through RPE	100 %
Inhalation exposure to a.s.	8,3772E-06 mg/day

DERMAL EXPOSURE DURING SPRAY APPLICATION

Application technique	Tractor-mounted/trailed boom sprayer: hydraulic nozzles		
Application volume	500 spray/ha		
Volume of surface contamination	10 ml/h		
Distribution	Hands	Trunk	Legs
	65%	10%	25%
Clothing	None	Permeable	Permeable
Penetration	100%	5%	15%
Dermal exposure	6,5	0,05	0,375 ml/h
Duration of exposure	6 h		
Total dermal exposure to spray	ml/day		
Concentration of a.s. in spray solution	mg/ml		
Dermal exposure to a.s.	mg/day		

INHALATION EXPOSURE DURING SPRAYING

Inhalation exposure to spray	0,01 ml/h
Duration of exposure	6 h
Concentration of a.s. in spray	0 mg/ml
Inhalation exposure to a.s.	0 mg/day
Percent absorbed	100 %
Absorbed dose	0 mg/day

ABSORBED DOSE

	Mix/load	Application	
Dermal exposure to a.s.	1,33848E-05 mg/day		mg/day
Percent absorbed	10,7 %		%
Absorbed dose (dermal route)	1,43217E-06 mg/day		mg/day
Inhalation exposure to a.s.	8,3772E-06 mg/day		mg/day
Absorbed dose	9,80937E-06 mg/day		mg/day

PREDICTED EXPOSURE

Total absorbed dose	9,80937E-06 mg/day
Operator body weight	70 kg
Operator exposure	1,40134E-07 mg/kg bw/day

Appendix B.6.4.1-24: Gantry indoor application, EFSA AOEM model M/L: daminozide – with PPE
Exposure assessment

Substance	Daminozide	Formulation = Wettable granules, soluble granules	Application rate-7,65 kg a.s. /ha	Spray dilution = 15,3 g a.s./l	Vapour pressure = low volatile substances having a vapour pressure of
Scenario	Ornamentals / Outdoor / Downward spraying / Manual-Knapsack			Buffer = 5	Number applications = 5, Application interval = 7 days
Percentage Absorption	Dermal for product = 0,4	Dermal for in use dilution = 0	Oral = 100	Inhalation = 100	
RVNAS	0,00875 mg/kg bw/day		RVAAS	mg/kg bw/day	
DFR	3 µg a.s./cm ² per kg a.s./ha		DT50	30 days	

Operator Model		Mixing, loading and application AOEM			
Potential exposure	Longer term systemic exposure mg/kg bw/day	0,0078		% of RVNAS	89,58%
	Acute systemic exposure mg/kg bw/day	0,0140		% of RVAAS	
Mixing and Loading	Gloves = Yes	Clothing = Work wear - arms, body and legs covered		RPE = None	Soluble bags = No
Application	Gloves = No	Clothing = Work wear - arms, body and legs covered		RPE = None	Closed cabin = No
Exposure (including PPE options above)	Longer term systemic exposure mg/kg bw/day	0,0044		% of RVNAS	49,73%
	Acute systemic exposure mg/kg bw/day	0,0045		% of RVAAS	

Substance	Daminozide	Formulation = Wettable granules, soluble granules	Application rate-7,65 kg a.s. /ha	Spray dilution = 15,3 g a.s./l	Vapour pressure = low volatile substances having a vapour pressure of
Scenario	Ornamentals / Outdoor / Downward spraying / Vehicle-mounted			Buffer = 5	Number applications = 5, Application interval = 7 days
Percentage Absorption	Dermal for product = 0,4	Dermal for in use dilution = 0	Oral = 100	Inhalation = 100	
RVNAS	0,00875 mg/kg bw/day		RVAAS	mg/kg bw/day	
DFR	3 µg a.s./cm2 per kg a.s./ha		DT50	30 days	
Operator Model		Mixing, loading and application AOEM			
Potential exposure	Longer term systemic exposure mg/kg bw/day		0,0073	% of RVNAS	83,13%
	Acute systemic exposure mg/kg bw/day		0,0294	% of RVAAS	
Mixing and Loading		Gloves = Yes	Clothing = Work wear - arms, body and legs covered	RPE = FP1, P1 and similar	Soluble bags = No
Application		Gloves = No	Clothing = Work wear - arms, body and legs covered	RPE = None	Closed cabin = No
Exposure (including PPE options above)	Longer term systemic exposure mg/kg bw/day		0,0014	% of RVNAS	16,54%
	Acute systemic exposure mg/kg bw/day		0,0102	% of RVAAS	

Appendix B.6.4.1-25: Gantry indoor application, EFSA AOEM model M/L: UDMH – with PPE**Exposure assessment**

Substance	UDMH	Formulation = Wettable granules, soluble granules	Application rate- 0,00023 kg a.s. /ha	Spray dilution = 0,00046 g a.s./l	Vapour pressure = low volatile substances having a vapour pressure of
Scenario	Ornamentals / Outdoor / Upward spraying / Manual-Knapsack			Buffer = 5	Number applications = 5, Application interval = 7 days
Percentage Absorption	Dermal for product = 10,7	Dermal for in use dilution = 0	Oral = 100	Inhalation = 100	
RVNAS	0,00009 mg/kg bw/day		RVAAS	mg/kg bw/day	
DFR	3 µg a.s./cm ² per kg a.s./ha		DT50	30 days	

Operator Model		Mixing, loading and application AOEM		
Potential exposure	Longer term systemic exposure mg/kg bw/day	0,0188	% of RVNAS	20879,58%
	Acute systemic exposure mg/kg bw/day	0,0509	% of RVAAS	
Mixing and Loading	Gloves = Yes	Clothing = Work wear - arms, body and legs covered	RPE = FP2, P2 and similar	Soluble bags = No
Application	Gloves = No	Clothing = Work wear - arms, body and legs covered	RPE = None	Closed cabin = No
Exposure (including PPE options above)	Longer term systemic exposure mg/kg bw/day	0,0001	% of RVNAS	140,84%
	Acute systemic exposure mg/kg bw/day	0,0006	% of RVAAS	

Substance	UDMH	Formulation = Wettable granules, soluble granules	Application rate- 0,00023 kg a.s. /ha	Spray dilution = 0,00046 g a.s./l	Vapour pressure = low volatile substances having a vapour pressure of
Scenario	Ornamentals / Outdoor / Downward spraying / Vehicle-mounted			Buffer = 2-3	Number applications = 5, Application interval = 7 days
Percentage Absorption	Dermal for product = 10,7	Dermal for in use dilution = 0	Oral = 100	Inhalation = 100	
RVNAS	0,00009 mg/kg bw/day		RVAAS	mg/kg bw/day	
DFR	3 µg a.s./cm ² per kg a.s./ha		DT50	30 days	

Operator Model		Mixing, loading and application AOEM			
Potential exposure	Longer term systemic exposure mg/kg bw/day		0,0002	% of RVNAS	176,53%
	Acute systemic exposure mg/kg bw/day		0,0088	% of RVAAS	
Mixing and Loading		Gloves = Yes	Clothing = Work wear - arms, body and legs covered	RPE = FP1, P1 and similar	Soluble bags = No
Application		Gloves = No	Clothing = Work wear - arms, body and legs covered	RPE = None	Closed cabin = No
Exposure (including PPE options above)	Longer term systemic exposure mg/kg bw/day		0,0000	% of RVNAS	33,87%
	Acute systemic exposure mg/kg bw/day		0,0010	% of RVAAS	

Appendix B.6.4.2-1: Bystander estimation, German model: daminozide

Estimation of bystander exposure during/after application in High crops, hand held (HCHH)

Input parameters considered for the estimation of bystander exposure:

Intended use(s):		Drift (D):	0,29	% (HCHH, 10 m)
Application rate (AR):	4,25 kg a.s./ha	Exposed Body Surface Area (BSA):	1	m ² (adults)
			0,21	m ² (children)
Body weight (BW):	60 kg/person (adults)	Specific Inhalation Exposure (I* _A):	0,3	mg/kg a.s. (6 hours, adults)
	16,15 kg/person (children)		0,17241	mg/kg a.s. (6 hours, children)
Dermal absorption (DA):	2,00 % ('worst case')	Area Treated (A):	20	ha/d (based on High crops, hand held (HCHH))
Inhalation absorption (IA):	100 %	Exposure duration (T):	5	min
AOEL:	0,00875 mg/kg bw/d			

Bystander exposure towards daminozide

Adults			Children		
Bystander: Dermal exposure after application in (via spray drift)					
$SDE_B = (AR \times D \times BSA \times DA) / BW$ (425 x 0,29% x 1 x 2%) / 60			$SDE_B = (AR \times D \times BSA \times DA) / BW$ (425 x 0,29% x 0,21 x 2%) / 16,15		
External exposure	1,2325	mg/person	External exposure	0,258825	mg/person
External exposure	0,02054167	mg/kg bw/d	External exposure	0,01602632	mg/kg bw/d
Absorbed dose:	0,0004108	mg/kg bw/d	Absorbed dose:	0,0003205	mg/kg bw/d
Bystander: Inhalation exposure after application in					
$SIE_B = (I^*_A \times AR \times A \times T \times IA) / BW$ (0,300 / 360 x 4,25 x 20 x 5 x 100%) / 60			$SIE_B = (I^*_A \times AR \times A \times T \times IA) / BW$ (0,172 / 360 x 4,25 x 20 x 5 x 100%) / 16,15		
External exposure	0,35416667	mg/person	External exposure	0,20354406	mg/person
External exposure	0,00590278	mg/kg bw/d	External exposure	0,01260335	mg/kg bw/d
Absorbed dose:	0,0059028	mg/kg bw/d	Absorbed dose:	0,0126033	mg/kg bw/d
Total systemic exposure: $SE_B = SDE_B + SIE_B$			Total systemic exposure: $SE_B = SDE_B + SIE_B$		
Total systemic exposure (absorbed dose)	0,37881667	mg/person	Total systemic exposure (absorbed dose)	0,20872056	mg/person
Total systemic exposure (absorbed dose)	0,0063136	mg/kg bw/d	Total systemic exposure (absorbed dose)	0,0129239	mg/kg bw/d
% of AOEL:	72,16	%	% of AOEL:	147,70	%

Appendix B.6.4.2-2: Bystander estimation, German model: UDMH
Estimation of bystander exposure during/after application in High crops, hand held (HCHH)

Input parameters considered for the estimation of bystander exposure:

Intended use(s):		Drift (D):	0,29 % (HCHH, 10 m)
Application rate (AR):	0,000887 kg a.s./ha	Exposed Body Surface Area (BSA):	1 m ² (adults)
			0,21 m ² (children)
Body weight (BW):	60 kg/person (adults)	Specific Inhalation Exposure (I* _A):	0,3 mg/kg a.s. (6 hours, adults)
	16,15 kg/person (children)		0,17241 mg/kg a.s. (6 hours, children)
Dermal absorption (DA):	10,70 % ('worst case')	Area Treated (A):	20 ha/d (based on High crops, hand held (HCHH))
Inhalation absorption (IA):	100 %	Exposure duration (T):	5 min
AOEL:	0,00009 mg/kg bw/d		

Bystander exposure towards UDMH			
Adults		Children	
Bystander: Dermal exposure after application in (via spray drift)			
$SDE_B = (AR \times D \times BSA \times DA) / BW$		$SDE_B = (AR \times D \times BSA \times DA) / BW$	
$(0,0887 \times 0,29\% \times 1 \times 10,7\%) / 60$		$(0,0887 \times 0,29\% \times 0,21 \times 10,7\%) / 16,15$	
External exposure	0,00025723 mg/person	External exposure	5,4018E-05 mg/person
External exposure	4,2872E-06 mg/kg bw/d	External exposure	3,3448E-06 mg/kg bw/d
Absorbed dose:	0,0000005 mg/kg bw/d	Absorbed dose:	0,0000004 mg/kg bw/d
Bystander: Inhalation exposure after application in			
$SIE_B = (I^*_A \times AR \times A \times T \times IA) / BW$		$SIE_B = (I^*_A \times AR \times A \times T \times IA) / BW$	
$(0,300 / 360 \times 0,000887 \times 20 \times 5 \times 100\%) / 60$		$(0,172 / 360 \times 0,000887 \times 20 \times 5 \times 100\%) / 16,15$	
External exposure	7,3917E-05 mg/person	External exposure	4,2481E-05 mg/person
External exposure	1,2319E-06 mg/kg bw/d	External exposure	2,6304E-06 mg/kg bw/d
Absorbed dose:	0,0000012 mg/kg bw/d	Absorbed dose:	0,0000026 mg/kg bw/d
Total systemic exposure: $SE_B = SDE_B + SIE_B$		Total systemic exposure: $SE_B = SDE_B + SIE_B$	
Total systemic exposure (absorbed dose)	0,00010144 mg/person	Total systemic exposure (absorbed dose)	4,8261E-05 mg/person
Total systemic exposure (absorbed dose)	0,0000017 mg/kg bw/d	Total systemic exposure (absorbed dose)	0,0000030 mg/kg bw/d
% of AOEL:	1.88 %	% of AOEL:	3.32 %

Appendix B.6.4.2-3: Resident estimation, German model: daminozide
Estimation of resident exposure after application in High crops, hand held (HCHH)

Input parameters considered for the estimation of resident exposure:

Intended use(s):		Drift (D):	0,24 % (HCHH, 10 m)
Application rate (AR):	4,25 kg a.s./ha	Transfer coefficient (TC):	7300 cm ² /h (adults)
			2600 cm ² /h (children)
Number of applications (NA):	2	Turf Transferable Residues (TTR):	5 %
Body weight (BW):	60 kg/person (adults)	Exposure Duration (H):	2 h
	16,15 kg/person (children)	Airborne Concentration of Vapour (ACV):	0.001 mg/m ³
Dermal absorption (DA):	2,00 % (worst case)	Inhalation Rate (IR):	16,57 m ³ /d (adults),
Inhalation absorption (IA):	100 %		8,31 m ³ /d (children)
Oral absorption (OA)	35 %	Saliva Extraction Factor (SE):	50 %
AOEL	0,00875 mg/kg bw/d	Surface Area of Hands (SA):	20 cm ²
		Frequency of Hand to Mouth (Freq):	20 events/h
		Dislodgeable foliar residues (DFR):	20 %
		Ingestion Rate for Mouthing of Grass/Day (IgR):	25 cm ² /d

Resident exposure towards daminozide

Adults			Children		
Residents: Dermal exposure after application in (via deposits caused by spray drift)			Residents: Dermal exposure after application in (via deposits caused by spray drift)		
$SDE_R = (AR \times NA \times D \times TTR \times TC \times H \times DA) / BW$			$SDE_R = (AR \times NA \times D \times TTR \times TC \times H \times DA) / BW$		
$(0,0425 \times 2 \times 0,24\% \times 5\% \times 7300 \times 2 \times 2\%) / 60$			$(0,0425 \times 2 \times 0,24\% \times 5\% \times 2600 \times 2 \times 2\%) / 16,15$		
External exposure	0,14892	mg/person	External exposure	0,05304	mg/person
External exposure	0,002482	mg/kg bw/d	External exposure	0,00328421	mg/kg bw/d
Absorbed dose:	0,0000496	mg/kg bw/d	Absorbed dose:	0,0000657	mg/kg bw/d
Residents: Inhalation exposure to vapour			Residents: Inhalation exposure to vapour		
$SIE_R = (ACV \times IR \times IA) / BW$			$SIE_R = (ACV \times IR \times IA) / BW$		
$(0,001 \times 16,57 \times 100\%) / 60$			$(0,001 \times 8,31 \times 100\%) / 16,15$		
External exposure	0,01657	mg/person	External exposure	0,00831	mg/person
External exposure	0,00027617	mg/kg bw/d	External exposure	0,00051455	mg/kg bw/d
Absorbed dose:	0,0002762	mg/kg bw/d	Absorbed dose:	0,0005146	mg/kg bw/d
			Residents: Oral exposure (hand-to-mouth transfer)		
			$SOE_H = (AR \times NA \times D \times TTR \times SE \times SA \times Freq \times H \times OA) /$		
			$(0,0425 \times 2 \times 0,24\% \times 5\% \times 50\% \times 20 \times 20 \times 2 \times 35\%) / 16,15$		
			External exposure	0,00408	mg/person
			External exposure	0,00025263	mg/kg bw/d
			Absorbed dose	0,0000884	mg/kg bw/d
			Residents: Oral exposure (object-to-mouth transfer)		
			$SOE_O = (AR \times NA \times D \times DFR \times IgR \times OA) / BW$		
			$(0,0425 \times 2 \times 0,24\% \times 20\% \times 25 \times 35\%) / 16,15$		
			External exposure	0,00102	mg/person
			External exposure	6,3158E-05	mg/kg bw/d
			Absorbed dose	0,0000221	mg/kg bw/d
Total systemic exposure: $SE_R = SDE_R + SIE_R$			Total systemic exposure: $SE_R = SDE_R + SIE_R + SOE_H + SOE_O$		
Total systemic exposure (absorbed dose)	0,0195484	mg/person	Total systemic exposure (absorbed dose)	0,0111558	mg/person
Total systemic exposure (absorbed dose)	0,0003258	mg/kg bw/d	Total systemic exposure (absorbed dose)	0,0006908	mg/kg bw/d
% of AOEL:	3,72	%	% of AOEL:	7,89	%

Appendix B.6.4.2-4: Resident estimation, German model: UDMH
Estimation of resident exposure after application in High crops, hand held (HCHH)

Input parameters considered for the estimation of resident exposure:

Intended use(s):		Drift (D):	0,24 % (HCHH, 10 m)
Application rate (AR):	0,000887 kg a.s./ha	Transfer coefficient (TC):	7300 cm ² /h (adults)
			2600 cm ² /h (children)
Number of applications (NA):	2	Turf Transferable Residues (TTR):	5 %
Body weight (BW):	60 kg/person (adults)	Exposure Duration (H):	2 h
	16,15 kg/person (children)	Airborne Concentration of Vapour (ACV):	0,000085 mg/m ³
Dermal absorption (DA):	10,70 % ('worst case')	Inhalation Rate (IR):	16,57 m ³ /d (adults),
Inhalation absorption (IA):	100 %		8,31 m ³ /d (children)
Oral absorption (OA)	100 %	Saliva Extraction Factor (SE):	50 %
AOEL	0,00009 mg/kg bw/d	Surface Area of Hands (SA):	20 cm ²
		Frequency of Hand to Mouth (Freq):	20 events/h
		Dislodgeable foliar residues (DFR):	20 %
		Ingestion Rate for Mouthing of Grass/Day (IgR):	25 cm ² /d

Resident exposure towards UDMH				
Adults			Children	
Residents: Dermal exposure after application in (via deposits caused by spray drift)				
$SDE_R = (AR \times NA \times D \times TTR \times TC \times H \times DA) / BW$ (0,00000887 x 2 x 0,24% x 5% x 7300 x 2 x 10,7%) / 60			$SDE_R = (AR \times NA \times D \times TTR \times TC \times H \times DA) / BW$ (0,00000887 x 2 x 0,24% x 5% x 2600 x 2 x 10,7%) / 16,15	
External exposure	3,108E-05	mg/person	External exposure	1,107E-05 mg/person
External exposure	5,1801E-07	mg/kg bw/d	External exposure	6,8543E-07 mg/kg bw/d
Absorbed dose:	0,0000001	mg/kg bw/d	Absorbed dose:	0,0000001 mg/kg bw/d
Residents: Inhalation exposure to vapour				
$SIE_R = (AC_V \times IR \times IA) / BW$ (0,000085 x 16,57 x 100%) / 60			$SIE_R = (AC_V \times IR \times IA) / BW$ (0,000085 x 8,31 x 100%) / 16,15	
External exposure	0,00140845	mg/person	External exposure	0,00070635 mg/person
External exposure	2,3474E-05	mg/kg bw/d	External exposure	4,3737E-05 mg/kg bw/d
Absorbed dose:	0,0000235	mg/kg bw/d	Absorbed dose:	0,0000437 mg/kg bw/d
			Residents: Oral exposure (hand-to-mouth transfer)	
			$SOE_H = (AR \times NA \times D \times TTR \times SE \times SA \times Freq \times H \times OA) /$ (0,00000887 x 2 x 0,24% x 5% x 50% x 20 x 20 x 2 x 100%) /	
			External exposure	8,5152E-07 mg/person
			External exposure	5,2726E-08 mg/kg bw/d
			Absorbed dose	0,0000001 mg/kg bw/d
			Residents: Oral exposure (object-to-mouth transfer)	
			$SOE_O = (AR \times NA \times D \times DFR \times IgR \times OA) / BW$ (0,00000887 x 2 x 0,24% x 20% x 25 x 100%) / 16,15	
External exposure	2,1288E-07 mg/person			
External exposure	1,3181E-08 mg/kg bw/d			
Absorbed dose	0,0000000 mg/kg bw/d			
Total systemic exposure: $SE_R = SDE_R + SIE_R$			Total systemic exposure: $SE_R = SDE_R + SIE_R + SOE_H + SOE_O$	
Total systemic exposure (absorbed dose)	0,00141178	mg/person	Total systemic exposure (absorbed dose)	0,0007086 mg/person
Total systemic exposure (absorbed dose)	0,0000235	mg/kg bw/d	Total systemic exposure (absorbed dose)	0,0000439 mg/kg bw/d
% of AOEL:	26,14	%	% of AOEL:	48,75 %

Appendix B.6.4.2-5: Resident estimation, EFSA AOEM model: daminozide
Exposure assessment

Substance	Daminozide	Formulation = Wettable granules, soluble granules	Application rate-4,25 kg a.s. /ha	Spray dilution = 8,5 g a.s./l	Vapour pressure = low volatile substances having a vapour pressure of
Scenario	Ornamentals / Outdoor / Upward spraying / Manual-Knapsack			Buffer = 10	Number applications = 5, Application interval = 7 days
Percentage Absorption	Dermal for product = 0,4	Dermal for in use dilution = 2	Oral = 35	Inhalation = 100	
RVNAS	0,00875 mg/kg bw/day		RVAAS	mg/kg bw/day	
DFR	3 µg a.s./cm ² per kg a.s./ha		DT50	30 days	
Resident - child	Spray drift (75th percentile) mg/kg bw/day		0,0249	% of RVNAS	285,05%
	Vapour (75th percentile) mg/kg bw/day		0,0011	% of RVNAS	12,23%
	Surface deposits (75th percentile) mg/kg bw/day		0,0021	% of RVNAS	24,09%
	Entry into treated crops (75th percentile) mg/kg bw/day		0,0533	% of RVNAS	608,75%
	All pathways (mean) mg/kg bw/day		0,0618	% of RVNAS	705,90%
Resident - adult	Spray drift (75th percentile) mg/kg bw/day		0,0134	% of RVNAS	152,89%
	Vapour (75th percentile) mg/kg bw/day		0,0002	% of RVNAS	2,63%
	Surface deposits (75th percentile) mg/kg bw/day		0,0005	% of RVNAS	5,71%
	Entry into treated crops (75th percentile) mg/kg bw/day		0,0296	% of RVNAS	338,20%
	All pathways (mean) mg/kg bw/day		0,0330	% of RVNAS	377,14%

Appendix B.6.4.2-6: Resident estimation, EFSA AOEM model: UDMH
Exposure assessment

Substance	UDMH	Formulation = Wettable granules, soluble granules	Application rate- 0,000887 kg a.s. /ha	Spray dilution = 0,001774 g a.s./l	Vapour pressure = low volatile substances having a vapour pressure of
Scenario	Ornamentals / Outdoor / Upward spraying / Manual-Hand held			Buffer = 10	Number applications = 5, Application interval = 7 days
Percentage Absorption	Dermal for product = 10,7	Dermal for in use dilution = 10,7	Oral = 100	Inhalation = 100	
RVNAS	0,00009 mg/kg bw/day		RVAAS	mg/kg bw/day	
DFR	0,00033 µg a.s./cm2 per kg a.s./ha		DT50	3,25 days	
Resident - child	Spray drift (75th percentile) mg/kg bw/day		0,0000	% of RVNAS	29,53%
	Vapour (75th percentile) mg/kg bw/day		0,0011	% of RVNAS	1188,89%
	Surface deposits (75th percentile) mg/kg bw/day		0,0000	% of RVNAS	0,70%
	Entry into treated crops (75th percentile) mg/kg bw/day		0,0000	% of RVNAS	0,00%
	All pathways (mean) mg/kg bw/day		0,0011	% of RVNAS	1208,89%
Resident - adult	Spray drift (75th percentile) mg/kg bw/day		0,0000	% of RVNAS	16,30%
	Vapour (75th percentile) mg/kg bw/day		0,0002	% of RVNAS	255,56%
	Surface deposits (75th percentile) mg/kg bw/day		0,0000	% of RVNAS	0,22%
	Entry into treated crops (75th percentile) mg/kg bw/day		0,0000	% of RVNAS	0,00%
	All pathways (mean) mg/kg bw/day		0,0002	% of RVNAS	266,39%

Appendix B.6.4.3-1: Worker estimation, German model: daminozide

Estimation of post-application exposure of workers (re-entry exposure)			
Active substance (a.s.)	Daminozide		
Product	Alar		
Intended use(s)	ornamentals_indoor		
Application rate (AR)	7,65	kg a.s./ha	
Number of applications (NA)	2		1)
Dislodgeable foliar residues (DFR)	3	µg/cm ² /kg a.s.	2)
Transfer coefficient (TC)	5000	cm ² /person/h	3)
Work rate per day (WR)	8	h/d	4)
Penetration through clothing (P)	0,28	(28 %)	5)
Systemic AOEL	0,00875	mg/kg bw/d	
Dermal absorption DA)	0,4	% (worst case, e.g. for dilution)	
Body weight (BW)	60	kg	

1) consideration of more than two applications will not be necessary if degradation on foliage of at least 50 % can be assumed between 2 applications (otherwise use multiple application factor)

2) default of 1 µg a.s./cm² per kg a.s./ha acc. to Krebs et al. (2000)

3) TC 30000 cm²/person/hour ("worst case", hand harvesting, both sides of leaves) acc. to Krebs et al. (2000), acc. EUROPEM II (2002): 2500 (vegetables), 3000 (strawberries), 4500 (fruits from trees), 5000 (ornamentals) acc. US EPA Policy # 3.1 (2000): 1500 (cereals, e.g. crop inspection), 10000 (grapes)

4) 8 h/day for professional applications if re-entry tasks are intended, 2 h/day for professional applications if re-entry tasks are not intended (e.g. irrigation, maintenance) or for applications in the home and allotment garden area

5) 5 % of dermal exposure corresponding to protective clothing incl. gloves for professionals, 50 % reduction of dermal exposure corresponding to long sleeved shirt, long trousers and gloves for applications in the home and allotment garden area

Estimation of worker (re-entry) exposure

Input parameters considered for the estimation of worker exposure:

Intended use(s):	ornamentals_indoor		Dislodgeable foliar residues (DFR):	3	µg/cm²/kg a.s.
Application rate (AR):	7,65	kg a.s./ha	Transfer coefficient (TC):	5000	cm²/person/h
Number of applications (NA):	2		Work rate per day (WR):	8	h/d
Body weight (BW):	60	kg/person	PPE	28	%
Dermal absorption (DA):	0,4	% ("worst case")			
AOEL	0.00875	mg/kg bw/d			

Worker exposure towards Daminozide

Without PPE ¹⁾			With PPE ²⁾		
Worker (re-entry): Systemic dermal exposure after application in ornamentals indoor					
SDE _W = (DFR x TC x WR x AR x NA x DA) / BW			SDE _W = (DFR x TC x WR x AR x NA x PPE x DA) /		
(3 x 5000 x 8 x 7,65 x 2 x 0,4%) / 60			(3 x 5000 x 8 x 7,65 x 2 x 28% x 0,4%) / 60		
External dermal exposure	1836,00	mg/person	External dermal exposure	514,08	mg/person
External dermal exposure	30,60	mg/kg bw/d	External dermal exposure	8,57	mg/kg bw/d
Total systemic exposure	7,34	mg/person	Total systemic exposure	2,06	mg/person
Total systemic exposure	0,122400	mg/kg bw/d	Total systemic exposure	0,034272	mg/kg bw/d
% of AOEL	1398,9	%	% of AOEL	391,7	%

Inhalation exposure

Without RPE		With RPE	
TSF: 0.1 cutting; <u>0.01 sorting and bundling</u>		RPE FP1 25%	
PIE = (AR x MAF x TSF x WR) / BW		PIE = (AR x MAF x TSF x WR x PPE) / BW	
0,0204	mg/kg bw/d	0,0051	mg/kg bw/d
Total systemic exposure	0,14280 mg/kg bw/d	0,039372	mg/kg bw/d
% of AOEL	1632 %	449.9657143 %	

Appendix B.6.4.3-2: Worker estimation, German model: UDMH

Estimation of post-application exposure of workers (re-entry exposure)			
Active substance (a.s.)	UDMH		
Product	Alar		
Intended use(s)	ornamentals_indoor		
Application rate (AR)	0,001595	kg a.s./ha	1)
Number of applications (NA)	2		
Dislodgeable foliar residues (DFR)	3	µg/cm ² /kg a.s.	2)
Transfer coefficient (TC)	5000	cm ² /person/h	3)
Work rate per day (WR)	8	h/d	4)
Penetration through clothing (P)	0,28	(28 %)	5)
Systemic AOEL	0,00009	mg/kg bw/d	
Dermal absorption (DA)	10,7	% (worst case, e.g. for dilution)	
Body weight (BW)	60	kg	

1) consideration of more than two applications will not be necessary if degradation on foliage of at least 50 % can be assumed between 2 applications (otherwise use multiple application factor)

2) default of 1 µg a.s./cm² per kg a.s./ha acc. to Krebs et al. (2000)

3) TC 30000 cm²/person/hour ("worst case", hand harvesting, both sides of leaves) acc. to Krebs et al. (2000), acc. EUROPEM II (2002): 2500 (vegetables), 3000 (strawberries), 4500 (fruits from trees), 5000 (ornamentals) acc. US EPA Policy # 3.1 (2000): 1500 (cereals, e.g. crop inspection), 10000 (grapes)

4) 8 h/day for professional applications if re-entry tasks are intended, 2 h/day for professional applications if re-entry tasks are not intended (e.g. irrigation, maintenance) or for applications in the home and allotment garden area

5) 5 % of dermal exposure corresponding to protective clothing incl. gloves for professionals, 50 % reduction of dermal exposure corresponding to long sleeved shirt, long trousers and gloves for applications in the home and allotment garden area

Estimation of worker (re-entry) exposure

Input parameters considered for the estimation of worker exposure:

Intended use(s):	ornamentals_indoor	Dislodgeable foliar residues (DFR):	3	µg/cm ² /kg a.s.
Application rate (AR):	0,0016 kg a.s./ha	Transfer coefficient (TC):	5000	cm ² /person/h
Number of applications (NA):	2	Work rate per day (WR):	8	h/d
Body weight (BW):	60 kg/person	PPE	28	%
Dermal absorption (DA):	10,7 % ("worst case")			
AOEL	0.00009 mg/kg bw/d			

Worker exposure towards UDMH

Without PPE ¹⁾				With PPE ²⁾			
Worker (re-entry): Systemic dermal exposure after application in ornamentals indoor							
$SDE_W = (DFR \times TC \times WR \times AR \times NA \times DA) / BW$				$SDE_W = (DFR \times TC \times WR \times AR \times NA \times PPE \times DA) /$			
$(3 \times 5000 \times 8 \times 0,001595 \times 2 \times 10,7\%) / 60$				$(3 \times 5000 \times 8 \times 0,001595 \times 2 \times 28\% \times 10,7\%) / 60$			
External dermal exposure	0,38	mg/person		External dermal exposure	0,11	mg/person	
External dermal exposure	0,01	mg/kg bw/d		External dermal exposure	0,00	mg/kg bw/d	
Total systemic exposure	0,04	mg/person		Total systemic exposure	0,01	mg/person	
Total systemic exposure	0,000683	mg/kg bw/d		Total systemic exposure	0,000191	mg/kg bw/d	
% of AOEL	758,5	%		% of AOEL	212,4	%	

Inhalation exposure

Without RPE		With RPE	
TSF: 0.1 cutting; <u>0.01 sorting and bundling</u>		RPE FP1 25%	
PIE = (AR x MAF x TSF x WR) / BW		PIE = (AR x MAF x TSF x WR x PPE) / BW	
4,25333E-06		1,06333E-06	mg/kg bw/d
Total systemic exposure	0,00069	0,000192	mg/kg bw/d
% of AOEL	763.24 %	213.5645926 %	

Appendix B.6.4.3-3: Worker estimation, EFSA AOEM model: daminozide**Exposure assessment**

Substance	Daminozide	Formulation = Wettable granules, soluble granules	Application rate-7,65 kg a.s. /ha	Spray dilution = 15,3 g a.s./l	Vapour pressure = low volatile substances having a vapour pressure of
Scenario	Ornamentals / Indoor / Spray application / Manual-Knapsack			Buffer = 5	Number applications = 5, Application interval = 7 days
Percentage Absorption	Dermal for product = 0,4	Dermal for in use dilution = 0	Oral = 35	Inhalation = 100	
RVNAS	0,00875 mg/kg bw/day		RVAAS	mg/kg bw/day	
DFR	3 µg a.s./cm ² per kg a.s./ha		DT50	30 days	
Worker - Cutting, sorting, bundling, carrying	Potential exposure mg/kg bw/day		0,7383	% of RVNAS	8438,27%
	Working clothing mg/kg bw/day		0,3293	% of RVNAS	3763,06%
	Working clothing and gloves mg/kg bw/day		0,1656	% of RVNAS	1892,97%

Appendix B.6.4.3-4: Worker estimation, EFSA AOEM model: UDMH**Exposure assessment**

Substance	UDMH	Formulation = Wettable granules, soluble granules	Application rate-0,001595 kg a.s. /ha	Spray dilution = 0,00319 g a.s./l	Vapour pressure = low volatile substances having a vapour pressure of
Scenario	Ornamentals / Indoor / Spray application / Manual-Knapsack			Buffer = 2-3	Number applications = 5, Application interval = 7 days
Percentage Absorption	Dermal for product = 10,7	Dermal for in use dilution = 10,7	Oral = 100	Inhalation = 100	
RVNAS	0,00009 mg/kg bw/day		RVAAS	mg/kg bw/day	
DFR	3 µg a.s./cm ² per kg a.s./ha		DT50	30 days	
Worker - Cutting, sorting, bundling, carrying	Potential exposure mg/kg bw/day		0,0036	% of RVNAS	3967,08%
	Working clothing mg/kg bw/day		0,0013	% of RVNAS	1432,00%
	Working clothing and gloves mg/kg bw/day		0,0004	% of RVNAS	417,97%

Appendix B.6.4.3.1-5: Estimate of total dislodgeable foliar residue for daminozide assuming an application rate of 7.65 kg a.s./ha for a single application, five treatments, a 7 day interval between treatments and a half-life of 2.37 days for daminozide on treated foliage

$$N_t = N_o \times (0.5)^{\text{number of half-lives}}$$

N_t = amount remaining after specified number of half-lives

N_o = original amount

Number of half-lives = elapsed time ÷ half-life

Application rate (kg a.s./ha)	7.65
Interval between applications	7
Exclusion period	0

Application 1

Nt	No	Time	Half life	No of half-lives	
		10.97	28	2.37	11.814
0.0030					

Application 2

Nt	No	Time	Half life	No of half-lives	
		10.97	21	2.37	8.861
0.0236					

Application 3

Nt	No	Time	Half life	No of half-lives	
		10.97	14	2.37	5.907
0.1828					

Application 4

Application 4				
N_t	No	Time	Half life	No of half-lives
	10.97	7	2.37	2.954
1.4162				

Application 5

N_t	No	Time	Half life	No of half-lives
	10.97	0	2.37	0
10.9711				

Total N_t = 12.60

Appendix B.6.4.3.1-6: Estimate of dislodgeable foliar residue for UDMH assuming an application rate of 3.83×10^{-3} kg UDMH/ha for a single application, five applications, a 7 day interval between treatments and a half-life of 3.25 days for UDMH on treated foliage

$$N_t = N_o \times (0.5)^{\text{number of half-lives}}$$

N_t = amount remaining after specified number of half-lives

N_o = original amount

Number of half-lives = elapsed time ÷ half-life

Application rate daminozide (kg a.s./ha)	7.65
Application rate UDMH (kg/ha)	3.83E-03
Interval between applications	7
Exclusion period	0

Application 1

N_t	No	Time	Half life	No of half-lives
6E-06		2.5E-03	28	3.25
				8.615

Application 2

N_t	No	Time	Half life	No of half-lives
3E-05		2.5E-03	21	3.25
				6.462

Application 3

N_t	No	Time	Half life	No of half-lives
1E-04		2.5E-03	14	3.25
				4.308

Application 4

N_t	No	Time	Half life	No of half-lives
6E-04		2.5E-03	7	3.25
				2.154

Application 5

N_t	No	Time	Half life	No of half-lives
2E-03		2.5E-03	0	3.25
				0.0

Total $N_t = 3.2 \times 10^{-3}$

Appendix B.6.4.3-7: Worker estimation, German model: daminozide, incorporating DFR data

Estimation of post-application exposure of workers (re-entry exposure)			
Active substance (a.s.)	Daminozide		
Product	Alar		
Intended use(s)	ornamentals_indoor		
Application rate (AR)	7,65	kg a.s./ha	1)
Number of applications (NA)	1,15		
Dislodgeable foliar residues (DFR)	1,434	µg/cm ² /kg a.s.	2)
Transfer coefficient (TC)	5000	cm ² /person/h	3)
Work rate per day (WR)	8	h/d	4)
Penetration through clothing (P)	0,28	(28 %)	5)
Systemic AOEL	0,00875	mg/kg bw/d	
Dermal absorption DA)	0,4	% (worst case, e.g. for dilution)	
Body weight (BW)	60	kg	

1) consideration of more than two applications will not be necessary if degradation on foliage of at least 50 % can be assumed between 2 applications (otherwise use multiple application factor)

2) default of 1 µg a.s./cm² per kg a.s./ha acc. to Krebs et al. (2000)

3) TC 30000 cm²/person/hour ("worst case", hand harvesting, both sides of leaves) acc. to Krebs et al. (2000), acc. EUROPEM II (2002): 2500 (vegetables), 3000 (strawberries), 4500 (fruits from trees), 5000 (ornamentals) acc. US EPA Policy # 3.1 (2000): 1500 (cereals, e.g. crop inspection), 10000 (grapes)

4) 8 h/day for professional applications if re-entry tasks are intended, 2 h/day for professional applications if re-entry tasks are not intended (e.g. irrigation, maintenance) or for applications in the home and allotment garden area

5) 5 % of dermal exposure corresponding to protective clothing incl. gloves for professionals, 50 % reduction of dermal exposure corresponding to long sleeved shirt, long trousers and gloves for applications in the home and allotment garden area

Estimation of worker (re-entry) exposure

Input parameters considered for the estimation of worker exposure:

Intended use(s):	ornamentals_indoor		Dislodgeable foliar residues (DFR):	1,434	µg/cm²/kg a.s.
Application rate (AR):	7,65	kg a.s./ha	Transfer coefficient (TC):	5000	cm²/person/h
Number of applications (NA):	1,15		Work rate per day (WR):	8	h/d
Body weight (BW):	60	kg/person	PPE	28	%
Dermal absorption (DA):	0,4	% ("worst case")			
AOEL	0.00875	mg/kg bw/d			

Worker exposure towards Daminozide					
Without PPE ¹⁾			With PPE ²⁾		
Worker (re-entry): Systemic dermal exposure after application in ornamentals indoor					
SDE _w = (DFR x TC x WR x AR x NA x DA) / BW			SDE _w = (DFR x TC x WR x AR x NA x PPE x DA) /		
(1,434 x 5000 x 8 x 7,65 x 1,15 x 0,4%) / 60			(1,434 x 5000 x 8 x 7,65 x 1,15 x 28% x 0,4%) / 60		
External dermal exposure	504,62	mg/person	External dermal exposure	141,29	mg/person
External dermal exposure	8,41	mg/kg bw/d	External dermal exposure	2,35	mg/kg bw/d
Total systemic exposure	2,02	mg/person	Total systemic exposure	0,57	mg/person
Total systemic exposure	0,033642	mg/kg bw/d	Total systemic exposure	0,009420	mg/kg bw/d
% of AOEL	384,5	%	% of AOEL	107,7	%
Inhalation exposure					
Without RPE			With RPE		
TSF: 0.1 cutting; <u>0.01 sorting and bundling</u>			RPE FP1 25%		
PIE = (AR x MAF x TSF x WR) / BW			PIE = (AR x MAF x TSF x WR x PPE) / BW		
0,01173		mg/kg bw/d	0,0029325		mg/kg bw/d
Total systemic exposure	0,04537	mg/kg bw/d	Total systemic exposure	0,012352	mg/kg bw/d
% of AOEL	518,53	%	141,1675337 %		

Estimation of post-application exposure of workers (re-entry exposure)				
Active substance (a.s.)	UDMH			
Product	Alar			
Intended use(s)	ornamentals_indoor			
Application rate (AR)	7,65	kg a.s./ha		
Number of applications (NA)	1,3			1)
Dislodgeable foliar residues (DFR)	0,00033	µg/cm²/kg a.s.		2)
Transfer coefficient (TC)	5000	cm²/person/h		3)
Work rate per day (WR)	8	h/d		4)
Penetration through clothing (P)	0,28	(28 %)		5)
Systemic AOEL	0,00009	mg/kg bw/d		
Dermal absorption DA)	10,7	% (worst case, e.g. for dilution)		
Body weight (BW)	60	kg		
<p>1) consideration of more than two applications will not be necessary if degradation on foliage of at least 50 % can be assumed between 2 applications (otherwise use multiple application factor)</p> <p>2) default of 1 µg a.s./cm² per kg a.s./ha acc. to Krebs et al. (2000)</p> <p>3) TC 30000 cm²/person/hour ('worst case', hand harvesting, both sides of leaves) acc. to Krebs et al. (2000), acc. EUROPEM II (2002): 2500 (vegetables), 3000 (straw berries), 4500 (fruits from trees), 5000 (ornamentals) acc. US EPA Policy # 3.1 (2000): 1500 (cereals, e.g. crop inspection), 10000 (grapes)</p> <p>4) 8 h/day for professional applications if re-entry tasks are intended, 2 h/day for professional applications if re-entry tasks are not intended (e.g. irrigation, maintenance) or for applications in the home and allotment garden area</p> <p>5) 5 % of dermal exposure corresponding to protective clothing incl. gloves for professionals, 50 % reduction of dermal exposure corresponding to long sleeved shirt, long trousers and gloves for applications in the home and allotment garden area</p>				

Estimation of worker (re-entry) exposure

Input parameters considered for the estimation of worker exposure:

Intended use(s):	ornamentals_indoor	Dislodgeable foliar residues (DFR):	0,00033	µg/cm ² /kg a.s.
Application rate (AR):	7,65 kg a.s./ha	Transfer coefficient (TC):	5000	cm ² /person/h
Number of applications (NA):	1,3	Work rate per day (WR):	8	h/d
Body weight (BW):	60 kg/person	PPE	28	%
Dermal absorption (DA):	10,7 % ('worst case')	Application rate of UDMH	0,001595	kg a.s./ha
AOEL	0,00009 mg/kg bw/d			

Worker exposure towards UDMH					
Without PPE ¹⁾			With PPE ²⁾		
Worker (re-entry): Systemic dermal exposure after application in ornamentals_indoor					
SDE _W = (DFR x TC x WR x AR x NA x DA) / BW			SDE _W = (DFR x TC x WR x AR x NA x PPE x DA) / BW		
(0,00033 x 5000 x 8 x 7,65 x 1,3 x 10,7%) / 60			(0,00033 x 5000 x 8 x 7,65 x 1,3 x 28% x 10,7%) / 60		
External dermal exposure	0,13	mg/person	External dermal exposure	0,04	mg/person
External dermal exposure	0,00	mg/kg bw/d	External dermal exposure	0,00	mg/kg bw/d
Total systemic exposure	0,01	mg/person	Total systemic exposure	0,00	mg/person
Total systemic exposure	0,000234	mg/kg bw/d	Total systemic exposure	0,000066	mg/kg bw/d
% of AOEL	260,1	%	% of AOEL	72,8	%
Inhalation exposure					
Without RPE			With RPE		
TSF: 0.1 cutting ; 0.01 sorting and bundling			RPE FPI 25%		
PIE = (AR _{UDMH} x MAF x TSF x WR) / BW			PIE = (AR _{UDMH} x MAF x TSF x WR x PPE) / BW		
2,76467E-05		mg/kg bw/d	6,91167E-06		mg/kg bw/d
Total systemic exposure	0,00026	mg/kg bw/d	0,000072		mg/kg bw/d
% of AOEL	290.836	%	80.51238963		%

Appendix B.6.4.3-9: Worker estimation, EFSA AOEM model: daminozide, incorporating DFR data**Exposure assessment**

Substance	Daminozide	Formulation = Wettable granules, soluble granules	Application rate-7,65 kg a.s. /ha	Spray dilution = 15,3 g a.s./l	Vapour pressure = low volatile substances having a vapour pressure of
Scenario	Ornamentals / Indoor / Spray application / Manual-Knapsack			Buffer = 5	Number applications = 5, Application interval = 7 days
Percentage Absorption	Dermal for product = 0,4	Dermal for in use dilution = 0	Oral = 35	Inhalation = 100	
RVNAS	0,00875 mg/kg bw/day		RVAAS	mg/kg bw/day	
DFR	1,434 µg a.s./cm2 per kg a.s./ha		DT50	2,37 days	
Worker - Cutting, sorting, bundling, carrying	Potential exposure mg/kg bw/day		0,1960	% of RVNAS	2240,54%
	Working clothing mg/kg bw/day		0,1356	% of RVNAS	1549,58%
	Working clothing and gloves mg/kg bw/day		0,1114	% of RVNAS	1273,20%

Appendix B.6.4.3-10: Worker estimation, EFSA AOEM model: UDMH, incorporating DFR data, dermal + inhal. absorption**Exposure assessment**

Substance	UDMH - dermal absorption as daminozide proportion	Formulation = Wettable granules, soluble granules	Application rate-7,65 kg a.s. /ha	Spray dilution = 15,3 g a.s./l	Vapour pressure = low volatile substances having a vapour pressure of
Scenario	Ornamentals / Outdoor / Upward spraying / Manual-Hand held			Buffer = 2-3	Number applications = 5, Application interval = 7 days
Percentage Absorption	Dermal for product = 10,7	Dermal for in use dilution = 10,7	Oral = 100	Inhalation = 100	
RVNAS	0,00009 mg/kg bw/day		RVAAS	mg/kg bw/day	
DFR	0,00033 µg a.s./cm2 per kg a.s./ha		DT50	3,25 days	
Worker - Cutting, sorting, bundling, carrying	Potential exposure mg/kg bw/day		0,0007	% of RVNAS	722,22%
	Working clothing mg/kg bw/day		0,0002	% of RVNAS	257,94%
	Working clothing and gloves mg/kg bw/day		0,0001	% of RVNAS	72,22%

Exposure assessment

Substance	UDMH - inhalation absorption	Formulation = Wettable granules, soluble granules	Application rate-0,001595 kg a.s. /ha	Spray dilution = 0,00319 g a.s./l	Vapour pressure = low volatile substances having a vapour pressure of
Scenario	Ornamentals / Indoor / Spray application / Manual-Knapsack			Buffer = 2-3	Number applications = 5, Application interval = 7 days
Percentage Absorption	Dermal for product = 10,7	Dermal for in use dilution = 10,7	Oral = 100	Inhalation = 100	
RVNAS	0,00009 mg/kg bw/day		RVAAS	mg/kg bw/day	
DFR	0,00033 µg a.s./cm2 per kg a.s./ha		DT50	3,25 days	
Worker - Cutting, sorting, bundling, carrying	Potential exposure mg/kg bw/day		0,0000	% of RVNAS	23,78%
	Working clothing mg/kg bw/day		0,0000	% of RVNAS	23,68%
	Working clothing and gloves mg/kg bw/day		0,0000	% of RVNAS	23,64%

Total exposure to UDMH: 72.22+23.64 = 95,86 % AOEL