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Lambda-cyhalothrin technical

Lambda-cyhalothrin technical - *Salmonella Typhimurium* and *Escherichia Coli* Reverse Mutation Assay

Final Report

DATA REQUIREMENT(S):	OECD 471 (1997) EPA OPPTS 870.5100 (1998) EC 440/2008 B.13/14 (2008)
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STUDY COMPLETION DATE:	18 January 2012
PERFORMING LABORATORY:	Harlan Cytotest Cell Research GmbH (Harlan CCR) In den Leppsteinswiesen 19 64380 Rossdorf, Germany
LABORATORY PROJECT ID:	Report Number: 1458600 Study Number: 1458600 Task Number: TK0102717
SPONSOR(S):	Syngenta Ltd Jealott's Hill International Research Centre Bracknell, Berkshire RG42 6EY, United Kingdom

STATEMENT OF DATA CONFIDENTIALITY CLAIMS

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GOOD LABORATORY PRACTICE COMPLIANCE STATEMENT

This study performed in the test facility of Harlan CCR, In den Leppsteinswiesen 19, 64380 Rossdorf, Germany was conducted in compliance with Good Laboratory Practice Regulations:

"Chemikaliengesetz" (Chemicals Act) of the Federal Republic of Germany, "Anhang 1" (Annex 1), in its currently valid version

"OECD Principles of Good Laboratory Practice", as revised in 1997 [C(97)186/Final]

These procedures are compatible with Good Laboratory Practice regulations specified by regulatory authorities throughout the European Community, the United States (EPA and FDA), and Japan (MHW, MAFF, and METI).

There were no circumstances that may have affected the quality or integrity of the study.

Dipl. Biol. Andrea Sokolowski
Study Director Bacterial Systems

Date: 18 January 2012

Performing Laboratory:
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FLAGGING STATEMENT

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QUALITY ASSURANCE STATEMENT

Study Number: 1458600

Test Item: Lambda-cyhalothrin technical

Study Director: Dipl. Biol. Andrea Sokolowski

Title: Lambda-cyhalothrin technical -
Salmonella Typhimurium and
Escherichia Coli Reverse Mutation Assay

The general facilities and activities of Harlan CCR are inspected periodically and the results are reported to the responsible person and the management.

Study procedures were inspected periodically. The study plan and this report were audited by the Quality Assurance Unit. The dates are given below.

Phases and Dates of QAU Inspections/ Audits		Dates of Reports to the Study Director and to Management
Study Plan:	24 November 2011	24 November 2011
Process Inspection Preparation for Application:	22 November 2011	22 November 2011
Draft Report:	04 January 2012	04 January 2012

This statement is to confirm that the present final report reflects the raw data.

Head of Quality Assurance Unit for Frauke Hermann

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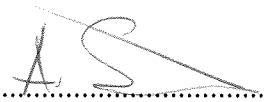
Date: 18 January 2012

Karlheinz Werner

PROJECT STAFF SIGNATURES

Study Director — Dipl. Biol. Andrea Sokolowski



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Date: 18 January 2012

GENERAL INFORMATION

Contributors

The following contributed to this report in the capacities indicated:

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Test Facility:	Harlan Cytotest Cell Research GmbH (Harlan CCR) In den Leppsteinswiesen 19 64380 Rossdorf Germany
Contracting Institute:	Harlan Laboratories Ltd. 4452 Itingen Switzerland
Reference Number:	D46693

Study dates

Study initiation date:	25 November 2011
Experimental start date:	29 November 2011
Experimental termination date:	09 December 2011

Deviations from the guidelines

None

Retention of samples

Raw data and a sample of the test item.

Performing laboratory test item reference number

S 13163 11

Other

Harlan CCR will archive:

Raw data, study plan, original report, and specimens (if any) for at least 3 years at the test facility's archive. Thereafter, the material will be transferred to the GLP archive of Harlan Laboratories Ltd. in Füllinsdorf, Switzerland for archiving the remaining time up to a total archiving period of 15 years. No data will be discarded without the Sponsor's written consent.

A sample of the test item will be archived two years after the expiration date provided by the sponsor. If no expiration date is given, the archiving period will be the required 15 years. Thereafter the samples will be discarded without further notice.

Good laboratory practice

The study was performed in compliance with:

"Chemikaliengesetz" (Chemicals Act) of the Federal Republic of Germany, "Anhang 1" (Annex 1), in its currently valid version

"OECD Principles of Good Laboratory Practice", as revised in 1997 [C(97)186/Final]

These procedures are compatible with Good Laboratory Practice regulations specified by regulatory authorities throughout the European Community, the United States (EPA and FDA), and Japan (MHW, MAFF, and METI).

Deviations to study plan

None

Distribution of the report

Sponsor	2 × electronic copy (1 × pdf-file, 1 × Word file)
Study Director	1 × (original)

TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY

1.1 Study Design

This study was performed to investigate the potential of lambda-cyhalothrin technical to induce gene mutations in the plate incorporation test (experiment I) and the pre-incubation test (experiment II) using the *Salmonella typhimurium* strains TA1535, TA1537, TA98, and TA100, and the *Escherichia coli* strains WP2 *uvrA* pKM101 and WP2 pKM101.

1.2 Results

The plates incubated with the test item showed normal background growth up to 5000 µg/plate with and without metabolic activation.

No toxic effects, evident as a reduction in the number of revertants (below the indication factor of 0.5), occurred in the test groups with and without metabolic activation with the exception of strain TA 1535 in experiment I where a minor toxic effect was observed at 5000 µg/plate without metabolic activation.

No substantial increase in revertant colony numbers of any of the six tester strains was observed following treatment with lambda-cyhalothrin technical at any dose level, neither in the presence nor absence of metabolic activation (S9 mix). There was also no tendency of higher mutation rates with increasing concentrations in the range below the generally acknowledged border of biological relevance. Appropriate reference mutagens were used as positive controls. They showed a distinct increase of induced revertant colonies.

1.3 Conclusion

In conclusion, it can be stated that during the described mutagenicity test and under the experimental conditions reported, the test item did not induce gene mutations by base pair changes or frameshifts in the genome of the strains used. Therefore, lambda-cyhalothrin technical is considered to be non-mutagenic in this *Salmonella typhimurium* and *Escherichia coli* reverse mutation assay.

2.0 INTRODUCTION

2.1 Purpose

These experiments were performed to assess the potential of the test item to induce gene mutations by means of the *S. typhimurium* and *E. coli* reverse mutation assay. Experiment I was performed as a plate incorporation assay. Since a negative result was obtained in this experiment, experiment II was performed as a pre-incubation assay.

The most widely used assays for detecting gene mutations are those using bacteria (1). They are relatively simple and rapid to perform, and give reliable data on the ability of an agent to interact with DNA and produce mutations.

Reverse mutation assays determine the frequency with which an agent reverses or suppresses the effect of the forward mutation. The genetic target presented to an agent is therefore small, specific and selective. Several bacterial strains, or a single strain with multiple markers are necessary to assure reliable detection of mutagens that may be specific to one tester strain or locus. The reversion of bacteria from growth-dependence on a particular amino acid to growth in the absence of that amino acid (reversion from auxotrophy to prototrophy) is the most widely used marker.

The S. *typhimurium* histidine (his) and the *E. coli* tryptophan (trp) reversion system measures $his^- \rightarrow his^+$ and $trp^- \rightarrow trp^+$ reversions, respectively. The *S. typhimurium* and *Escherichia coli* strains are constructed to differentiate between base pair (TA1535, TA100, WP2 *uvrA* pKM101, and WP2 pKM101) and frameshift (TA1537, TA98) mutations.

According to the direct plate incorporation and pre-incubation method the bacteria are exposed to the test item with and without metabolic activation and plated on selective medium. After a suitable period of incubation, revertant colonies are counted.

To establish a dose response effect at least seven dose levels with adequately spaced intervals were tested. The maximum dose level was 5000 µg/plate.

To validate the test, reference mutagens were tested in parallel to the test item.

2.2 Regulatory Guidelines

This study followed the procedures indicated by the following internationally accepted guidelines and recommendations:

"Ninth Addendum to OECD Guidelines for Testing of Chemicals", Section 4, No. 471: "Bacterial Reverse Mutation Test", adopted July 21, 1997

"United States Environmental Protection Agency, Health Effects Test Guideline OPPTS 870.5100 (1998). Bacterial Reverse Mutation Test."

"Commission Regulation (EC) No. 440/2008 B13/14", dated May 30, 2008

3.0 MATERIALS AND METHODS

3.1 Test Item

The test item and the information concerning the test item were provided by the Sponsor.

Internal Test Item Number:	S 13163 11
Identity:	lambda-cyhalothrin technical
Batch No.:	UKNB854/04
Purity:	90.5 % dose calculation adjusted to the purity
Stability in Solvent:	Not indicated by the sponsor
Storage:	At room temperature
Reanalysis Date:	End of November 2013

On the day of the experiment, the test item lambda-cyhalothrin technical was dissolved in DMSO (MERCK, D-64293 Darmstadt; purity > 99 %). The solvent was chosen because of its solubilisation properties and its relative non-toxicity to the bacteria (2).

3.2 Controls

3.2.1 Negative controls

Concurrent untreated and solvent controls were performed.

3.2.2 Positive control substances

Without metabolic activation

Strains:	TA 1535, TA 100
Name:	sodium azide, NaN_3
Supplier:	SERVA, 69042 Heidelberg/Germany
Catalogue No.:	30175
Purity:	at least 99 %
Dissolved in:	deionised water
Concentration:	10 µg/plate

Strains:	TA 1537, TA 98
Name:	4-nitro-o-phenylene-diamine, 4-NOPD
Supplier:	Fluka (Sigma Aldrich), 82024 Taufkirchen/Germany
Catalogue No.:	73630
Purity:	> 99.9 %
Dissolved in:	DMSO (purity >99 %, MERCK, 64293 Darmstadt/Germany)
Concentration:	10 µg/plate in strain TA 98, 50 µg/plate in strain TA 1537

Strain:	WP2 uvrA (pKM101), WP2 (pKM101)
Name:	methyl methane sulfonate, MMS
Supplier:	Sigma Aldrich, 82024 Taufkirchen/Germany
Catalogue No.:	129925
Purity:	> 99.0 %
Dissolved in:	deionised water
Concentration:	3.0 µL/plate

With metabolic activation

Strains:	TA 1535, TA 1537, TA 98, TA 100, WP2 uvrA (pKM101), WP2 (pKM 101)
Name:	2-aminoanthracene, 2-AA
Supplier:	Sigma Aldrich, 82024 Taufkirchen/Germany
Catalogue No.:	A3,880 - 0
Purity:	97.5 %
Dissolved in:	DMSO (MERCK, D-64293 Darmstadt, purity > 99 %)
Concentration:	2.5 µg/plate (TA 1535, TA 1537, TA 98, TA 100), 10 µg/plate (WP2 uvrA (pKM101), WP2 (pKM101))

The stability of the positive control substances in solution is unknown but a mutagenic response in the expected range will be sufficient evidence of biological stability.

3.3 Experimental Design

3.3.1 Characterisation of the *Salmonella typhimurium* and *E. coli* strains

The histidine dependent strains are derived from *S. typhimurium* strain LT2 through mutations in the histidine locus. Additionally due to the "deep rough" (*rfa*$^-$) mutation they possess a faulty lipopolysaccharide envelope which enables substances to penetrate the cell wall more easily. A further mutation causes a reduction in the activity of an excision repair system. The latter alteration includes mutational processes in the nitrate reductase and biotin genes produced in a UV-sensitive area of the gene named *uvrB*$^-$. In the strains TA 98 and TA 100 the R-factor plasmid pKM101 carries the ampicillin resistance marker (3).

Strain WP2 (4) and its derivatives all carry the same defect in one of the genes for tryptophan biosynthesis. Tryptophan-independent (*Trp*$^+$) mutants (revertants) can arise either by a base change at the site of the original alteration or by a base change elsewhere in the chromosome so that the original defect is suppressed. This second possibility can occur in several different ways so that the system seems capable of detecting all types of mutagen which substitute one base for another. Additionally, the *uvrA* derivative is deficient in the DNA repair process (excisable repair damage). Such a repair-deficient strain may be more readily mutated by agents. The *E. coli* strains WP2 *uvrA* pKM101 and WP2 pKM101 are constructed by introduction of the R-factor plasmid pKM101.

When summarised, the mutations of the TA and *E. coli* strains used in this study can be described as follows:

Salmonella typhimurium		
Strains	**Genotype**	**Type of mutations indicated**
TA1537	*his* C 3076; *rfa*$^-$; *uvrB*$^-$	frame shift mutations
TA98	*his* D 3052; *rfa*$^-$; *uvrB*$^-$; R-factor	" "
TA1535	*his* G 46; *rfa*$^-$; *uvrB*$^-$	base-pair substitutions
TA100	*his* G 46; *rfa*$^-$; *uvrB*$^-$; R-factor	" "
Escherichia coli		
WP2 *uvrA* pKM101	*trp* E 56 *uvrA*$^-$; R-factor	base-pair substitutions and others
WP2 pKM101	*trp* E 56; R-factor	" "

Regular checking of the properties of the *Salmonella typhimurium* and *E. coli* strains regarding the membrane permeability and ampicillin resistance as well as normal spontaneous mutation rates is performed by Harlan CCR according to B. Ames et al. (5) and D. Maron and B. Ames (3). In this way it is ensured that the experimental conditions set down by Ames are fulfilled.

The bacterial strains TA1535, TA1537, TA98, TA100, WP2 *uvrA* pKM101, and WP2pKM101 were obtained from Trinova Biochem GmbH (35394 Gießen, Germany).

3.3.2 Storage

The strain cultures were stored as stock cultures in ampoules with nutrient broth + 5 % DMSO (MERCK, D-64293 Darmstadt) in liquid nitrogen.

3.3.3 Precultures

From the thawed stock cultures of the strains 0.5 mL bacterial suspension was transferred into 250 mL Erlenmeyer flasks containing 20 mL nutrient medium. A solution of 20 µL ampicillin (25 µg/mL) was added to the strains TA 98, TA 100, WP2 *uvrA* pKM101, and WP2 pKM101. This nutrient medium contains per litre:

8 g Nutrient Broth (MERCK, D-64293 Darmstadt)
5 g NaCl (MERCK, D-64293 Darmstadt)

The bacterial cultures were incubated in a shaking water bath for 4 hours at 37 °C. The optical density of the bacteria was determined by absorption measurement and the obtained values indicated that the bacteria were harvested at the late exponential or early stationary phase (10^8-10^9 cells/mL).

3.3.4 Selective agar

The plates with the selective agar were obtained from E. Merck, D-64293 Darmstadt.

3.3.5 Overlay agar

The overlay agar contains per litre:

for *Salmonella* strains:	for *Escherichia coli*:
7.0 g Agar Agar*	7.0 g Agar Agar*
6.0 g NaCl*	6.0 g NaCl*
10.5mg L-Histidine×HCl×H_2O*	10.2 mg Tryptophan*
12.2mg Biotin*	

* (MERCK, D-64293 Darmstadt)

Sterilisations were performed at 121 °C in an autoclave.

3.4 Mammalian Microsomal Fraction S9 Mix

The bacteria used in this assay do not possess the enzyme systems which, in mammals, are known to convert promutagens into active DNA damaging metabolites. In order to overcome this major drawback an exogenous metabolic system is added in the form of mammalian microsome enzyme activation mixture.

3.4.1 S9 (Preparation by Harlan CCR)

Phenobarbital/ß-naphthoflavone induced rat liver S9 was used as the metabolic activation system. The S9 was prepared from 8 – 12 weeks old male Wistar rats (Hsd Cpb: WU; weight approx. 220 – 320 g, Harlan Laboratories B. V., 5960 AD Horst, The Netherlands) induced by intraperitoneal administration of 80 mg/kg b.w. phenobarbital (Desitin; 22335 Hamburg, Germany) and by peroral administrations of ß-naphthoflavone (Sigma-Aldrich Chemie GmbH, 82024 Taufkirchen, Germany) each, on three consecutive days. The livers were prepared 24 hours after the last treatment. The S9 fractions were produced by dilution of the liver homogenate with a KCl solution (1+3 parts) followed by centrifugation at 9000 g. Aliquots of the supernatant were frozen and stored in ampoules at –80 °C. Small numbers of the ampoules can be kept at –20 °C for up to one week. Each batch of S9 mix was routinely tested with 2-aminoanthracene as well as benzo[a]pyrene (Table 7).

The protein concentration in the S9 preparation was 25.7 mg/mL (lot no. R290711) in the pre-experiment/experiment I and 27.7 mg/mL (lot no. R041111) in experiment II.

3.4.2 S9 Mix

Before the experiment an appropriate quantity of S9 supernatant was thawed and mixed with S9 cofactor solution. The amount of S9 supernatant was 10% v/v in the S9 mix. Cofactors are added to the S9 mix to reach the following concentrations in the S9 mix:

8	mM	$MgCl_2$
33	mM	KCl
5	mM	Glucose-6-phosphate
4	mM	NADP

in 100 mM sodium-ortho-phosphate-buffer, pH 7.4.

During the experiment the S9 mix was stored in an ice bath. The S9 mix preparation was performed according to Ames *et al.*(5).

3.5 Pre-Experiment for Toxicity

To evaluate the toxicity of the test item a pre-experiment was performed with all strains. Eight concentrations were tested for toxicity and mutation induction each with three replicate plates. The experimental conditions in this pre-experiment were the same as described below for experiment I (plate incorporation test).

Toxicity of the test item results in a reduction in the number of spontaneous revertants (below a factor of 0.5) or a clearing of the bacterial background lawn.

The pre-experiment is reported as the main experiment I since the criteria mentioned in Section 3.8.2 are met.

3.6 Dose Selection

In the pre-experiment the concentration range of the test item was 3 – 5000 µg/plate. The pre-experiment is reported as experiment I. Since no toxic effects were observed 5000 µg/plate were chosen as maximal concentration. Based on the observed precipitation of the test item seven concentrations were tested in experiment II.

The following concentrations were tested in experiment II:

10; 33; 100; 333; 1000; 2500; and 5000 µg/plate

3.7 Experimental Performance

For each strain and dose level including the controls, three plates were used.

The following materials were mixed in a test tube and poured onto the selective agar plates:

100 µL	Test solution at each dose level, solvent (negative control) or reference mutagen solution (positive control),
500 µL	S9 mix (for test with metabolic activation) or S9 mix substitution buffer* (for test without metabolic activation),
100 µL	Bacteria suspension (cf. test system, pre-culture of the strains),
2000 µL	Overlay agar

For the pre-incubation method 100 µL test solution (solvent or reference mutagen solution (positive control)), 500 µL S9 mix / S9 mix substitution buffer* and 100 µL bacteria suspension were mixed in a test tube and incubated at 37 °C for 60 minutes. After pre-incubation 2.0 mL overlay agar (45 °C) was added to each tube. The mixture was poured on selective agar plates.

After solidification the plates were incubated upside down for 48 - 72 hours at 37°C in the dark (6).

* Substitution buffer: 7 parts of the 100 mM sodium-ortho-phosphate-buffer pH 7.4 with 3 parts of KCl solution 0.15 M

3.8 Data Evaluation

3.8.1 Data recording

The colonies were counted using the Petri Viewer Mk2 (Perceptive Instruments Ltd, Suffolk CB9 7BN, UK) with the software program Ames Study Manager. The counter was connected to an IBM AT compatible PC with printer to print out the individual values and the means from the plates for each concentration together with standard deviations and enhancement factors as compared to the spontaneous reversion rates (see tables of results). Due to precipitation of the test item, the colonies were partly counted manually.

3.8.2 Acceptability of the assay

The *Salmonella typhimurium* and *Escherichia coli* reverse mutation assay is considered acceptable if it meets the following criteria:

- regular background growth in the negative and solvent control
- the spontaneous reversion rates in the negative and solvent control are in the range of the historical data
- the positive control substances should produce a significant increase in mutant colony frequencies
- a minimum of five analysable dose levels should be present with at least four dose levels showing no signs of toxic effects, evident as a reduction in the number of revertants below the indication factor of 0.5.

3.8.3 Evaluation of results

A test item is considered as a mutagen if a biologically relevant increase in the number of revertants exceeding the threshold of twice the colony count of the corresponding solvent control is observed (1).

A dose dependent increase is considered biologically relevant if the threshold is exceeded at more than one concentration (6).

An increase exceeding the threshold at only one concentration is judged as biologically relevant if reproduced in an independent second experiment.

A dose dependent increase in the number of revertant colonies below the threshold is regarded as an indication of a mutagenic potential if reproduced in an independent second experiment. However, whenever the colony counts remain within the historical range of negative and solvent controls such an increase is not considered biologically relevant.

3.8.4 Biometry

According to the OECD guideline 471, a statistical analysis of the data is not mandatory.

4.0 RESULTS AND DISCUSSION

4.1 Dose Selection

In the pre-experiment the concentration range of the test item was 3 – 5000 µg/plate. The pre-experiment is reported as experiment I. Since no toxic effects were observed 5000 µg/plate were chosen as maximal concentration. Based on the observed precipitation of the test item seven concentrations were tested in experiment II.

The following concentrations were tested in experiment II:

10; 33; 100; 333; 1000; 2500; and 5000 µg/plate

4.2 Discussion

The test item lambda-cyhalothrin technical was assessed for its potential to induce gene mutations in the plate incorporation test (experiment I) and the pre-incubation test (experiment II) using *S. typhimurium* strains TA1535, TA1537, TA98, and TA100, and the *E. coli* strains WP2 *uvrA* pKM101 and WP2 pKM101.

The assay was performed with and without liver microsomal activation. Each concentration, including the controls, was tested in triplicate. The test item was tested at the following concentrations:

Pre-Experiment/Experiment I:	3; 10; 33; 100; 333; 1000; 2500; and 5000 µg/plate
Experiment II:	10; 33; 100; 333; 1000; 2500; and 5000 µg/plate

The plates incubated with the test item showed normal background growth up to 5000 µg/plate with and without metabolic activation.

No toxic effects, evident as a reduction in the number of revertants (below the indication factor of 0.5), occurred in the test groups with and without metabolic activation with the exception of strain TA 1535 in experiment I where a minor toxic effect was observed at 5000 µg/plate without metabolic activation.

The test item precipitated in the overlay agar in the test tubes from 333 to 5000 µg/plate in experiment I and from 1000 - 5000 µg/plate in experiment II. Precipitation of the test item in the overlay agar on the incubated agar plates was observed from 1000 to 5000 µg/plate in both experiments. The undissolved particles had no adverse influence on the data recording.

No substantial increase in revertant colony numbers of any of the six tester strains was observed following treatment with lambda-cyhalothrin technical at any dose level, neither in the presence nor absence of metabolic activation (S9 mix). There was also no tendency of higher mutation rates with increasing concentrations in the range below the generally acknowledged border of biological relevance.

Appropriate reference mutagens were used as positive controls. They showed a distinct increase of induced revertant colonies.

5.0 CONCLUSIONS

During the described mutagenicity tests and under the experimental conditions reported, lambda-cyhalothrin technical did not induce gene mutations by base pair changes or frameshifts in the genome of the strains used. Lambda-cyhalothrin technical is considered to be non-mutagenic in the *Salmonella typhimurium* and *Escherichia coli* reverse mutation assay.

6.0 REFERENCES

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   Mutation Res. 88, 343-350

3. Maron D.M., Ames, B.N. (1983)
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   Mutation Res. 113, 173-215

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TABLES SECTION

TABLE 1 Summary of Results Pre-Experiment/Experiment I

Study Name: 1458600
Experiment: 1458600 VV Plate
Assay Conditions:

Study Code: Harlan CCR 1458600
Date Plated: 29/11/2011
Date Counted: 02/12/2011

Metabolic Activation	Test Group	Dose Level (per plate)	Revertant Colony Counts (Mean ±SD)					
			TA 1535	TA 1537	TA 98	TA 100	WP2 pKM101	WP2 uvrA pKM101
Without Activation	DMSO		17 ± 6	10 ± 2	25 ± 3	99 ± 7	203 ± 8	390 ± 32
	Untreated		15 ± 5	15 ± 7	26 ± 3	110 ± 4	214 ± 13	378 ± 27
	Lambda-cyhalothrin technical	3 µg	14 ± 5	8 ± 2	20 ± 3	99 ± 15	195 ± 10	394 ± 16
		10 µg	16 ± 6	12 ± 4	20 ± 6	105 ± 7	204 ± 18	387 ± 29
		33 µg	17 ± 2	11 ± 3	23 ± 3	94 ± 13	224 ± 42	380 ± 5
		100 µg	13 ± 3	9 ± 4	27 ± 5	95 ± 18	219 ± 15	353 ± 2
		333 µg	15 ± 2	11 ± 3	24 ± 7	105 ± 17	188 ± 14	373 ± 22
		1000 µg	15 ± 3 P M	11 ± 3 P M	23 ± 3 P M	106 ± 4 P M	203 ± 14 P M	388 ± 20 P M
		2500 µg	15 ± 4 P M	9 ± 4 P M	23 ± 3 P M	100 ± 5 P M	220 ± 35 P M	404 ± 9 P M
		5000 µg	6 ± 1 P M	9 ± 4 P M	21 ± 3 P M	90 ± 6 P M	206 ± 13 P M	423 ± 4 P M
	NaN3	10 µg	1942 ± 63			2214 ± 98		
	4-NOPD	10 µg			306 ± 26			
	4-NOPD	50 µg		64 ± 8				
	MMS	3.0 µL					3520 ± 209	3893 ± 321
With Activation	DMSO		21 ± 1	18 ± 5	36 ± 9	122 ± 3	240 ± 19	429 ± 7
	Untreated		18 ± 3	21 ± 7	36 ± 1	115 ± 12	249 ± 20	435 ± 6
	Lambda-cyhalothrin technical	3 µg	21 ± 2	19 ± 6	40 ± 3	115 ± 3	255 ± 26	420 ± 25
		10 µg	18 ± 3	16 ± 3	40 ± 9	139 ± 18	275 ± 15	416 ± 25
		33 µg	19 ± 5	19 ± 2	35 ± 6	122 ± 6	247 ± 17	393 ± 62
		100 µg	19 ± 3	18 ± 7	39 ± 6	123 ± 5	233 ± 14	414 ± 7
		333 µg	18 ± 5	20 ± 5	44 ± 4	100 ± 10	222 ± 5	410 ± 10
		1000 µg	19 ± 2 P M	18 ± 3 P M	37 ± 3 P M	112 ± 11 P M	255 ± 26 P M	437 ± 13 P M
		2500 µg	15 ± 3 P M	19 ± 3 P M	31 ± 3 P M	113 ± 8 P M	266 ± 29 P M	435 ± 32 P M
		5000 µg	13 ± 2 P M	21 ± 2 P M	24 ± 6 P M	112 ± 5 P M	250 ± 10 P M	436 ± 7 P M
	2-AA	2.5 µg	455 ± 10	441 ± 10	2698 ± 144	2978 ± 106		
	2-AA	10.0 µg					1207 ± 214	1891 ± 131

Key to Positive Controls

NaN3	sodium azide
2-AA	2-aminoanthracene
4-NOPD	4-nitro-o-phenylene-diamine
MMS	methyl methane sulfonate

Key to Plate Postfix Codes

P	Precipitate
M	Manual count

TABLE 2 Summary of Results Experiment II

Study Name: 1458600
Experiment: 1458600 HV2 Pre
Assay Conditions:

Study Code: Harlan CCR 1458600
Date Plated: 06/12/2011
Date Counted: 09/12/2011

Metabolic Activation	Test Group	Dose Level (per plate)	Revertant Colony Counts (Mean ±SD)					
			TA 1535	TA 1537	TA 98	TA 100	WP2 pKM101	WP2 uvrA pKM101
Without Activation	DMSO		16 ± 0	10 ± 3	29 ± 8	103 ± 5	198 ± 10	349 ± 19
	Untreated		13 ± 3	18 ± 4	33 ± 3	96 ± 5	208 ± 5	359 ± 11
	Lambda-cyhalothrin technical	10 µg	14 ± 2	13 ± 3	25 ± 7	93 ± 10	180 ± 14	336 ± 13
		33 µg	11 ± 3	12 ± 3	32 ± 3	97 ± 7	170 ± 13	347 ± 17
		100 µg	13 ± 6	11 ± 3	33 ± 1	100 ± 9	185 ± 9	352 ± 22
		333 µg	12 ± 3	9 ± 1	27 ± 2	84 ± 9	168 ± 10	326 ± 17
		1000 µg	13 ± 6 P	11 ± 5 P	31 ± 5 P	80 ± 5 P	160 ± 20 P	308 ± 3 P
		2500 µg	12 ± 4 P	12 ± 6 P	24 ± 5 P	82 ± 6 P	179 ± 11 P	312 ± 13 P
		5000 µg	12 ± 5 P	11 ± 2 P	19 ± 4 P	81 ± 4 P	148 ± 9 P	330 ± 14 P
	NaN3	10 µg	1908 ± 26			2181 ± 21		
	4-NOPD	10 µg			318 ± 21			
	4-NOPD	50 µg		71 ± 2				
	MMS	3.0 µL					3722 ± 38	2923 ± 44
With Activation	DMSO		18 ± 3	16 ± 3	37 ± 12	110 ± 11	216 ± 14	403 ± 21
	Untreated		18 ± 4	25 ± 8	38 ± 8	131 ± 1	261 ± 16	431 ± 25
	Lambda-cyhalothrin technical	10 µg	19 ± 3	16 ± 7	44 ± 4	118 ± 12	230 ± 16	406 ± 25
		33 µg	15 ± 3	16 ± 4	41 ± 7	111 ± 3	233 ± 7	380 ± 12
		100 µg	16 ± 6	17 ± 2	37 ± 11	125 ± 9	213 ± 11	380 ± 29
		333 µg	17 ± 3	19 ± 3	42 ± 2	93 ± 12	210 ± 24	393 ± 11
		1000 µg	19 ± 5 P	18 ± 2 P	35 ± 3 P	109 ± 6 P	216 ± 14 P	353 ± 20 P
		2500 µg	16 ± 4 P M	13 ± 2 P M	28 ± 5 P M	108 ± 4 P M	213 ± 20 P M	359 ± 6 P M
		5000 µg	15 ± 4 P M	15 ± 7 P M	31 ± 5 P M	109 ± 10 P M	205 ± 10 P M	356 ± 11 P M
	2-AA	2.5 µg	325 ± 20	222 ± 21	1608 ± 95	2322 ± 155		
	2-AA	10.0 µg					3606 ± 78	1866 ± 105

Key to Positive Controls

NaN3	sodium azide
2-AA	2-aminoanthracene
4-NOPD	4-nitro-o-phenylene-diamine
MMS	methyl methane sulfonate

Key to Plate Postfix Codes

P	Precipitate
M	Manual count

TABLE 3 Pre-Experiment and Experiment I: 1458600 VV Plate Incorporation

Study Name: 1458600 Study Code: Harlan CCR 1458600
Experiment: 1458600 VV Plate Date Plated: 29/11/2011
Assay Conditions: Date Counted: 02/12/2011

Without metabolic activation

Strain	Compound	Dose level per plate	Mean revertants per plate	Standard Deviation	Ratio treated / solvent	Individual revertant colony counts
TA 1535	**Lambda-**	3 µg	*14.0*	*4.6*	*0.8*	19, 10, 13
	cyhalothrin	10 µg	*15.7*	*5.5*	*0.9*	10, 16, 21
	technical	33 µg	*17.3*	*1.5*	*1.0*	19, 16, 17
		100 µg	*12.7*	*2.5*	*0.8*	13, 15, 10
		333 µg	*14.7*	*1.5*	*0.9*	13, 15, 16
		1000 µg	*15.0*	*2.6*	*0.9*	16 P M, 12 P M, 17 P M
		2500 µg	*15.0*	*4.4*	*0.9*	10 P M, 18 P M, 17 P M
		5000 µg	*6.3*	*0.6*	*0.4*	7 P M, 6 P M, 6 P M
	DMSO		*16.7*	*5.8*		20, 20, 10
	Untreated Control		*15.0*	*5.3*		19, 17, 9
TA 1537	**Lambda-**	3 µg	*8.0*	*1.7*	*0.8*	9, 9, 6
	cyhalothrin	10 µg	*12.0*	*4.4*	*1.2*	14, 15, 7
	technical	33 µg	*10.7*	*2.9*	*1.1*	14, 9, 9
		100 µg	*9.3*	*4.0*	*1.0*	14, 7, 7
		333 µg	*11.0*	*3.5*	*1.1*	13, 7, 13
		1000 µg	*11.0*	*2.6*	*1.1*	9 P M, 14 P M, 10 P M
		2500 µg	*8.7*	*4.0*	*0.9*	5 P M, 13 P M, 8 P M
		5000 µg	*9.0*	*3.6*	*0.9*	8 P M, 6 P M, 13 P M
	DMSO		*9.7*	*2.1*		12, 9, 8
	Untreated Control		*14.7*	*6.5*		15, 8, 21
TA 98	**Lambda-**	3 µg	*20.0*	*3.0*	*0.8*	17, 20, 23
	cyhalothrin	10 µg	*20.0*	*6.1*	*0.8*	27, 17, 16
	technical	33 µg	*23.3*	*3.1*	*0.9*	24, 26, 20
		100 µg	*27.0*	*4.6*	*1.1*	22, 31, 28
		333 µg	*23.7*	*7.0*	*1.0*	17, 23, 31
		1000 µg	*23.3*	*2.5*	*0.9*	21 P M, 26 P M, 23 P M
		2500 µg	*23.3*	*2.5*	*0.9*	21 P M, 26 P M, 23 P M
		5000 µg	*20.7*	*3.2*	*0.8*	17 P M, 22 P M, 23 P M
	DMSO		*24.7*	*3.1*		22, 24, 28
	Untreated Control		*26.0*	*3.5*		28, 28, 22

Key to Plate Postfix Codes

P	Precipitate
M	Manual count

TABLE 3 Pre-Experiment and Experiment I: 1458600 VV Plate Incorporation (Continued)

Study Name: 1458600
Experiment: 1458600 VV Plate
Assay Conditions:

Study Code: Harlan CCR 1458600
Date Plated: 29/11/2011
Date Counted: 02/12/2011

Without metabolic activation

Strain	Compound	Dose level per plate	Mean revertants per plate	Standard Deviation	Ratio treated / solvent	Individual revertant colony counts
TA 100	**Lambda-**	3 µg	*98.7*	*14.5*	*1.0*	113, 99, 84
	cyhalothrin	10 µg	*105.0*	*6.6*	*1.1*	112, 104, 99
	technical	33 µg	*94.0*	*13.5*	*1.0*	79, 98, 105
		100 µg	*94.7*	*18.0*	*1.0*	77, 113, 94
		333 µg	*105.0*	*17.3*	*1.1*	85, 114, 116
		1000 µg	*106.0*	*3.6*	*1.1*	110 P M, 105 P M, 103 P M
		2500 µg	*100.3*	*4.5*	*1.0*	100 P M, 96 P M, 105 P M
		5000 µg	*90.3*	*5.9*	*0.9*	88 P M, 86 P M, 97 P M
	DMSO		*98.7*	*6.5*		92, 105, 99
	Untreated Control		*109.7*	*3.8*		108, 107, 114
WP2	**Lambda-**	3 µg	*195.3*	*9.8*	*1.0*	201, 184, 201
pKM101	**cyhalothrin**	10 µg	*203.7*	*17.9*	*1.0*	215, 183, 213
	technical	33 µg	*224.0*	*41.6*	*1.1*	267, 221, 184
		100 µg	*218.7*	*14.6*	*1.1*	214, 235, 207
		333 µg	*187.7*	*13.7*	*0.9*	172, 194, 197
		1000 µg	*203.3*	*14.0*	*1.0*	204 P M, 217 P M, 189 P M
		2500 µg	*219.7*	*34.8*	*1.1*	257 P M, 214 P M, 188 P M
		5000 µg	*206.0*	*13.0*	*1.0*	221 P M, 198 P M, 199 P M
	DMSO		*202.7*	*7.6*		208, 206, 194
	Untreated Control		*214.3*	*12.7*		208, 229, 206
WP2	**Lambda-**	3 µg	*394.3*	*16.2*	*1.0*	384, 413, 386
uvrA	**cyhalothrin**	10 µg	*387.3*	*29.1*	*1.0*	420, 364, 378
pKM101	**technical**	33 µg	*380.3*	*4.9*	*1.0*	377, 386, 378
		100 µg	*353.3*	*2.1*	*0.9*	354, 355, 351
		333 µg	*373.0*	*21.6*	*1.0*	397, 367, 355
		1000 µg	*388.0*	*19.7*	*1.0*	367 P M, 391 P M, 406 P M
		2500 µg	*403.7*	*8.7*	*1.0*	406 P M, 411 P M, 394 P M
		5000 µg	*422.7*	*4.2*	*1.1*	418 P M, 426 P M, 424 P M
	DMSO		*390.0*	*31.6*		403, 354, 413
	Untreated Control		*378.3*	*26.5*		357, 370, 408

Key to Plate Postfix Codes

P	Precipitate
M	Manual count

TABLE 3 Pre-Experiment and Experiment I: 1458600 VV Plate Incorporation (Continued)

Study Name: 1458600
Experiment: 1458600 VV Plate
Assay Conditions:

Study Code: Harlan CCR 1458600
Date Plated: 29/11/2011
Date Counted: 02/12/2011

Without metabolic activation

Strain	Compound	Dose level per plate	Mean revertants per plate	Standard Deviation	Ratio treated / solvent	Individual revertant colony counts
TA 1535	**NaN3**	10 µg	*1941.7*	*63.1*	*116.5*	1982, 1974, 1869
TA 1537	**4-NOPD**	50 µg	*64.3*	*8.1*	*6.7*	69, 55, 69
TA 98	**4-NOPD**	10 µg	*305.7*	*26.0*	*12.4*	331, 279, 307
TA 100	**NaN3**	10 µg	*2213.7*	*98.3*	*22.4*	2102, 2252, 2287
WP2 pKM101	**MMS**	3.0 µL	*3519.7*	*209.0*	*17.4*	3418, 3760, 3381
WP2 uvrA pKM101	**MMS**	3.0 µL	*3893.3*	*321.2*	*10.0*	4259, 3764, 3657

Key to Positive Controls

NaN3	sodium azide
4-NOPD	4-nitro-o-phenylene-diamine
MMS	methyl methane sulfonate

TABLE 4 Pre-Experiment and Experiment I: 1458600 VV Plate Incorporation

Study Name: 1458600
Experiment: 1458600 VV Plate
Assay Conditions:

Study Code: Harlan CCR 1458600
Date Plated: 29/11/2011
Date Counted: 02/12/2011

With metabolic activation

Strain	Compound	Dose level per plate	Mean revertants per plate	Standard Deviation	Ratio treated / solvent	Individual revertant colony counts
TA 1535	**Lambda-**	3 µg	*21.0*	*1.7*	*1.0*	22, 22, 19
	cyhalothrin	10 µg	*17.7*	*2.9*	*0.8*	21, 16, 16
	technical	33 µg	*19.0*	*5.3*	*0.9*	13, 21, 23
		100 µg	*19.0*	*3.5*	*0.9*	21, 15, 21
		333 µg	*18.0*	*4.6*	*0.9*	14, 23, 17
		1000 µg	*18.7*	*1.5*	*0.9*	20 P M, 19 P M, 17 P M
		2500 µg	*15.0*	*2.6*	*0.7*	13 P M, 18 P M, 14 P M
		5000 µg	*13.0*	*1.7*	*0.6*	14 P M, 11 P M, 14 P M
	DMSO		*21.0*	*1.0*		21, 22, 20
	Untreated Control		*18.0*	*2.6*		21, 16, 17
TA 1537	**Lambda-**	3 µg	*19.3*	*5.7*	*1.1*	21, 13, 24
	cyhalothrin	10 µg	*16.0*	*2.6*	*0.9*	19, 15, 14
	technical	33 µg	*19.0*	*2.0*	*1.0*	21, 19, 17
		100 µg	*17.7*	*7.2*	*1.0*	13, 26, 14
		333 µg	*20.3*	*4.7*	*1.1*	15, 22, 24
		1000 µg	*18.3*	*2.5*	*1.0*	18 P M, 21 P M, 16 P M
		2500 µg	*19.3*	*2.5*	*1.1*	17 P M, 22 P M, 19 P M
		5000 µg	*20.7*	*1.5*	*1.1*	19 P M, 21 P M, 22 P M
	DMSO		*18.3*	*4.7*		13, 20, 22
	Untreated Control		*21.3*	*6.7*		27, 14, 23
TA 98	**Lambda-**	3 µg	*39.7*	*2.9*	*1.1*	38, 38, 43
	cyhalothrin	10 µg	*40.0*	*8.5*	*1.1*	48, 41, 31
	technical	33 µg	*34.7*	*6.4*	*1.0*	31, 31, 42
		100 µg	*39.0*	*5.6*	*1.1*	40, 33, 44
		333 µg	*44.3*	*4.0*	*1.2*	45, 40, 48
		1000 µg	*37.0*	*2.6*	*1.0*	38 P M, 34 P M, 39 P M
		2500 µg	*30.7*	*3.1*	*0.9*	34 P M, 28 P M, 30 P M
		5000 µg	*23.7*	*6.4*	*0.7*	31 P M, 19 P M, 21 P M
	DMSO		*36.0*	*8.5*		27, 37, 44
	Untreated Control		*36.0*	*1.0*		35, 36, 37

Key to Plate Postfix Codes

P	Precipitate
M	Manual count

TABLE 4 Pre-Experiment and Experiment I: 1458600 VV Plate Incorporation (Continued)

Study Name: 1458600
Experiment: 1458600 VV Plate
Assay Conditions:

Study Code: Harlan CCR 1458600
Date Plated: 29/11/2011
Date Counted: 02/12/2011

With metabolic activation

Strain	Compound	Dose level per plate	Mean revertants per plate	Standard Deviation	Ratio treated / solvent	Individual revertant colony counts
TA 100	**Lambda-**	3 µg	*115.3*	*2.5*	*0.9*	115, 118, 113
	cyhalothrin	10 µg	*139.0*	*18.0*	*1.1*	119, 144, 154
	technical	33 µg	*122.0*	*6.0*	*1.0*	116, 128, 122
		100 µg	*123.0*	*4.6*	*1.0*	128, 122, 119
		333 µg	*100.0*	*9.5*	*0.8*	95, 111, 94
		1000 µg	*112.0*	*10.8*	*0.9*	109 P M, 124 P M, 103 P M
		2500 µg	*113.3*	*8.0*	*0.9*	121 P M, 105 P M, 114 P M
		5000 µg	*112.0*	*4.6*	*0.9*	111 P M, 108 P M, 117 P M
	DMSO		*122.0*	*3.5*		120, 126, 120
	Untreated Control		*115.3*	*12.4*		122, 123, 101
WP2	**Lambda-**	3 µg	*255.0*	*26.2*	*1.1*	262, 277, 226
pKM101	**cyhalothrin**	10 µg	*274.7*	*14.6*	*1.1*	290, 261, 273
	technical	33 µg	*247.3*	*17.4*	*1.0*	267, 241, 234
		100 µg	*232.7*	*14.5*	*1.0*	216, 240, 242
		333 µg	*221.7*	*4.7*	*0.9*	227, 220, 218
		1000 µg	*255.0*	*25.5*	*1.1*	245 P M, 236 P M, 284 P M
		2500 µg	*266.0*	*28.6*	*1.1*	257 P M, 298 P M, 243 P M
		5000 µg	*250.0*	*9.5*	*1.0*	245 P M, 244 P M, 261 P M
	DMSO		*240.3*	*18.9*		227, 232, 262
	Untreated Control		*249.0*	*20.2*		226, 257, 264
WP2	**Lambda-**	3 µg	*420.0*	*25.1*	*1.0*	446, 418, 396
uvrA	**cyhalothrin**	10 µg	*415.7*	*24.7*	*1.0*	412, 393, 442
pKM101	**technical**	33 µg	*392.7*	*62.2*	*0.9*	321, 424, 433
		100 µg	*414.0*	*7.0*	*1.0*	406, 419, 417
		333 µg	*409.7*	*9.5*	*1.0*	419, 410, 400
		1000 µg	*437.0*	*13.5*	*1.0*	426 P M, 433 P M, 452 P M
		2500 µg	*435.3*	*32.3*	*1.0*	472 P M, 411 P M, 423 P M
		5000 µg	*435.7*	*7.1*	*1.0*	428 P M, 437 P M, 442 P M
	DMSO		*429.0*	*7.0*		432, 434, 421
	Untreated Control		*435.3*	*6.4*		438, 440, 428

Key to Plate Postfix Codes

P	Precipitate
M	Manual count

TABLE 4 Pre-Experiment and Experiment I: 1458600 VV Plate Incorporation (Continued)

Study Name: 1458600
Experiment: 1458600 VV Plate
Assay Conditions:

Study Code: Harlan CCR 1458600
Date Plated: 29/11/2011
Date Counted: 02/12/2011

With metabolic activation

Strain	Compound	Dose level per plate	Mean revertants per plate	Standard Deviation	Ratio treated / solvent	Individual revertant colony counts
TA 1535	**2-AA**	2.5 µg	*455.0*	*9.5*	*21.7*	456, 464, 445
TA 1537	**2-AA**	2.5 µg	*441.0*	*10.4*	*24.1*	436, 434, 453
TA 98	**2-AA**	2.5 µg	*2698.0*	*143.7*	*74.9*	2855, 2573, 2666
TA 100	**2-AA**	2.5 µg	*2978.3*	*105.7*	*24.4*	2859, 3016, 3060
WP2 pKM101	**2-AA**	10.0 µg	*1207.0*	*214.3*	*5.0*	1135, 1448, 1038
WP2 uvrA pKM101	**2-AA**	10.0 µg	*1891.3*	*130.7*	*4.4*	1765, 2026, 1883

Key to Positive Controls

2-AA	2-aminoanthracene

TABLE 5 Experiment II: 1458600 HV2 Pre Incubation

Study Name: 1458600
Experiment: 1458600 HV2 Pre
Assay Conditions:

Study Code: Harlan CCR 1458600
Date Plated: 06/12/2011
Date Counted: 09/12/2011

Without metabolic activation

Strain	Compound	Dose level per plate	Mean revertants per plate	Standard Deviation	Ratio treated / solvent	Individual revertant colony counts
TA 1535	**Lambda-**	10 µg	*13.7*	*1.5*	*0.9*	15, 14, 12
	cyhalothrin	33 µg	*11.3*	*3.2*	*0.7*	9, 10, 15
	technical	100 µg	*13.0*	*5.6*	*0.8*	19, 12, 8
		333 µg	*12.0*	*2.6*	*0.8*	14, 13, 9
		1000 µg	*12.7*	*5.5*	*0.8*	19 P, 9 P, 10 P
		2500 µg	*11.7*	*4.0*	*0.7*	7 P, 14 P, 14 P
		5000 µg	*11.7*	*4.7*	*0.7*	8 P, 17 P, 10 P
	DMSO		*16.0*	*0.0*		16, 16, 16
	Untreated Control		*13.0*	*3.0*		10, 13, 16
TA 1537	**Lambda-**	10 µg	*12.7*	*3.1*	*1.2*	10, 12, 16
	cyhalothrin	33 µg	*12.0*	*3.0*	*1.2*	15, 9, 12
	technical	100 µg	*11.0*	*2.6*	*1.1*	8, 13, 12
		333 µg	*8.7*	*0.6*	*0.8*	9, 8, 9
		1000 µg	*11.0*	*5.3*	*1.1*	9 P, 17 P, 7 P
		2500 µg	*12.3*	*5.5*	*1.2*	6 P, 15 P, 16 P
		5000 µg	*11.3*	*2.1*	*1.1*	9 P, 12 P, 13 P
	DMSO		*10.3*	*2.5*		10, 8, 13
	Untreated Control		*18.3*	*3.8*		20, 21, 14
TA 98	**Lambda-**	10 µg	*25.0*	*6.9*	*0.9*	29, 29, 17
	cyhalothrin	33 µg	*31.7*	*3.1*	*1.1*	31, 35, 29
	technical	100 µg	*33.3*	*0.6*	*1.1*	34, 33, 33
		333 µg	*27.3*	*1.5*	*0.9*	26, 29, 27
		1000 µg	*31.3*	*5.1*	*1.1*	37 P, 30 P, 27 P
		2500 µg	*24.3*	*4.9*	*0.8*	30 P, 22 P, 21 P
		5000 µg	*19.0*	*4.4*	*0.6*	16 P, 17 P, 24 P
	DMSO		*29.3*	*7.5*		37, 22, 29
	Untreated Control		*32.7*	*3.2*		35, 34, 29

Key to Plate Postfix Codes

P Precipitate

TABLE 5 Experiment II: 1458600 HV2 Pre Incubation (Continued)

Study Name: 1458600
Experiment: 1458600 HV2 Pre
Assay Conditions:

Study Code: Harlan CCR 1458600
Date Plated: 06/12/2011
Date Counted: 09/12/2011

Without metabolic activation

Strain	Compound	Dose level per plate	Mean revertants per plate	Standard Deviation	Ratio treated / solvent	Individual revertant colony counts
TA 100	**Lambda-**	10 µg	*92.7*	*10.1*	*0.9*	99, 98, 81
	cyhalothrin	33 µg	*97.0*	*7.2*	*0.9*	95, 105, 91
	technical	100 µg	*99.7*	*9.1*	*1.0*	101, 108, 90
		333 µg	*83.7*	*9.5*	*0.8*	87, 73, 91
		1000 µg	*80.3*	*4.5*	*0.8*	85 P, 76 P, 80 P
		2500 µg	*81.7*	*5.7*	*0.8*	88 P, 80 P, 77 P
		5000 µg	*81.0*	*4.0*	*0.8*	77 P, 85 P, 81 P
	DMSO		*103.3*	*5.0*		104, 108, 98
	Untreated Control		*96.3*	*5.0*		97, 91, 101
WP2	**Lambda-**	10 µg	*180.3*	*13.6*	*0.9*	165, 191, 185
pKM101	**cyhalothrin**	33 µg	*170.3*	*12.9*	*0.9*	165, 161, 185
	technical	100 µg	*185.0*	*8.7*	*0.9*	191, 189, 175
		333 µg	*168.3*	*10.0*	*0.9*	169, 158, 178
		1000 µg	*160.0*	*19.9*	*0.8*	183 P, 148 P, 149 P
		2500 µg	*179.3*	*11.1*	*0.9*	191 P, 169 P, 178 P
		5000 µg	*147.7*	*9.0*	*0.7*	158 P, 143 P, 142 P
	DMSO		*197.7*	*10.1*		187, 207, 199
	Untreated Control		*208.0*	*4.6*		207, 213, 204
WP2	**Lambda-**	10 µg	*336.0*	*12.5*	*1.0*	335, 349, 324
uvrA	**cyhalothrin**	33 µg	*347.0*	*16.8*	*1.0*	328, 353, 360
pKM101	**technical**	100 µg	*352.3*	*22.1*	*1.0*	362, 368, 327
		333 µg	*326.0*	*17.4*	*0.9*	314, 346, 318
		1000 µg	*307.7*	*3.1*	*0.9*	307 P, 311 P, 305 P
		2500 µg	*311.7*	*12.7*	*0.9*	318 P, 297 P, 320 P
		5000 µg	*330.3*	*13.6*	*0.9*	315 P, 341 P, 335 P
	DMSO		*348.7*	*18.7*		341, 335, 370
	Untreated Control		*359.3*	*11.2*		347, 369, 362
TA 1535	**NaN3**	10 µg	*1908.3*	*25.8*	*119.3*	1938, 1891, 1896
TA 1537	**4-NOPD**	50 µg	*71.0*	*1.7*	*6.9*	70, 73, 70
TA 98	**4-NOPD**	10 µg	*318.0*	*21.4*	*10.8*	342, 301, 311
TA 100	**NaN3**	10 µg	*2181.3*	*20.8*	*21.1*	2163, 2204, 2177
WP2 pKM101	**MMS**	3.0 µL	*3721.7*	*38.0*	*18.8*	3759, 3683, 3723
WP2 uvrA pKM101	**MMS**	3.0 µL	*2923.3*	*43.6*	*8.4*	2878, 2965, 2927

Key to Positive Controls

NaN3	sodium azide
4-NOPD	4-nitro-o-phenylene-diamine
MMS	methyl methane sulfonate

Key to Plate Postfix Codes

P	Precipitate

TABLE 6 Experiment II: 1458600 HV2 Pre Incubation

Study Name: 1458600
Experiment: 1458600 HV2 Pre
Assay Conditions:

Study Code: Harlan CCR 1458600
Date Plated: 06/12/2011
Date Counted: 09/12/2011

With metabolic activation

Strain	Compound	Dose level per plate	Mean revertants per plate	Standard Deviation	Ratio treated / solvent	Individual revertant colony counts
TA 1535	**Lambda-**	10 µg	*19.3*	*3.1*	*1.1*	20, 16, 22
	cyhalothrin	33 µg	*15.0*	*3.5*	*0.8*	13, 13, 19
	technical	100 µg	*16.3*	*5.5*	*0.9*	20, 10, 19
		333 µg	*17.0*	*3.0*	*1.0*	17, 20, 14
		1000 µg	*19.3*	*4.7*	*1.1*	21 P, 23 P, 14 P
		2500 µg	*16.3*	*3.5*	*0.9*	20 P M, 16 P M, 13 P M
		5000 µg	*15.0*	*4.0*	*0.8*	11 P M, 19 P M, 15 P M
	DMSO		*17.7*	*3.1*		21, 17, 15
	Untreated Control		*18.0*	*4.4*		16, 23, 15
TA 1537	**Lambda-**	10 µg	*16.0*	*6.9*	*1.0*	12, 12, 24
	cyhalothrin	33 µg	*16.3*	*3.5*	*1.0*	16, 13, 20
	technical	100 µg	*16.7*	*2.1*	*1.0*	19, 15, 16
		333 µg	*18.7*	*2.5*	*1.2*	16, 21, 19
		1000 µg	*18.0*	*1.7*	*1.1*	17 P, 20 P, 17 P
		2500 µg	*13.3*	*2.1*	*0.8*	11 P M, 14 P M, 15 P M
		5000 µg	*14.7*	*7.4*	*0.9*	9 P M, 23 P M, 12 P M
	DMSO		*16.0*	*3.0*		13, 16, 19
	Untreated Control		*25.0*	*7.9*		16, 31, 28
TA 98	**Lambda-**	10 µg	*44.0*	*4.0*	*1.2*	48, 44, 40
	cyhalothrin	33 µg	*41.3*	*7.1*	*1.1*	40, 35, 49
	technical	100 µg	*36.7*	*10.7*	*1.0*	30, 49, 31
		333 µg	*41.7*	*1.5*	*1.1*	40, 42, 43
		1000 µg	*34.7*	*3.2*	*0.9*	31 P, 36 P, 37 P
		2500 µg	*28.3*	*5.1*	*0.8*	34 P M, 27 P M, 24 P M
		5000 µg	*30.7*	*5.0*	*0.8*	36 P M, 26 P M, 30 P M
	DMSO		*37.0*	*11.8*		47, 24, 40
	Untreated Control		*37.7*	*8.1*		33, 33, 47

Key to Plate Postfix Codes

P	Precipitate
M	Manual count

TABLE 6 Experiment II: 1458600 HV2 Pre Incubation (Continued)

Study Name: 1458600
Experiment: 1458600 HV2 Pre
Assay Conditions:

Study Code: Harlan CCR 1458600
Date Plated: 06/12/2011
Date Counted: 09/12/2011

With metabolic activation

Strain	Compound	Dose level per plate	Mean revertants per plate	Standard Deviation	Ratio treated / solvent	Individual revertant colony counts
TA 100	**Lambda-**	10 µg	*118.0*	*12.5*	*1.1*	122, 128, 104
	cyhalothrin	33 µg	*111.3*	*3.1*	*1.0*	114, 112, 108
	technical	100 µg	*125.0*	*9.0*	*1.1*	125, 116, 134
		333 µg	*92.7*	*11.5*	*0.8*	106, 86, 86
		1000 µg	*108.7*	*5.5*	*1.0*	106 P, 105 P, 115 P
		2500 µg	*107.7*	*4.0*	*1.0*	112 P M, 104 P M, 107 P M
		5000 µg	*109.0*	*9.8*	*1.0*	98 P M, 117 P M, 112 P M
	DMSO		*109.7*	*10.7*		98, 112, 119
	Untreated Control		*130.7*	*1.2*		130, 130, 132
WP2 pKM101	**Lambda-**	10 µg	*229.7*	*15.9*	*1.1*	212, 234, 243
	cyhalothrin	33 µg	*232.7*	*7.4*	*1.1*	227, 230, 241
	technical	100 µg	*212.7*	*11.1*	*1.0*	223, 201, 214
		333 µg	*210.0*	*24.0*	*1.0*	191, 237, 202
		1000 µg	*216.3*	*14.0*	*1.0*	212 P, 205 P, 232 P
		2500 µg	*212.7*	*20.4*	*1.0*	204 P M, 198 P M, 236 P M
		5000 µg	*204.7*	*10.0*	*0.9*	216 P M, 197 P M, 201 P M
	DMSO		*216.0*	*14.0*		216, 230, 202
	Untreated Control		*261.3*	*16.1*		243, 273, 268
WP2 uvrA pKM101	**Lambda-**	10 µg	*405.7*	*25.4*	*1.0*	435, 390, 392
	cyhalothrin	33 µg	*380.3*	*11.9*	*0.9*	390, 384, 367
	technical	100 µg	*380.3*	*29.1*	*0.9*	413, 371, 357
		333 µg	*393.3*	*11.2*	*1.0*	403, 381, 396
		1000 µg	*352.7*	*20.1*	*0.9*	350 P, 334 P, 374 P
		2500 µg	*358.7*	*6.1*	*0.9*	364 P M, 352 P M, 360 P M
		5000 µg	*356.0*	*11.4*	*0.9*	348 P M, 369 P M, 351 P M
	DMSO		*403.0*	*20.7*		384, 425, 400
	Untreated Control		*431.3*	*25.1*		410, 425, 459
TA 1535	**2-AA**	2.5 µg	*325.3*	*19.9*	*18.4*	332, 341, 303
TA 1537	**2-AA**	2.5 µg	*221.7*	*20.5*	*13.9*	222, 242, 201
TA 98	**2-AA**	2.5 µg	*1608.0*	*94.6*	*43.5*	1620, 1508, 1696
TA 100	**2-AA**	2.5 µg	*2322.0*	*154.8*	*21.2*	2145, 2389, 2432
WP2 pKM101	**2-AA**	10.0 µg	*3606.3*	*77.7*	*16.7*	3696, 3560, 3563
WP2 uvrA pKM101	**2-AA**	10.0 µg	*1865.7*	*104.7*	*4.6*	1750, 1954, 1893

Key to Positive Controls

2-AA 2-aminoanthracene

Key to Plate Postfix Codes

P Precipitate
M Manual count

TABLE 7 Batch Control of S9

Lot R 290711		
Treatment	µL S9 / plate	Number of revertants in TA 98
Negative Control	0	35
	100	34
10 µg/plate 2-Aminoanthracene	0	35
	100	3545
10 µg/plate Benzo(a)pyrene	0	37
	100	269

Lot R 041111		
Treatment	µL S9 / plate	Number of revertants in TA 98
Negative Control	0	26
	100	30
10 µg/plate 2-Aminoanthracene	0	35
	100	2509
10 µg/plate Benzo(a)pyrene	0	30
	100	234

APPENDICES SECTION

APPENDIX 1 Historical Control Data

These data represent the laboratory´s historical control data from January 2009 until December 2009 representing approx. 550 experiments (WP2 uvrA pKM101 and WP2 pKM101the historical data are based on approx. 100 experiments).

Strain		without S9 mix				with S9 mix			
		Mean	SD	Min	Max	Mean	SD	Min	Max
TA1535	Solvent control	16	3.37	8	38	19	4.37	10	41
	Untreated control	15	3.41	7	36	18	4.69	8	55
	Positive control	1886	242.09	663	2690	304	154.47	134	2404
TA1537	Solvent control	12	2.84	6	27	15	3.59	7	33
	Untreated control	12	3.23	5	27	16	3.92	7	31
	Positive control	101	28.30	58	440	227	67.24	68	498
TA98	Solvent control	30	5.26	15	52	38	6.58	16	59
	Untreated control	31	5.67	14	59	39	6.91	16	84
	Positive control	407	98.13	216	897	1586	454.52	198	3309
TA100	Solvent control	132	23.21	94	218	144	25.42	94	241
	Untreated control	142	21.88	85	226	154	25.80	94	239
	Positive control	1954	426.94	563	2844	2032	569.62	594	3724
WP2uvrA pKM 101	Solvent control	430	69.32	332	569	456	62.40	382	553
	Untreated control	432	61.78	352	564	486	65.39	409	607
	Positive control	3150	1082.68	1379	4911	2031	309.13	1480	2947
WP2 pKM 101	Solvent control	188	22.50	154	226	197	25.76	147	266
	Untreated control	202	22.55	168	251	240	27.94	201	303
	Positive control	2905	832.09	1657	4560	2095	432.92	1259	2983

Mean = mean value of revertants/plate
SD = standard deviation Min = minimal value/Max = maximal value

APPENDIX 2 Copy of GLP Certificate

HESSEN

Gute Laborpraxis/Good Laboratory Practice

GLP-Bescheinigung/Statement of GLP Compliance
(gemäß/according to § 19b Abs. 1 Chemikaliengesetz)

Eine GLP-Inspektion zur Überwachung der Einhaltung der GLP-Grundsätze gemäß Chemikaliengesetz bzw. Richtlinie 2004/9/EG wurde durchgeführt in

Assessment of conformity with GLP according to Chemikaliengesetz and Directive 2004/9/EEC at:

☒ Prüfeinrichtung/Test facility ☐ Prüfstandort/Test site

Harlan Cytotest Cell Research GmbH
Harlan Cytotest Cell Research GmbH
In den Leppsteinswiesen 19
64380 Roßdorf

(Unverwechselbare Bezeichnung und Adresse/Unequivocal name and adress)

Prüfungen nach Kategorien/Areas of Expertise
(gemäß/according chemVwV-GLP Nr. 5.3/OECD guidance)

2 Prüfungen zur Bestimmung der toxikologischen Eigenschaften	**2** Toxicity studies
3 Prüfungen zur Bestimmung der erbgutverändernden Eigenschaften (in vitro und in vivo)	**3** Mutagenicity studies
6 Prüfungen zur Bestimmung von Rückständen	**6** Residues
8 Analytische Prüfungen an biologischen Materialien	**8** Analytical studies on biological materials

15.08. und 27. – 29.10.2008
Datum der Inspektion/Date of Inspection
(Tag Monat Jahr/day month year)

Die genannte Prüfeinrichtung befindet sich im nationalen GLP-Überwachungsverfahren und wird regelmäßig auf Einhaltung der GLP-Grundsätze überwacht.

The above mentioned test facility is included in the national GLP Compliance Programme and is inspected on a regular basis.

Auf der Grundlage des Inspektionsberichtes wird hiermit bestätigt, dass in dieser Prüfeinrichtung die oben genannten Prüfungen unter Einhaltung der GLP- Grundsätze durchgeführt werden können.

Based on the inspection report it can be confirmed, that this test facility is able to conduct the aforementioned studies in compliance with the Principles of GLP.

Im Auftrag

Th. Zimmermann, Referent, Wiesbaden, den **30. März 2009**
(Name und Funktion der verantwortlichen Person/
Name and function of responsible person)

HESSISCHES MINISTERIUM FÜR UMWELT, LÄNDLICHEN RAUM UND VERBRAUCHERSCHUTZ 2

Hess. Ministerium für Umwelt, Energie, Landwirtschaft und Verbraucherschutz,
Mainzer Straße 80 D65189 Wiesbaden
(Name und Adresse der GLP-Überwachungsbehörde/Name and address of the GLP Monitoring Authority

English name and address of the GLP Monitoring Authority: Hessian Ministry for Environment, Energy, Agriculture and Consumer Protection; Department II 10; P.O. Box 31 09; 65189 Wiesbaden

APPENDIX 3 Certificate of Analysis

syngenta

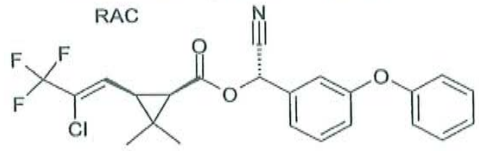
GLP Testing Facility WMU
Analytical Development &
Product Chemistry GS2131

Syngenta Crop Protection
Münchwilen AG
Breitenloh 5
CH-4333 Münchwilen

Certificate of Analysis

Lambda-cyhalothrin tech

RAC



UKNB854/04 - Purity 90.5 %w/w

Batch Identification	**UKNB854/04**
Product Code	**PP321C**
Other Product Code(s)	ASF364
CA Reg. No.	91465-08-6
CA Index Name	cyclopropanecarboxylic acid, 3-(2-chloro-3,3,3-trifluoro-1-propenyl)-2,2-dimethyl-, cyano(3-phenoxyphenyl)methyl ester, [1.alpha.(S*),3.alpha.(Z)]-(.+-.)-
IUPAC Name	(1R,3R)-3-((Z)-2-Chloro-3,3,3-trifluoro-propenyl)-2,2-dimethyl-cyclopropanecarboxylic acid (S)-cyano-(3-phenoxy-phenyl)-methyl ester and (1S,3S)-3-((Z)-2-Chloro-3,3,3-trifluoro-propenyl)-2,2-dimethyl-cyclopropanecarboxylic acid (R)-cyano-(3-phenoxy-phenyl)-methyl ester
Molecular formula	$C_{23}H_{19}ClF_3NO_3$
Molecular mass	449.9
Chemical Analysis	
– **Identity ***	**confirmed**
– **Content of lambda-cyhalothrin ***	**90.5 %w/w**
Methodology used for Characterization	GC, HPLC
Physical Analysis	
– **Appearance***	**Amber liquid**
Stability:	
– **Storage temperature**	**< 30°C**
– **Recertification date**	**End of November 2013**

If stored under the conditions given above, this test substance can be considered stable until the recertification date is reached.

This Certificate of Analysis summarizes data which originates either from a single study or from several individual studies. Tests marked with an asterisk (*) have been conducted in compliance with GLP. Raw data, documentation, study plans, any amendments to study plans and reports pertaining to this/these study/studies are stored under the study number(s) referenced below within the archives of the GLP Testing Facility WMU at Syngenta Crop Protection Muenchwilen AG.

Study number of batch characterization: 123816

Study number(s) of batch recertification:

Authorization:

11-Nov-2011

Dr. K. Heintz
Analytical Development & Product Chemistry

10480036

Page 1 of 1