ENVIRONMENTAL RISK MANAGEMENT AUTHORITY
NGA KAIWHAKATUPATO WHAKARARU TAIAO

ERMA New Zealand

FORM HS1

Application for approval to

IMPORT OR MANUFACTURE ANY HAZARDOUS SUBSTANCE FOR RELEASE

under section 28 of the Hazardous Substances and New Organisms Act 1996

Name of Substance(s): FIREBIRD ®

Applicant: Bayer New Zealand Ltd.

Office use only

Application Code: ☐☐☐☐☐☐☐☐☐☐ Date received:___/ ___/ ___/

ERMA NZ Contact: _____ Initial Fees Paid: $

Application Version No: _____

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FIREBIRD

Schedule of Appendices

A	**Formulated product: Summary of toxicology / metabolism**
B	**Flufenacet (FOE 5043) Summary of tox/ metabolism, inc. ADI, AOEL calcn.s**
C	**Flufenacet (FOE 5043) Summary of Ecotoxicity studies**
D	**Flufenacet (FOE 5043) : Fate and Behaviour in the Environment (Summaries)**
E	**Diflufenican (AE F088657) : Summary of tox/ metabolism, inc. ADI, AOEL calcn.s**
F	**Diflufenican (AE F088657) : Summary of Ecotoxicity studies**
G	**Diflufenican (AE F088657) : Fate and Behaviour in the Environment (Summaries)**
H	**Formulation & Excipients [CONFIDENTIAL FILE]**

Section One - Applicant Details

1.1 Name and postal address in New Zealand of the organisation making the application:

Name: Bayer New Zealand Ltd.
Address: P.O. Box 2825 Auckland, and P.O. Box 11332 Sockburn CHRISTCHURCH
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Fax: [09] 443 1194 and [03] 348 4016

1.2 The applicant's location address in New Zealand (if different from above):

Street Address: 3, Argus Place, Glenfield, AUCKLAND

1.3 Name of the contact person for the application:

Name: Max Moore, Technical & Regulatory Affairs Manager
Address: Bayer New Zealand Ltd
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CHRISTCHURCH

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Section Two - Application Type and Related Approvals Required

2.1 Is the information in this application relevant to import, manufacture or both:

- Import only? **Yes**
- If import only, indicate whether or not manufacture is likely in New Zealand [Unlikely ever to be economically justified] **No**

2.2 If the information in the application relates to manufacture in New Zealand, provide information on the proposed manufacturing process and any alternatives

Not applicable

2.3 If you have reasons for not providing detailed information in this application, explain what they are and provide some justification.

2.4 If this substance(s) needs an approval under any other legislation, has an application for this approval been made ?
(Optional) (See comments under "Section 2.4 of Form" in the User Guide.

Name of Approval	Application made
Agricultural Compounds and Veterinary Medicines Act 1997	Yes
Food Act 1981	Yes [via ACVMG]
Medicines Act 1981	No N/A
Chemical Weapons (Prohibition) Act 1996	No N/A
Radiation Protection Act 1965	No N/A
Biosecurity Act 1993	No N/A
Resource Management Act 1991	No N/A
Other (please specify	No N/A

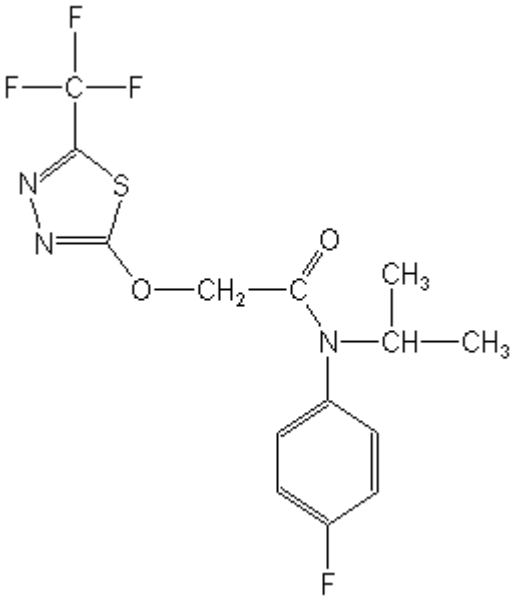
Section Three - Information on the Substance(s)

3.1 State the unequivocal identification of the substance(s).

Firebird is a herbicide containing 400 g/litre flufenacet, plus 200 g/litre diflufenican, in the form of a suspension concentrate.

Flufenacet [for diflufenican see following page]

- Chemical Name (CA) — N-(4-fluorophenyl)-N-(1-methylethyl)-2-[[5-(trifluoromethyl)-1,3,4-thiadiazol-2-yl]oxy]acetamide
- Chemical Name (IUPAC) — 4′-fluoro-N-isopropyl-2-[5-(trifluoromethyl)-1,3,4-thiadiazol-2-yloxy]acetanilide
- Common Name — flufenacet
- Synonyms — FOE 5043
- Trade Names — Firebird
- CAS Registry Number — 142459-58-3
- Molecular Formula — $C_{14}H_{13}F_4N_3O_2S$
- Molecular weight: — 363.3 g/mol



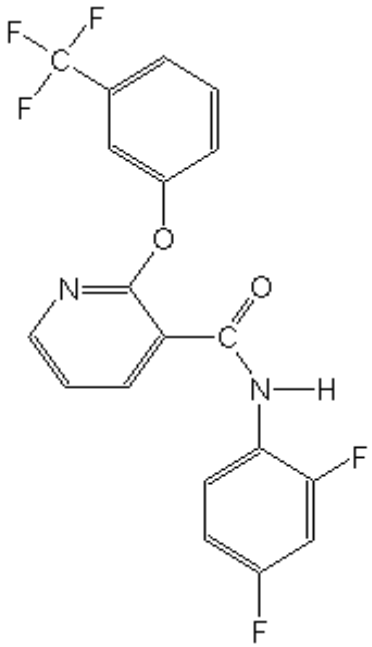
- Structural Formula

3.1 State the unequivocal identification of the substance(s).

Firebird is a herbicide containing 400 g/litre flufenacet, plus 200 g/litre diflufenican, in the form of a suspension concentrate.

Diflufenican [for flufenacet see previous page]

- Chemical Name (CA) — *N*-(2,4-difluorophenyl)-2-[3-(trifluoromethyl)phenoxy] -3-pyridinecarboxamide
- Chemical Name (IUPAC) — 2′,4′-difluoro-2-(α,α,α-trifluoro-*m*-tolyloxy)nicotinanilide •
  Common Name — diflufenican
- Synonyms — The name “diflufenicanil” is used in France.
- Trade Names — Firebird M&B 38544, AE F088657, RPA 590339
- CAS Registry Number — 83164-33-4
- Molecular Formula — $C_{19}H_{11}F_5N_2O_2$
- Molecular weight: — 394.3 g/mol
- Structural Formula



http://www.dive.afssa.fr/agritox/php/sa.php?source=RPA&sa=505
http://www.efsa.eu.int/EFSA/PRAPER_Conclusion/praper_diflufenican_04_eval_table_rev_2-1_public.pdf

3.2 Provide information on the chemical and physical properties of the substance i.e. the formulated product

Physical and Chemical properties of Firebird 600 SC [formulated product]

Appearance: White / beige liquid suspension
Odour: Weak characteristic odour
pH: ca. 5.0 – 6.0 at 20° C (undiluted)
Vapour pressure: 90 µPa at 20 °C - Method : OECD 104 (flufenacet)
Vapour pressure: 4.25×10^{-3} mPa at 25 °C (diflufenican)
Boiling point: > 100° C
Solubility: Miscible in water (forms a suspension)
Density: Ca. 1.24 g/cm³ at 20° C
Flash Point: No flash point up to the boiling point. > 100° C
Flammability Non flammable
Partition coefficient (octanol/water): flufenacet: log P : 3.2 at 24 °C
Partition coefficient (octanol/water): diflufenican: log P : 4.2 (pH 7, 20 ºC)
Corrosive: Not considered to be corrosive
Oxidising: Not considered to be an oxidiser

3.3 Provide information on the hazardous properties of the substance(s).

Physical and Chemical properties of Firebird 600 SC [formulated product]: Impact on Hazard Classification:

1	Explosive	Not triggered [see Sec. 3.2]
3	Flammable	Not triggered [see Sec. 3.2]
5	Oxidising	Not triggered [see Sec. 3.2]
8.1	Metallic corrosive	Not triggered [see Sec. 3.2]

Acute toxicity: Firebird 600 SC [formulated product]

Summary of end points

Acute oral LD50:	< 2000 mg/kg b.w. : rat
Acute dermal LD50:	> 4,000 mg/ kg b.w. : rat
Acute inhalation LC50:	< 2,078 mg/m3 : rat
Skin irritation:	Non irritant
Eye irritation:	Non irritant
Skin sensitisation	Sensitiser (M & K)

Ref: Appendix A

Impact on Hazard classification

6.1	**Acute toxicity**	**Triggered: see above**	**6.1 D**
6.3	Skin irritation	Not triggered: see above	
6.4	Eye irritation	Not triggered: see above	
6.5	**Sensitisation**	**Triggered: see above**	**6.5 B**
8.2	Skin corrosive	Not triggered: see above	
8.3	Eye corrosive	Not triggered: see above	

Systemic Toxicity of the active ingredients

1. Flufenacet

(For more detail see Appendix A, for full reports of each study see disks)

Summary of Short-term Toxicity Studies

In subchronic oral studies in rats, mice, and dogs, the main target organs affected by exposure to FOE 5043 were brain, thyroid, liver, kidney, and spleen as indicated by changes in clinical chemistries, organ weights and/or histopathological findings. The comparative species differences in toxicological profile, find the rat and the mice similar in primary and secondary target organs, but a sensitivity of certain cell types was observed in the dog as evidenced by histopathological lesions of vacuoles in the brain. Alterations in circulating serum thyroid hormones (thyroxine-T_4 and triiodothyronine-T_3) were observed in each species and were considered indicative of hepatic interference. Primary hematological parameters affected by treatment in each species included changes in erythrocytes, platelets, hemoglobin, and hematocrit concentrations. Histopathological findings generally correlated with alterations in organ weights. A decrease in body weight gain was observed in rats and mice.

In a subacute dermal toxicity study in rats, findings included a decrease in thyroxine (T_4) and free thyroxine (FT_4) levels, an increase in liver weights, and histopathological findings for the liver. A high-dose recovery group treated similarly with FOE 5043 demonstrated a complete recovery from all responses to treatment by two weeks after the final application.

Summary of Genotoxicity Testing

Mutagenicity studies with FOE 5043 were consistently negative. Point mutation assays in bacteria and mammalian cells revealed no evidence of mutagenic potential. In vitro and in vivo cytogenetic studies revealed no evidence of clastogenicity, and an unscheduled DNA synthesis assay using primary rat hepatocytes revealed no evidence of genotoxic activity. Thus, FOE 5043 is not mutagenic, clastogenic or genotoxic.

Summary of Chronic Toxicity / Oncogenicity Studies

Evidence of toxicity from exposure to FOE 5043 was observed in chronic feeding studies on mice, rats and dogs. In the oncogencity mouse study, findings included an increased blood methemoglobin content and ocular cataracts.

For rats and dogs, the toxicological response could be broadly characterized as involving structural and/or functional alterations in liver-, kidney-, hematologic/spleen-, and thyroid-related endpoints. The liver was considered the primary target organ with increases in organ weight, cell size and number, and/or associated hepatic parameters. Hepatocytomegaly was exhibited in both species exposed to higher doses of FOE 5043. The FOE 5043-induced liver changes would appear to be fundamentally adaptive in nature as the organism's principal metabolic organ responds to physiological need to clear, biotransform, and excrete a xenobiotic.

The hematological profile of the rats and dogs indicated a mild anemia for animals at higher dose levels. Thyroid involvement was noted in both species by an increase in thyroid organ weights, and for dogs, a decrease in thyroxine (T_4) and triiodothyronine (T_3) levels. The lower levels of exposure used in the chronic rat study, as compared to the subchronic bioassy, suggested a dose >800 ppm (highest dose tested) was necessary for a broader and more significant toxicological response in this tissue. The thyroid organ changes resulting from exposure to FOE 5043 are likely to be a secondary effect in response to hepatic induction.

Ophthalmological findings noted in the rat included cataracts and ocular scleral mineralization. For dogs, eye effects included minimal to moderate vacuolization of the ciliary body epithelium and cystic vacuolization of the peripheral optic retina.

In dogs, specialized testing such as computerized electrocardiograms, clinical neurological examinations, and quantitative electroencephalography revealed a number of compound-related effects.

Renal pelvic epithelial hyperplasia was observed in the kidneys of rats and dogs. A minimal to moderate axonopathy was noted in the brain, spinal cord and sciatic nerve of dogs.

No evidence of an oncogenic potential of FOE 5043 was found in the long-term feeding studies in rats and mice.

Summary of Reproductive and Developmental Toxicity Studies

The reproductive toxicity of FOE 5043 was studied in a 2-generation study in rats and developmental toxicity studies in rats and rabbits.

Dietary levels up to and including 500 ppm, the highest dose tested, had no effect on reproduction when fed to rats over a period of 2 generations. In parental animals, there was a compound-related reduction in body weights for P generation females during the pre-mating phase. Other effects accuring in the P and F_1 generation adults included increased absolute and relative liver weights and histopathological changes in the liver. The NOELs obtained for overall and reproductive toxicity were 20 and 500 ppm, respectively.

In an oral developmental toxicity study in rats, developmental effects were observed at 125 mg/kg bw/day (highest dose tested) as demonstrated by decreased fetal body weights, and increased incidences of delayed ossification and skeletal variation. These effects were correlated with a reduction in body weight and food

consumption in dams at 125 mg/kg bw/day. The NOEL for both maternal and developmental toxicity in the rat via oral administration was 25 mg/kg bw/day.

In an oral rabbit developmental toxicity study, developmental effects occurred at doses of 125 and 200 mg/kg bw/day. Effects included reduced fetal weights, and increased incidences of delayed ossification and skeletal variation. Maternal toxicity was exhibited by clinical signs, reduced body weight gain during treatment, and an increase incidence of histopathological changes in the liver. The NOELs established in the rabbit for maternal and developmental toxicity by oral administration were 5 and 25 mg/kg bw/day, respectively.

Overall, it can be concluded that FOE 5043 is not a reproductive or developmental toxicant. The developmental effects observed were restricted to the higher dose levels which produced overt maternal toxicity.

Summary on Studies with Metabolites and Neurotoxicity Screening Studies

Thiadone (FOE 6457), a metabolite of FOE 5043, was tested for its acute oral toxicity in rats. Although, LD_{50} values were not specifically determined, the author of the report concluded that thiadone (FOE 6457) is more toxic by the oral route of exposure than its parent compound, FOE 5043.

FOE 5043 has been investigated in acute and subchronic oral neurotoxicity screening studies using rats. In an acute neurotoxicity screening study, all clinical and neurobehavioral effects observed following administration of a single dose of FOE 5043 were abscribed to acute systemic toxicity. Complete recovery occurred in surviving animals with the exception of urine stains which persisted till termination in females. There were no correlative micropathologic findings to indicate any evidence of an adverse effect on the nervous system. In a subchronic neurotoxicity screening study, a dose-related increase in evidence of neurotoxicity was demonstrated following dietary exposure of FOE 5043. Compound-related effects in the functional observation battery and motor activity assessments were evident in animals treated at higher concentrations. These findings were correlated with microscopic lesions (swollen axons) observed in the brain and spinal cord. These effects, however, occurred only at exposure levels that produced substantial evidence of systemic toxicity as demonstrated in a separate subchronic feeding study (Christenson and Wahle, 1995b) in which tissue damage involving liver-, kidney,- hematologic/spleen- and thyroid-related endpoints was observed at similar high dietary levels. Thus, the results of these studies taken collectively suggest that an increased incidence of axonal swelling occurred in animals exposed to high levels of FOE 5043 which saturate metabolic pathways.

Table 5.10.1b Results of Short-term Toxicity, Mutagenicity, Neurotoxicity, Long-term Toxicity, and Reproductive Testing.

Study Type	Test Species	Result Obtained*
oral, 90 days	rat dog	NOEL: 25 ppm (1.7 mg/kg bw/day)[1] NOEL: 50 ppm (1.67 mg/kg bw/day)
dermal, 17-18 x 6 h/day	rat	NOEL: 20 mg/kg bw/day
mutagenicity	bacteria mammalian cells / in vitro in vivo	negative (1 of 1) negative (3 of 3) negative (1 of 1)
acute neurotoxicity 90-day neurotoxicity	rat rat	NOEL: 150 mg/kg bw/day[2,3] NOEL: 120 ppm (7.30 mg/kg bw/day)
oral, 20 months oral, 1 year oral, 2 years	mouse rat rat	NOEL: 50 ppm (7.4 mg/kg bw/day)[4] NOEL: 25 ppm (1.7 mg/kg bw/day) NOEL: 25 ppm (1.2 mg/kg bw/day)[5]
oral, 12 months	dog	NOEL: 40 ppm (1.14 mg/kg bw/day)
oncogenicity	mouse, rat	not oncogenic
2 generation	rat	Parental NOEL: 20 ppm (1.4 mg/kg bw/day) Reproductive NOEL: 500 ppm (37.4 mg/kg bw/day)[2]
teratogenicity	rat, rabbit rat rabbit	no primary developmental toxicity NOELs: Developmental toxicity: 25 mg/kg bw/day Maternal toxicity: 25 mg/kg bw/day NOELs: Developmental toxicity: 25 mg/kg bw/day Maternal toxicity: 5 mg/kg bw/day

* NOELs (mg/kg bw/day) presented are for the most sensitive sex.

1 A NOEL for male rats exclusive to this subchronic study was not established at the lowest level tested (100 ppm). However, the chronic toxicity profile which emerged through the first year of the 2-year rat study including bleeding intervals at 3, 6 and 12 months) confirmed a subchronic NOEL for male rats of 25 ppm or 1.7 mg/kg bw/day.

2 Highest Dose Level Tested

3 Highest dose tested with survivors.

4 This dose level was at or near the threshold for the cataractogenic response in the mouse.

5 NOEL established with the possible exception of a slight increase of a common background, geriatric change (renal pelvic mineralization) in low dose males (25 ppm)

From the results of these studies we propose a hazard classification as under

6.6	Mutagenic	Not triggered: see above	
6.7	Carcinogenic	Not triggered: see above	
6.8	Reproductive/developmental	Not triggered: see above	
6.9	**Target organ/systemic**	**Triggered: see above**	**6.9B**

2. Diflufenican
(For more detail see Appendix E, for full reports of each study see disks)

Summary of short-term toxicity
Gavage administration of diflufenican to rats for two weeks led to no clinical signs of toxicity and only few, toxicologically insignificant, alterations in hematology and clinical chemistry parameters. Administration of diflufenican in the diet of rats and mice for for 13 weeks caused a decrease in body weight and food consumption at the highest doses tested. Diflufenican administration also caused increases in activities of liver enzymes such as alkaline phosphatase, alanine aminotransferase, and aspartate aminotransferase. Relative liver weight was generally increased in a dose-related manner. The effects of diflufenican in the rat on body weight and body weight gain, food consumption, and enzyme activities were rapidly and completely reversible.

In the dog, administration of diflufenican for 90 days by oral gavage led to slightly decreased body weight gain at the highest doses. This is most likely due to increased incidence of vomiting and not to a specific effect of diflufenican on metabolism. There were no toxicologically significant effects on hematology, clinical chemistry, or organ weights.

Administration of diflufenican to the dog for one year produced no clinical signs, and no effects on body weight, body weight gain, or food consumption. There were also no effects on hematology. Alkaline phosphatase was increased at the highest doses tested, in a time- and dose-dependent manner. Liver weight was increased at these same doses. The effects on liver weight and alkaline phosphatase reflect an adaptive response to the consumption of diflufenican over an extended time period, rather than a major toxic insult.

The No Observable Adverse Effect Levels for diflufenican in the rat, mouse, and dog short-term studies were established on the basis of decreased body weight or body weight gain, decreased food consumption, and increases in liver weights and diagnostic enzyme activities.

Summary of genotoxicity testing
Diflufenican has been tested for potential genotoxicity *in vitro* in bacteria and on cultured mammalian cells, and *in vivo* in a mammalian test system.

Diflufenican was non-genotoxic in a standard Ames *Salmonella typhimurium* microsomal-mediated assay. Diflufenican induced a weak positive response in the absence of S9 in mouse L5178Y lymphoma cells. However, diflufenican was negative in Chinese hamster V79 cells. Diflufenican was not clastogenic in either cultured human lymphocytes or in rat bone marrow cells after in vivo administration. Also, diflufenican did not induce unscheduled DNA synthesis in rat primary hepatocytes. The totality of the data suggests that diflufenican is not genotoxic.

Summary of long-term toxicity and carcinogenicity
Diflufenican administered to rats and mice at concentrations exceeding the maximum tolerated dose did not induce signs of carcinogenic potential. The top dose used in these two species induced decreases in body weight and body weight gain, as well as in food consumption in the rat. Liver weight was increased in the mouse but not in the rat, and was accompanied at histopathological examination by periacinar hepatocytic hypertrophy. There were no signs of neoplastic effects in either species.

Diflufenican was apparently not an inducer of hepatic cytochrome P450 enzymes.

Summary of reproductive toxicity
In a two-generation reproduction study in the rat, diflufenican was administered in the diet at concentrations of up to 12,500 ppm. Adult food consumption, body weight, and body weight gain decreased during the pre-mating and rearing phases of the study at the top doses. Pup body weight during weaning was decreased compared to controls. However, there was no delay in attainment of developmental landmarks in pups, nor was there any effect of diflufenican on fertility or pregnancy. Pup survival in the

F1B and F2A litters was decreased at the top dose, but survival was unaffected in the F1A and F2B litters. The NOAEL for systemic toxicity was 500 ppm, or from 35.5 mg/kg/day in F0 pre-mating males to 47.3 mg/kg/day for F1A pre-mating females. The NOAEL for reproductive toxicity is set at 500 ppm, based on the effect of pup body weight and survival in some generations.

Diflufenican had no effect on the reproductive organs of either male or female rats.

In a rat developmental toxicity study, diflufenican administration caused a slight decrease in body weight gain during treatment, although maternal body weight returned to near normal after treatment ended. There was no effect of diflufenican on fetal weight or embryonic death. There was also no increase in either visceral or skeletal findings. The NOAEL for both dams and fetuses is 5000 mg/kg/day.

In a rabbit developmental toxicity study, diflufenican decreased body weight gain at the top dose used, and also decreased food consumption compared to controls. Both body weight and food consumption returned to near normal after treatment ended. Diflufenican did not affect pre- or post-implantation loss, fetal development, or fetal body weight. There were also no skeletal or visceral abnormalities. The NOAEL for this study for both dams and fetuses is 2500 mg/kg/day.

Neurotoxicity
Diflufenican is not a neurotoxicant, and did not cause any neurotoxic effects in the acute, sub-chronic, or chronic studies.

Proposal for acceptable daily intake (ADI)
The potential health risk for consumers would result mainly from exposure to residues of diflufenican in food. Therefore, the evaluation of the consumer risk needs to be based on subchronic and long-term dietary studies. In accordance with internationally accepted procedures, the Acceptable Daily Intake (ADI) for consumers is derived from the No Observable Adverse Effect Level (NOAEL) in the most sensitive species. A safety factor is applied which takes into consideration the type of effect seen in this study, its severity, reversibility and potential inter- and intra-species variability.

Based on the above studies, the lowest overall NOAEL was observed in the 90-day study in rats with a value of 18.5 mg/kg body weight/day in males based on the observation of reduced body weight and food consumption and food conversion at the higher dose level (185.2 mg/kg/day) tested in that study. Therefore, the overall lowest NOAEL for the calculation of the ADI was considered to be 18.5 mg/kg body weight/day.

Given the absence of any major signs of acute or chronic toxicity, the absence of carcinogenicity, genotoxicity, reproduction or developmental toxicity or neurotoxicity, and taking the low toxicity profile, poor absorption, predominantly of the parent compound, a standard safety factor of 100 is considered appropriate. Therefore, the proposed Acceptable Daily Intake (ADI) for diflufenican is as follows:

ADI = 0.185 mg/kg body weight/day

From the results of these studies we propose a hazard classification as under

6.6	Mutagenic	Not triggered: see above	
6.7	Carcinogenic	Not triggered: see above	
6.8	Reproductive/developmental	Not triggered: see above	
6.9	Target organ/systemic	Not triggered: see above	

Ecotoxicity of the active ingredients (flufenacet, diflufenican)

1. Flufenacet

(For more detail see Appendix C, for full reports of each study see disks)

Acute toxicity to birds

Acute oral LD50 (Bobwhite quail) 1608 mg a.i./kg b.w.

Short-term toxicity to birds

LC50 (Bobwhite quail) 5317 mg a.i./kg feed
LC50 (Mallard duck) 4970 mg a.i./kg feed

Subchronic toxicity and effects on reproduction of birds

Toxic threshold effect concentration, TEC (mean LOEC-NOEC)
Bobwhite quail 913 mg a.i./kg feed
Mallard duck 136.3 mg a.i./kg feed

Acute toxicity to fish

Threshold effect concentration, TEC (mean LOEC-NOEC)
Rainbow trout 2.33 mg a.i./l

Fish early life stage toxicity test

Threshold effect concentration, TEC (mean LOEC-NOEC)
Rainbow trout 0.495 mg a.i./l

Fish: bioconcentration (Blugill Sunfish)

The steady-state bioconcentration factor was calculated as 71.4 for the exposure level. During the depuration phase, residues in fish declined with a half-life for clearance of 0.3 days.

Acute toxicity to waterfleas

EC50 / LC50 30.9 mg a.i./l (48 h. static)

Chronic toxicity to aquatic invertebrates

Threshold effect concentration, TEC (mean LOEC-NOEC)
Daphnia 4.54 mg a.i./l (21 d. semi-static)

Effects on algal growth

Threshold effect concentration, TEC (mean LOEC-NOEC)
Selenastrum capricornutum 0.00356 mg a.i./l (120 h, static)

Effects on aquatic plants

Threshold effect concentration, TEC (mean LOEC-NOEC)
Lemna gibba 0.000611 mg a.i./l (14 d. static)

Toxicity to Honey Bee

The oral LD 50 was determined to be greater than 170.1 µg a.i./bee and the contact LD 50 was greater than 193.8 µg a.i./bee.

Toxicity to Parasitoids

Overall it was considered unlikely that the product would have any harmful effects on *Aphidius rhopalosiphi* under conditions of normal field use.

Toxicity to Predatory Mites
According to the findings presented predatory mites may be impacted under field conditions by a spray treatment with 592 g a.i./ha of FOE 5043 WG 60. As predatory mites are not relevant to product use (preemergence/early postemergence herbicide) there is no risk to affect biological control capacity.

Ground dwelling predators
Poecilus cupreus, Pardosa agrestis,
No significantly increased mortality, No impacts on behaviour, No effects on feeding capacity
Aleochara bilineata
No significantly increased mortality, No impacts on reproduction

Foliage dwelling predators
Coccinella septempunctata / larvae: No significantly increased mortality, no influence on reproductive performance

Toxicity to Earthworms

Acute:	The LC50 was 218.8 mg a.i./kg dry weight soil
Sublethal / reproduction:	FOE 5043 WG 60 did not affect reproduction of earthworms up to the highest tested rate of 3000 g a.i./ha. Thus the NOEC would be ≥ 3000 g a.i./ha (or: ≥ 3.99 mg a.i./kg d.w. soil).

Effects on soil non-target micro-organisms
When applied as recommended, FOE 5043 should not influence the degradation of organic carbon and the turnover of nitrogen in soils

Effects on biological methods for sewage treatment
No risk to biological sewage treatment processes is anticipated.

Impact on Hazard classification

9.1	**Aquatic**	**triggered 9.1A**
9.2	Soil	Not triggered
9.3	Terrestrial vertebrate	Not triggered
9.4	Terrestrial invertebrate	Not triggered

1. Diflufenican

(For more detail see Appendix F, for full reports of each study see disks)

Toxicity to birds

STUDY	SPECIES	**Result**
Acute	Bobwhite quail	LD_{50} > 2150 mg/kg bw
	Mallard duck	LD_{50} > 4000 mg/kg bw
Short-term	Bobwhite quail	LC_{50} > 1000 ppm
Subchronic and reproduction	Bobwhite quail	NOEC = 1000 mg/kg/day

Toxicity to aquatic organisms

Aquatic toxicity of diflufenican (AE F088657), active substance

Test organism	Study type	Test duration	LC/EC_{50} mg/L	NOEC mg/L
Acute toxicity to fish				
Oncorhynchus mykiss (rainbow trout)	static acute	96 h	> 0.1088*	-
Oncorhynchus mykiss (rainbow trout)	flow-through acute	96 h	74.8*	-
Cyprinus carpio (common carp)	static acute	96 h	> 0.0985*	-
Cyprinus carpio (common carp)	flow-through acute	96 h	105*	
Chronic toxicity to fish				
Oncorhynchus mykiss (rainbow trout)	Juvenile growth flow-through	28 d	-	0.0192
Pimephales promelas (fathead minnow)	Early Life Stage flow-through	35 d	-	0.015
Acute toxicity to aquatic invertebrates				
Daphnia magna (water flea)	static acute	48 h	> 0.240*	-
Daphnia magna (water flea)	static acute	48 h	> 10*	-

Effects on algal growth

Selenastrum capricornutum (green alga)	growth inhibition test	72 h	E_bC_{50}: 0.00027 E_rC_{50}: 0.00058
Microcystis aeruginosa (blue-green algae)	growth inhibition test	72 h	E_bC_{50}: 0.05100 E_rC_{50}> 0.09800
Anabaena flos-aquae (blue-green algae)	growth inhibition test	72 h	E_bC_{50}: 0.05100 E_rC_{50}> 0.08900
Navicula pelliculosa (diatom)	growth inhibition test	72 h	E_bC_{50}: 0.00350 E_rC_{50}: 0.00430
Scenedesmus subspicatus (green alga)	growth inhibition test	72 h	E_bC_{50}: 0.00025 E_rC_{50}: 0.00045
Scenedesmus subspicatus (green alga)	growth inhibition test (+ recovery phase)	72 h	E_bC_{50}: 0.00046 E_rC_{50}: 0.00122
Scenedesmus subspicatus (green alga)	growth inhibition test, in presence of sediment	72 h	E_bC_{50}: 0.00310 E_rC_{50}> 0.00390
Scenedesmus subspicatus (green alga)	growth inhibition test, in presence of sediment	72 h	E_bC_{50}: 0.00244 E_rC_{50}: 0.00473

Aquatic toxicity of diflufenican (AE F088657), active substance (continued)

Test organism	Study type	Test duration	LC/EC_{50} mg/L	NOEC mg/L
Sediment dwelling organisms				
Chironomus riparius (chironomid)	Chronic test – spiked water static	28 d	NOEC	0.100*
Chironomus riparius (chironomid)	Chronic test – spiked sediment static	28 d	NOEC	2.0 mg/Kg
Aquatic plants				
Lemna gibba (duck weed)	growth inhibition test	14 d	E_bC_{50}: 0.039 E_rC_{50}: 0.056	

* above the limit of aqueous solubility

Based on the studies above it can be concluded that at concentrations not exceeding the limit of solubility, i.e. under environmentally relevant conditions, DFF is practically non-toxic to aquatic fauna (fish and invertebrates).

DFF is very highly toxic to various species of algae. This clearly demonstrates the herbicidal activity of the compound. Green algae showed to be the most sensitive group of all tested species.

Toxicity to honeybees
An acute laboratory toxicity study using diflufenican was conducted on honey-bees. This study showed diflufenican to be harmless to bees *Apis mellifera* L.
Contact 48 hrs LD50 > 100 µg a.i./bee. Oral 48 hrs LC50 > 112.3 µg a.i./bee.

Toxicity of Diflufenican to Non Target Arthropods
Following worst case artificial laboratory conditions, diflufenican was determined to be harmless (mortality) to the parasitic wasp *Aphidius rhopalosiphi* and to the predacious mite *Typhlodromus pyri* when applied at a rate of 187.5 g diflufenican/ha.

Toxicity To Earthworms And Soil Microorganisms
Following worst case artificial laboratory conditions, diflufenican was determined to be harmless (mortality) to the parasitic wasp *Aphidius rhopalosiphi* and to the predacious mite *Typhlodromus pyri* when applied at a rate of 187.5 g diflufenican/ha.
Diflufenican is not be expected to cause any significant effects on either soil microflora respiration or nitrogen . This lack of effects on soil microorganisms was also confirmed by the litter bag study indicating no effect of diflufenican and metabolites to the decomposition of organic matters

Impact on Hazard classification

9.1	**Aquatic**	**triggered 9.1A**
9.2	Soil	Not triggered
9.3	Terrestrial vertebrate	Not triggered
9.4	Terrestrial invertebrate	Not triggered

Impact of excipients on hazard classification

A review of the Material Safety Data Sheets of the excipients [See Appendix H CONFIDENTIAL] indicates that the excipients contribute no hazards other than those accommodated in the data for the acute toxicity of the formulated product, or the toxicological / ecotoxicological hazards of the active ingredients.

Summary of proposed overall classification:

6.1D, 6.5B, 6.9B, 9.1A

3.4 Identification of the default Controls on the substance(s).

Substance	**HSNO Classification**	**HSNO Default Controls**
flufenacet / diflufenican		
suspension concentrate containing 400 g/litre flufenacet and 200 g/litre diflufenican This includes the following trade name product: **Firebird**	**6.1 D** **6.5 B** **6.9B** **9.1A**	Toxic T1, T2, T4, T5, T7, T8 Ecotoxic El, E2, E5, E6, E7, E8, Identification I1, I8, I9, I11, I16, I17, I18, I19, I20, I21, I23, I28, I29, I30 Packaging and Packaging Group P1, P3, P13, P15, PS4, PG3 Disposal D4, D5, D6, D7, D8, Emergency Management EM1, EM6, EM7, EM8, EM11, EM12, EM13 TR1, AH1

3.5 Provide information on what will happen to the substance throughout its whole life from its introduction into New Zealand, its uses, through to disposal.

Manufacture, Formulation:

Firebird is manufactured and formulated in the Europe., and will be imported into New Zealand as the formulated product, packed for retail sale.

Manufacture, Formulation in New Zealand:

It is not expected to be either manufactured [active ingredient] nor formulated in New Zealand: neither is justified on the grounds of economics.

Packaging:

Firebird will be packed in 3 litre HDPE containers, to UN specification.
The quantity imported per year is not expected to exceed 10,000 litres, it may be assumed this will be imported into Christchurch in April each year.

Transport:

Firebird has the following Dangerous Goods classification for Sea Transport:

UN No.	3082
Description:	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. [flufenacet, plus diflufenican]
Class:	9
Packing Group:	III

It is not classed as Dangerous Goods for road transport

Storage:

Bulk Storage: Firebird will be stored primarily in the dedicated chemical warehouse of Bayer New Zealand Ltd., situated at Treffers Road, Sockburn, Christchurch. This store has procedures in place for managing a wide range of chemical products. The staff are trained in and familiar with the protocols for the separation of products according to their characteristics, for safe handling and storage, and the measures to adopt in case of any emergency.

Firebird will be stored in original packaging, palletised, in 500 litre lots.

Distributors: During the course of sale and distribution the product will be transported to the premises of agricultural distributors each of whom has dedicated pesticide storage facilities, and whose staff have been trained in the procedures for managing and storing such products, and in dealing with emergencies that might arise. The maximum quantity of Firebird stored in such a distributor's store is not expected to exceed 500 litres.

End users: The use of Firebird is restricted by its label claims to growers of Winter sown wheat and barley. These are all expected to be familiar with safe practices regarding the storage and handling of pesticides: Firebird will not present them with any hazards with which they are not already familiar. We would not expect on-farm storage to exceed 50 litres.

Use:

Firebird is recommended for application to winter wheat and winter barley for the control of annual grasses and broad-leaved weeds. A single application per crop, or per season, is recommended at a standard application rate of 300 ml. product per hectare. (120 g. flufenacet, 60 g. Diflufenican).

Disposal:

The preferred option for disposal, and considered the primary route, is for its use as per the label instructions. Because of the value of the product, and its chemical stability, any unused material can be held over to the following season without incurring any special problems.

If disposal as above is not possible, due to product contamination, or for other reasons, Firebird may be disposed of in an approved landfill.

Empty containers will be accommodated in the Agrecovery scheme for the retrieval of empty pesticide containers.

4.1 Identify all of the potential risks, costs and benefits of the substance(s)

4.1 Identification of risks, costs, benefits.

Review of potential environmental effects

Environmental constants

parameter	**flufenacet**
Henry constant	9 e-4 Pa*m3/mole at 20°C
Vapour pressure	90 µPa at 20 °C - Method : OECD 104
Solubility in water	56 mg/l : pH 4 - 7 53 mg/l : pH 9
Solubility in organic solvents	acetone : >200 g/l acetonitrile : >200 g/l dichloromethane : >200 g/l dimethylformamide : >200 g/l dimethylsulphoxide : >200 g/l octanol : 88 g/l propylene glycol : 74 g/l
Partition coefficient: octanol/ water	log P : 3.2 at 24 °C
Rate of hydrolysis	Half-life : > 650 days at pH 5 – 9 (EPA 161 – 1) > 365 days at pH 5 – 9
Rate of photolysis in water (in natural light)	DT 50 > 30 days

parameter	**diflufenican**
Henry constant	0.033 Pa*m3/mole
Vapour pressure	31 µPa at 25 °C
Solubility in water	<0.05 mg/l
Solubility in organic solvents	cyclohexane : <10 g/l dimethylformamide : 100 g/l xylene : 20 g/l
Partition coefficient: octanol/ water	log P : 4.9
Rate of hydrolysis	Half-life : >30 days : pH 5 - 9
Rate of photolysis in water (fluorescent tubes, between 300-400 nm))	DT50 : 97 days : pH 9

Water contamination/ degradation:	**See Appendix D (flufenacet), G (Diflufenican)**
Soil contamination / degradation:	**See Appendix D (flufenacet), G (Diflufenican)**
Behaviour in air	**See Appendix D (flufenacet), G (Diflufenican)**
Effects on ecosystems:	**See Appendix C (flufenacet), F (Diflufenican)**
Effects on aquatic organisms:	**See Appendix C (flufenacet), F (Diflufenican)**
Effects on vertebrates:	**See Appendix B (flufenacet), E (Diflufenican)**
Effects on native flora:	**See Appendix C (flufenacet), F (Diflufenican)**

4.1 Identification of risks, costs, benefits.

Review of potential environmental effects

(For study reports on environmental behaviour / degradation see Appendix D (for flufenacet), Appendix G (for diflufenican)

	HRAC group/ WSSA group	chemical family	mode of action
Diflufenican	F 1 / 12	Pyridinecarboxamides	Bleaching: Inhibition of carotenoid biosynthesis at the phytoene desaturase step (PDS)
flufenacet	K 3 / 15	Oxyacetamides	Inhibition of cell division Inhibition of very long chain fatty acids (VLCFA)

http://www.plantprotection.org/hrac/MOA.html (Herbicide Resistance Action Committee [HRAC] herbicides: mode of action)

The identified risk posed by Firebird is to aquatic organisms, especially aquatic plants, to which both active ingredients are highly toxic. The hazard to fish and aquatic invertebrates is mitigated by the very low water solubility of the two chemicals. While flufenacet is quite stable with respect to hydrolytic degradation, both actives have photolylic half lives of 30 – 97 days.

The toxicity of Firebird to terrestrial vertebrates, invertebrates, soil macro and micro organisms is low. There is expected to be little or no effect on terrestrial plant life from say inadvertent application. The phytotoxic effect of the product is limited to plants from the pre-emergent stage up to about the 2 true-leaf stage. Established plants are not expected to show any effect.

Effects on Economic Social and Cultural Wellbeing of Communities

Adverse effects on public health:
No adverse effects are anticipated.

Table 4.1 Summary of risk identification of Firebird

Source of potentially significant risk	Adverse effect/ impact	Likelihood	Distribution of effects [geographic]	Distribution of effects [demographic]	Distribution of effects [temporal]	Reversible/ irreversible	Voluntary/ involuntary	Magnitude	Level of residual risk
Transport accident over land	Human health	Very unlikely	Localised	Not expected	Short term	Reversible	Involuntary	Minimal	Insignificant
	Aquatic environment	Very unlikely	Localised		Short term	Reversible	Involuntary	Minor	Insignificant
	Terrestrial Environment	Very unlikely	Localised		Short term	Reversible	Involuntary	Minimal	Insignificant
Damage to packaging during storage	Human health	Very unlikely	Localised	Not expected	Short term	Reversible	Involuntary	Minimal	Insignificant
	Aquatic environment	Very unlikely	Localised		Short term	Reversible	Involuntary	Minimal	Insignificant
	Terrestrial Environment	Very unlikely	Localised		Short term	Reversible	Involuntary	Minimal	Insignificant
Spillage of substance during dispensing and use	Human health	Unlikely	Localised	Not expected	Short term	Reversible	Involuntary	Minimal	Insignificant
	Aquatic environment	Unlikely	Localised		Short term	Reversible	Involuntary	Minimal	Insignificant
	Terrestrial Environment	Unlikely	Localised		Short term	Reversible	Involuntary	Minimal	Insignificant
Incorrect disposal of surplus substance	Human health	Unlikely	Localised	Not expected	Short term	Reversible	Involuntary	Minimal	Insignificant
	Aquatic environment	Unlikely	Localised		Short term	Reversible	Involuntary	Minor	Insignificant
	Terrestrial Environment	Unlikely	Localised		Short term	Reversible	Involuntary	Minimal	Insignificant

Costs
Since Firebird is intended to directly replace currently used cereal herbicides, with no adverse variation in risk relative to the existing products it can be regarded as cost neutral.

Identification of Benefits

Effective early control of annual grasses and most of the important broad-leaved weeds in winter wheat and winter barley.

Unique combination of Diflufenican and flufenacet provides a non-IPU based herbicidal option.

Permits flexible timing of application from pre-emergence to early post emergence of crop and weeds. (Early control of weeds favours improved crop growth)

Safe on all varieties of winter wheat and winter barley.

An easy and inoffensive product to use: an low odour suspension concentrate.

The very low dose rate, 300 ml / hectare reduces environmental contamination and packaging waste.

4.3 Provide an assessment of any particular risks, costs and benefits which arise from the relationship of Maori and their culture and traditions with their taonga, or which are, for other reasons, of particular relevance to Maori.

In our judgement the importation and use of Firebird will not adversely affect the natural resources of the flora, fauna, waterways, land and culture of the indigenous Maori.

4.4 Provide an assessment of any risks, costs or benefits to New Zea1and's international obligations.

Firebird is registered in Europe and the USA.
Residues in products exported to other countries will be accommodated by MRL's established in those countries and/or by the Codex Alimentarius. In any case the use rate and use timing of Firebird will ensure there are no residues in treated produce above the default MRL. Our international obligations are satisfied.

4.5 Provide information on the proposed management of the substance.

Firebird is an agricultural herbicide which will be handled, stored, transported and used by persons familiar with similar materials. Handled with care and according to the label we consider it represents a low risk, both to humans and to the environment. It is our opinion that the warnings and precautions set out on the label, are adequate to eliminate or mitigate the slight hazard posed by the product.

The overall management of the substance in respect of transport, storage, application and container disposal will be in compliance with the Code of Practice for the Management of Agrichemicals. [NZS 8409:2004] Documentation to facilitate this will include the ready availability of the container label, Product Safety Card and Material Safety Data sheet.

Transport / Storage
Firebird has the following Dangerous Goods classification for Sea Transport:

UN No.	3082
Description:	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. [flufenacet plus diflufenican]
Class:	9
Packing Group:	III

It is not classed as Dangerous Goods for road transport

Firebird conforms to the requirements of Schedule 4 of the Hazardous Substances. (Packaging) Regulations 2001. We are advised by Bayer AG that the packaging for Firebird is required to meet a “drop-test” of 1.8 metres. Warehouse staff of proprietors and resellers are required to observe Codes of Practice [ISO 9002 or Growsafe] while storing Firebird, growers are also Growsafe accredited. [As per NZS 8409:2004]

Dispensing and use

The concentrated product is added to the spray tank and diluted with water, as per the label, prior to application. Label statements warn: Toxic to aquatic organisms. Do not mix or load near any body of water: avoid spray drift over, or spillage into open water. Avoid contamination of any water supply with chemical or empty container.

Disposal of surplus substance

Advice regarding disposal is included on the label. The value of the product is such as to discourage careless disposal.

4.6 Provide an overall evaluation of the combined impact of all of the risks, costs and benefits set out in sections 4.2, 4.3 and 4.4.

4.6 Quantification Analysis of risks

	Risk	At risk	Probability of occurrence	Degree of effect	Risk score = probability x degree §	Level of risk without controls	Level of risk with controls
1	Oral exposure	End user	1	1	1	negligible	negligible
		Storeman	1	1	1	negligible	negligible
2	Dermal / eye exposure	End user	1	1	1	negligible	negligible
		Storeman	1	1	1	negligible	negligible
3	Inhalation exposure	End user	1	1	1	negligible	negligible
		Storeman	1	1	1	negligible	negligible
4	Food residues	Consumer	1	1	1	negligible	negligible
	Water contamination	Fish invertebrates Aquatic plants	1 1 1	2 2 2	2 2 2	low low low	negligible negligible negligible
5	Soil contamination	Soil micro flora, fauna	1	1	1	negligible	negligible
6	Non-target species	Plants, animals	1	1	1	negligible	negligible

§ Scale: 1 = Negligible risk. 10 = Monitoring/ intervention required.

5.1 ERMA New Zealand is interested in whether this substance (or any of its components) has been considered by any other regulatory authority in New Zealand or by any other country.

Firebird is registered in Europe and the USA.

It is also being submitted to the ACVMG for registration under the ACVM Act.

Section 6.1 Glossary

Section 7.1 Name of the substance for the public register

Firebird ®

Section 7.2 Purpose of the Application, for the public register

To import or manufacture Firebird, an agricultural herbicide containing 400 g/l flufenacet, plus 200 g/l diflufenican, in the form of a suspension concentrate, for the control of annual grass and broad-leaved weeds in winter wheat and barley.

7.3 Use Category

Main Category	3
Industry Category	1
Function/ Use	38

Section 7.4 Executive Summary

The application is to seek approval to import Firebird, an agricultural herbicide containing 400 g/litre flufenacet, plus 200 g/litre diflufenican, in the form of a suspension concentrate, intended for the control of annual grass and broad-leaved weeds in winter wheat and winter barley.

Firebird is recommended for application to winter wheat and winter barley for the control of annual grasses and broad-leaved weeds. A single application per crop, or per season, is recommended at a standard application rate of 300 ml. product per hectare. (equivalent to 120 g. flufenacet, 60 g. diflufenican).

Our estimation of the hazard classification of Firebird is as follows:

6.1D, 6.5B, 6.9B, 9.1A

With normal care during handling and application, and the observance of label directions we believe the risks to users, consumers, bystanders and the environment are negligible.

In our judgement the importation and use of Firebird will not adversely affect the natural resources of the flora, fauna, waterways, land and culture of the indigenous Maori.

Following importation Firebird will be handled, stored and transported by trained personnel, experienced in the safe management of hazardous substances. The overall management of the substance in respect of transport, storage, application and container disposal will be in compliance with the Code of Practice for the Management of Agrichemicals. [NZS 8409:2004] Documentation to facilitate this will include the ready availability of the container label, Product Safety Card and Material Safety Data sheet.

In summary, the benefits of Firebird are:

Effective early control of annual grasses and most of the important broad-leaved weeds in winter wheat and winter barley.

Unique combination of Diflufenican and flufenacet provides a non-IPU based herbicidal option.

Permits flexible timing of application from pre-emergence to early post emergence of crop and weeds. (Early control of weeds favours improved crop growth)

Safe on all varieties of winter wheat and winter barley.

An easy and inoffensive product to use: an low odour suspension concentrate.

The very low dose rate, 300 ml / hectare reduces environmental contamination and packaging waste.

CHECKLIST

Mandatory sections filled out	Yes
Appendices enclosed	Yes / ~~NA~~
Fees enclosed	Yes
Application signed and dated	Yes

Signed Date 25/8/08