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Canadian Wildlife Service
National Wildlife Research Centre
Ottawa, Ontario K1A 0E7

22 April 1987

Dr. F.Y. Chang
Pesticides Directorate
Agriculture Canada
S.B.I. Building
2323 Riverside Drive
Ottawa, Ontario K1A 0C6

Dear Dr. Chang

Re: DuPont Ally Herbicide (metsulfuron methyl)
Submission No. 84-0199 (technical)
84-0585 (formulation)

Enclosed is the summary of our review of the environmental toxicology of Ally (60% metsulfuron methyl DF), and a list of the published literature and Dupont reports used in whole or in part in that review.

The document is in support of our recommendation that temporary registration of Ally for application by ground equipment in wheat (spring and durum) and barley in the black and gray-wooded soil zones (pH 7.5 or less) of the Prairie Provinces and the Peace River region of British Columbia **not** be considered until the following studies have been submitted and reviewed:

1. The Algal Acute Toxicity Test originially requested by CWS in November 1984 for the technical product, and for Ally and recommended tank mixes following an acceptable protocol such as EPA 540/9-82-020 (1982); and

2. Acute Toxicity Tests with technical grade material, Ally and recommended tank mixes to determine minimal-effect-levels for margin, emergent, floating and submerged plants commonly associated with sloughs in the area of intended use. Species should be selected in consultation with CWS and protocols should be submitted for review.

Field testing of Ally and recommended tank mixes under conditions of intended use which maximize potential exposure of nontarget plant species commonly associated with sloughs may also be required pending review of data requested by all agencies.

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In his letter of 6 April 1987 to you, Allan Brown, DuPont Canada noted that EPA considered the data package for Ally to be complete. We contacted EPA during our review to discuss the registration of Ally in the U.S. At the time that Ally was reviewed, phytotoxicity data for nontarget plants was not required for the use pattern requested. EPA agrees with our concerns about the use of Ally in the prairie pothole region of Canada because of the intimate association of cultivated croplands and small prairie wetland basins coupled with the persistence of metsulfuron methyl, its potential mobility, and its phytotoxicity at very low concentrations. As I have already indicated, the herbicidal level of Ally has not been experimentally determined for nontarget plants or many weed species. Under these circumstances, from a regulatory and monitoring point-of-view, it seems unreasonable to accept that analytical methods are not required to detect metsulfuron methyl at least at a minimal-effect-level.

If you have comments regarding the above, please contact me at 997-6073.

Yours sincerely,

Kathryn Freemark

Kathryn Freemark, Ph.D.
Pesticides Evaluation Officer

c.c. H. Thompson, CCB
L. de March, DFO
A. Brown, DuPont Canada
D. Forsyth, CWS-Western & Northern Region

Canada

EVALUATION SUMMARY AND RECOMMENDATIONS FOR ALLY

AGENCY: CANADIAN WILDLIFE SERVICE, ENVIRONMENT CANADA

COMMON NAME: Metsulfuron methyl   CHEMICAL FAMILY: Sulfonyl urea

CHEMICAL NAME: Methyl 2-[[[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl]amino]-sulfonyl]benzoate

TRADE NAME: Dupont Ally Herbicide   PESTICIDE TYPE: Herbicide

SUBMISSION NO.(S.N.): 84-0199 (technical)
84-0585 (formulation)

EVALUATION SUMMARY: The requested use of Ally does not pose a hazard to birds and mammals from dermal, respiratory, acute oral or dietary exposure or from food removal associated with acute toxicity to terrestrial or aquatic invertebrates (based on limited data for invertebrates). Data were not available for amphibians and reptiles, but a hazard is not expected given the plant specific mode of action of metsulfuron methyl and its low acute toxicity to aquatic invertebrates and fish. The impact on wildlife habitat and associated food resources from the use of Ally cannot be evaluated because the minimal-effect-level for nontarget plants has not been determined. The data submitted indicate that Ally is likely to be toxic to aquatic plants at initial concentrations expected in slough water from direct overspray or from runoff. Exposure of floating, emergent and slough-margin vegetation to overspray from ground application, and spray drift into nontarget habitats adjacent to use areas may also be hazardous. Repeated use of Ally could pose an additional hazard to nontarget plants from residue accumulation. Nontarget plant testing is required.

RECOMMENDATIONS: The following data are the minimum required to evaluate potential impacts of Ally on wildlife habitat and associated food resources, and to determine if current detection limits for metsulfuron methyl are adequate:

1. The Algal Acute Toxicity Test originally requested by CWS in November 1984 for technical product, and for Ally and recommended tank mixes following an acceptable protocol such as EPA 540/9-82-020 (1982).

2. Acute Toxicity Tests with technical grade material, Ally and recommended tank mixes to determine minimal-effect-levels for margin, emergent, floating and submerged plants commonly associated with sloughs in the area of intended use. Species should be selected in consultation with CWS and protocols should be submitted for review.

Field testing of Ally and recommended tank mixes under conditions of intended use which maximize potential exposure of nontarget plant species commonly associated with sloughs may also be required pending review of data requested by all agencies.

USE PATTERN REQUESTED:

Formulation: 60% dry flowable

Application Sites: Wheat (spring and durum) and barley in the black and gray-wooded soil zones (pH of 7.5 or less) of the Prairie Provinces and the Peace River region of British Columbia.

Application rate: 7.5 g of product/ha (or 4.5 g a.i./ha)

Types and methods of application: Application by ground equipment only to control or suppress certain broadleaf weeds. A single application is recommended between postemergence from the 2 leaf stage of the crop and the boot stage when weeds are actively growing.

EXISTING USE PATTERN: none

EXISTING ALTERNATIVES: Based on agricultural guides for Manitoba, Saskatchewan and Alberta, the following products are currently registered for use in wheat (spring or durum) and barley to control at least 9 of the 14 weed species controlled by Ally:

Product Name	Active ingredient(s)
Blagal	cyanazine MCPA-K
Buctril M, Sabre-Bromox 720	bromoxynil MCPA
Estaprop	dichlorprop 2,4-D
Glean	chlorsulfuron
Kil-mor	dicamba mecoprop 2,4-D
Stampede CM	propanil MCPA (l.v. ester)
Target	dicamba mecoprop MCPA

ESTIMATED ENVIRONMENTAL CONCENTRATIONS: The intended area of use is located in the prairie pothole region of North America (Kantrud & Stewart 1977). In a wetland habitat study in the intended area of use, the average pothole or 'slough' density was 36.4 per square km, occupying 12.5% of the total land surface, with 82% of the sloughs smaller than .25 ha and less than 0.8 m deep (Millar 1969). The size of margins between cropland and slough water cannot be readily determined but is likely to be minimal given the density of sloughs in the intended area of use and crop production demands on farmers.

Inflow of water to sloughs consists mostly of snowmelt, rainfall and groundwater, while water loss is due mainly to evaporation and, on a lesser scale, groundwater seepage (Sheehan et al. 1987). In an average year, about two-thirds of the sloughs dry up by July (Smith et al. 1964). The sloughs are generally slightly to moderately alkaline (7.7 to 9.7) except for temporary sloughs which tend to be slightly acidic (Driver & Peden 1977).

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Plant Residues: Based on crop residue data for wheat green forage (S.N. 84-0585 Part 5.3), the residue per unit dose (residue ppm/application rate in kg/ha) ranged from 2.3 - 13.8 ppm immediately after application at test rates. Assuming a linear relationship exists (cf. Hoerger and Kenaga 1972), at the field application rate of 4.5 g a.i./ha, plant residues are expected to range from 0.011 - 0.062 ppm.

Plant residues from spray drift into nontarget habitats have not been estimated.

Soil Residues: Assuming a soil bulk density of 1.2 g/cc and a sampling depth of 15 cm, soil residues immediately after application of 4.5 g a.i./ha of Ally are expected to be 2.5 ppb.

Soil residues from spray drift into nontarget habitats have not been estimated.

Water Concentrations: Ally is to be applied by ground equipment only. A narrow margin (10-20 m) between cropland and a slough could be easily oversprayed with ground application equipment and spray techniques. Direct application to wetland margins could be either intentional for weed control or accidental as the result of tractor and boom movement.

Assuming a worst case scenario, if a pothole typical of the intended area of use (0.2 ha, 0.8 m deep) were directly oversprayed with Ally at field rates, the initial water concentration would be 0.6 ppb.

Initial water concentrations from spray drift have not been estimated.

Total runoff loss of herbicides from agricultural fields under "worst case" conditions of high rainfall shortly after application have ranged from 2-27% (summarized in Wauchope 1978). Assuming a slough in the intended area of use occupies 10, 15 or 20% of the field rate would result in initial concentrations in the water of 0, 0.2, 0.4, 0.6 and 0.8 ppb, respectively.

ENVIRONMENTAL IMPACT:

Environmental Toxicology

Summary: The requested use of Ally does not pose a hazard to birds and mammals from dermal, respiratory, acute oral or dietary exposure. Data were not available for amphibians and reptiles, but a hazard is not expected given the plant specific mode of action of metsulfuron methyl and its low acute toxicity to aquatic invertebrates and fish.

Wild Birds: Technical metsulfuron methyl is practically non-toxic to 6-month old mallards (LD50 > 2510 mg/kg; S.N. 84-0199 Part 7.1.2 Report HLO-359-81). However, sublethal effects were observed during the tw0-week study period. All dose groups had weight losses and lower weight gains relative to the control group, in part because of lower food consumption, but also because of lower food conversion efficiency particularly in the first week after dosing.

Technical metsulfuron methyl was not toxic to 14 day-old Mallard (S.N. 84-0199 Part 7.1.3 Report HLO-455-81) or Bobwhite Quail (S.N. 84-0199 Part 7.1.3 Report HLO-460-81) when administered in the diet for 5 days (both LC50's >5620 ppm). No adverse effects on body weight gain or food consumption were observed over the 8-day study period. Food conversion efficiency could not be calculated from the data.

No data were available on the metabolism or persistence of metsulfuron methyl in birds.

An avian reproduction study was waived primarily because the mode of action of metsulfuron methyl is specific to plant enzyme inhibition. Energetic costs observed in the acute oral toxicity test could potentially affect reproductive output but are unlikely to occur at the low environmental concentrations expected.

No field studies were available.

Wild birds may be exposed to metsulfuron methyl by direct overspray, spray drift, or by consumption of vegetation or prey sprayed with Ally. Exposure through these routes, is not expected to result in adverse toxicological effects because of low application rates and residues and the extremely low acute oral and dietary toxicity of the technical and formulated product to bird species tested.

Wild Mammals: Studies on acute and short-term (90 days) toxicity, metabolism and teratology were vetted. Summaries only were reviewed for longer-term studies. These data were used to evaluate the potential hazard to wildlife only. Suitability of these data for human health evaluation is determined by Health & Welfare Canada.

Metsulfuron methyl is practically nontoxic to laboratory mammals exposed by oral, dermal or respiratory routes. Mild weight loss or reduced weight gain associated with reduced food consumption were the only sublethal effects consistently observed.

No mortalities were observed in rats administered single oral doses of 5000 mg/kg of the active as technical grade (Submission No. 84-0199 Part 3.1.2 Report HLR-207-82) or formulated product (S.N. 84-0585 Part 3.2.2. Report HL-181-84). Acute oral tests on single animals indicated 25000 mg/kg of technical material was not lethal (Submission No. 84-0199 Part 3.1.2 Report HL-716-80).

The approximate lethal oral dose in dogs was greater than 2500 mg/kg (S.N. 84-0199 Part 3.1.2 Report HLR-309-83).

Orally administered metsulfuron methyl is very rapidly cleared by rats. At doses of 16 or 3000 mg/kg, there was no tissue-selective accumulation, half-lives were 9-16 and 23-29 hours, respectively, and over 90% was excreted unaltered within 72-96 hours, predominantly in the urine (S.N. 84-0199 Part 4.4 Reports AMR-108-83 and AMR-405-85).

In ruminants, orally-administered metsulfuron methyl was excreted unaltered predominantly in the urine and feces. A lactating goat exposed to 3.4 ppm metsulfuron methyl in the diet for 5 consecutive days eliminated most of the total dosed intact via the urine (78.9%) and feces (14.1%). Twenty-four hours after the last dose, ca. 2.7% was recovered in the rumen, stomach and intestine contents, and hide (S.N. 84-0199 Part 4.2 Report AMR-124-83). Metsulfuron methyl was also rapidly excreted in the urine and feces of cows fed for four weeks with diets containing 5 to 100 ppm of technical material (S.N. 84-0199 Part 4.2 Report AMR-167-83).

When metsulfuron methyl was administered orally to rats as ten repeated doses up to 3400 mg/kg over a two week period, only slight weight losses were observed (S.N. 84-0199 Part 3.1.2 HL-1033-80).

Mice exposed to dietary doses as high as 5000 ppm for 90 days showed only decreases in body weight gain associated with decreased food consumption (S.N. 84-0199 Part 3.6.5 Report HL-463-84). Dietary concentrations as high as 5000 ppm were not toxic to rats fed continuously for two years (S.N. 84-0199 Part 3.6.2 Report HLO-61-85). Dogs consuming a diet containing 5000 ppm for one year were also not affected (S.N. 84-0199 Part 3.5.2 Report HLO-330-84).

In rabbits, the acute lethal dermal dose was greater than 2000 mg/kg of the active as technical grade (Submission No. 84-0199 Part 3.1.3 Report HL-321-82) or formulated product (Submission No. 84-0585 Part 3.2.3 Report HLO-139-84). Rabbits exposed dermally up to 2000 mg/kg of the technical material for 21 days showed no compound-related effects (S.N. 84-0199 Part 3.3.3 Report HL-137-83).

Rats inhaling doses up to 5.3 mg/l of technical material were not adversely affected (S.N. 84-0199 Part 3.1.4 Report HL-784-82).

Metsulfuron methyl had no embryopathic or teratogenic potential when orally administered to rats at concentrations as high as 1000 mg/kg (S.N. 84-0199 Part 3.6.3 Report HLO-655-82) or to rabbits at 700 mg/kg (S.N. 84-0199 Part 3.6.3 Report HLO-663-82).

No field studies were available.

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Wild mammals may be exposed to metsulfuron methyl by direct overspray, spray drift or by consumption of vegetation or prey sprayed with Ally. Exposure through these routes is not expected to result in adverse effects because of low application rates and residues, and the extremely low toxicity of the technical and formulated product to mammals tested.

Amphibians and Reptiles: No data are available to evaluate the risk to amphibians and reptiles from the use of Ally on wheat and barley.

A hazard is not expected given the plant specific mode of action of metsulfuron methyl and its low acute toxicity to aquatic invertebrates and fish (LC50's > 150 ppm, S.N. 84-0199 Part 7.2.2 Reports HL-154-82, HL-157-82, HL-515-82).

Habitat Impact Assessment

Summary: The use of Ally is not expected to pose a hazard to wildlife from food removal associated with acute toxicity to terrestrial or aquatic invertebrates (although data were limited and no data were available for earthworms). The impact on wildlife habitat and associated food resources from the use of Ally cannot be evaluated because the minimal-effect-level for nontarget plants has not been determined. The data submitted indicate that Ally is likely to be toxic to aquatic macrophytes at initial concentrations expected in slough water from direct overspray or from runoff. Exposure of floating, emergent and slough-margin vegetation to overspray from ground application, and spray drift into nontarget habitats adjacent to use areas may also be hazardous. Repeated use of Ally could pose an additional hazard to plants in nontarget habitats from residue accumulation in soil or water. Nontarget plant testing is required.

Terrestrial Invertebrates: Ally is nontoxic to honeybees (Apis mellifera). The contact LD50 was greater than 25 ug/bee (S.N. 84-0199 Part 7.3.4 Report ABM-84-4).

No studies are available to evaluate the risk to earthworms and other nontarget terrestrial invertebrate species.

The requested use of Ally is not expected to pose a hazard to terrestrial invertebrates from acute toxicity. However, terrestrial invertebrates may be at risk from plant removal in nontarget habitats as a result of contamination by Ally (See below).

Aquatic Invertebrates: Metsulfuron methyl was not acutely toxic to Daphnia magna at concentrations as high as 150 ppm (v/v) (S.N.

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84-0199 Part 7.2.2 Report HL-157-82).

Aquatic invertebrates should not be at risk from acute oxicity at the environmental concentrations expected in slough in the intended area of use. However, aquatic invertebrates m y be at risk from the loss of plants commonly associated with sl ughs as a result of contamination by Ally (See below).

Plants: Ally is absorbed by foliage and roots and is translocated. Metsulfuron methyl inhibits cell division in the shoots or roots by blocking synthesis of the amino acids valine and isoleucine. Sensitivity of plant species is related to the rate of metabolic inactivation of metsulfuron methyl (Ray 1985).

No data were available for nontarget plants to determine minimal-effect-levels of metsulfuron methyl or Ally. Consequently, the impact on terrestrial or aquatic wildlife habitat and associated food resources from the use of Ally cannot be evaluated.

An algal toxicity test was requested by CWS in November of 1984, but has not been received to date.

Some data on the effects of Ally on aquatic macrophytes were available for efficacy studies in the laboratory and in rice paddies in southeast Asia (S.N. 84-0199 Part 7.2 Vol. 39). Although these studies were not designed to determine minimal-effect-concentrations, they do indicate that Ally is phytotoxic to aquatic plants at very low concentrations in water.

The most sensitive aquatic plants reported were the submerged species, Potomogeton nodosus and P. pectinatus. Growth in shoot length was inhibitted by 77-90% relative to the control 4 weeks after treatment at a nominal rate of 1 ppb prior to plant emergence from the soil. Affected plants survived under laboratory conditions but are not likely to survive under field conditions (N. Dechoretz, USDA Aquatic Research Laboratory, U. Calif, Davis, pers. comm.) As 1 ppb was the lowest rate tested, the minimum-effective-concentration for growth inhibition is unknown, but a concentration of 0.05 ppb or less is not unreasonable to assume based on dose-growth response of submersed aquatic plants to other sulfonyl ureas (N. Dechoretz, pers. comm.) or other herbicides (Forney and Davis 1981).

Efficacy studies in rice paddies in southeast Asia indicated that Ally also controlled floating and emergent aquatic plants at low concentrations. Test conditions varied among studies and few details on methods were reported. Treatment rates were tabled in g a.i./ha and converted to water concentrations by the proponents. At 7 ppb (the lowest water concentration reported), the emergent species Monochoria vaginalis and Sphenochlea zeylanica were 100% controlled. At 10 ppb, the floating species Salvinia molesta, Marsilea crenata, Limnocharis flava, and the emergent sedges Cyperus difformis, C. iria, Scirpus juncoides, Eleocharis spp. were 45-90% controlled. At 10 ppb, Ally exhibited

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50% control on young plants of the emergent sedge Fimbristylis miliacea, but plants became insensitive at later stages of development. Little or no control of the emergent grasses Echinochloa crus-galli, and Leptochloa chinensis was reported at water concentrations as high as 27 ppb.

Since the minimal-effect-level for nontarget plants has not been determined, the impact on wildlife habitat and associated food resources from the use of Ally cannot be evaluated. However, the data submitted indicate that Ally is likely to be toxic to aquatic macrophytes at initial concentrations expected in slough water from direct overspray or from runoff. Exposure of floating, emergent and slough-margin vegetation to overspraying from ground application and spray drift into nontarget habitats adjacent to use areas is also potentially hazardous.

Ally also has a high degree of residual phytotoxicity in soil following a single application at field rates as indicated by damage to rotational crops (S.N. 84-0585 Part 8 Vol. 13 Efficacy) and recropping intervals of 10 months for 'tolerant' crops and 22 months or more for other crops such as alfalfa (S.N. 84-0580 Part 1 Label). No data were reported for the persistence in water under aerobic conditions. Under anaerobic conditions in the lab, the half-life of metsulfuron methyl was about 25 weeks at pH 6.9 (S.N. 84-0199 Part 6.2 Report AMR-134-83). Thus, repeated use of Ally could pose an additional hazard to plants in nontarget habitats from residue accumulation in soil or water.

Sloughs in the prairie pothole region of Canada support a substantial portion of North American waterfowl populations during the breeding season. Their reproductive and recruitment success depend on continued access to a variety of sloughs (e.g. temporary, semi-permanent, permanent). These sloughs provide a balance of protective cover and appropriate nesting vegetation as well as plant and aquatic invertebrate food resources for laying hens and young ducklings from mid-April to late September (data cited in Sheehan et al. 1987).

Nontarget plant testing is required to evaluate potential impacts of Ally on wildlife habitat and associated food resources in the intended area of use, as well as to determine if the current detection limits for metsulfuron methyl of 0.1 ppb in water (S.N. 84-0199 Part 6 AMR-356-85A Revised) and 0.2 ppb in soil (S.N. 84-0199 Part 6 AMR-152-83 Revised) are adequate. The following studies are therefore required:

1. The Algal Acute Toxicity Test originally requested by CWS in November 1984 for technical product, and for Ally and recommended tank mixes following an acceptable protocol such as EPA 540/9-82-020 (1982).

2. Acute Toxicity Tests with technical grade material, Ally and recommended tank mixes to determine minimal-effect-levels for margin, emergent, floating and submerged plants commonly associated with sloughs in the area of intended use. Species

should be selected in consultation with CWS and protocols should be submitted for review.

Field testing of Ally and recommended tank mixes under conditions of intended use which maximize potential exposure of nontarget plant species commonly associated with sloughs may also be required pending review of data requested by all agencies.

PUBLISHED LITERATURE

Driver, E.A. and D.G. Peden. 1977. The chemistry of surface water in prairie ponds. Hydrobiologia 53(1):33-48.

Forney, D.R. and D. E. Davis. 1981. Effects of low concentrations of herbicides on submersed aquatic plants. Weed Science 29:677-685.

Hoerger, F. and E.E. Kenaga. 1972. Pesticide residues on plants: Correlation of representative data as a basis for estimation of their magnitude in the environment. Environ. Qual. and Safety 1:9-28.

Kantrud, H.A. and R.E. Stewart. 1977. Use of natural basin wetlands by breeding waterfowl in North Dakota. J. Wildl. Manage. 41(2):243-253.

Millar, J.B. 1969. Some characteristics of wetland basins in central and southwestern Saskatchewan. pp. 73-101 IN: Canadian Wildlife Service Report Series No. 6. 262 pp.

Ray, T.B. 1985. The site of action of the sulfonylurea herbicides. Proc. Br. Crop Prot. Conf.-Weeds, ISS 1:131-138. Abstract only.

Sheehan, P.K., A. Baril, P. Mineau, D.K. Smith, A. Harfenist and W.K. Marshall. 1987. The impact of pesticides on the ecology of prairie-nesting ducks. CWS Technical Report Series No. 19.

Smith, A.G., J.H. Stoudt and J.B. Gollop. 1964. Prairie potholes and marshes. pp. 39-50 IN: J.P. Linduska and A.L. Nelson (eds.). Waterfowl Tomorrow. U.S. Fish and Wildlife Service.

Wauchope, R.D. 1978. The pesticide content of surface water draining from agricultural fields: A review. J. Environ. Qual. 7(4):459-472.

DUPONT REPORTS

1. Submission No. 84-0199 (technical)

		REPORT NO.	VOLUME: PAGE NO.
PART 2	PRODUCT CHEMISTRY		
2.13	Identification of Impurities		3:5
	DuPont 1983 Technical DPX-T6376 Impurity Profile		
	Status: Reviewed.		
2.16	Chemical and Physical Properties		3:41
	Status: Reviewed.		
PART 3	TOXICOLOGY		
3.1	Acute Studies - Technical		
3.1.2	Oral Toxicity		
	Haskell Laboratory/DuPont/Kennedy, G.L. 1982 Oral LD50 Test in Rats	HL 207-82	4:1
	Status: Vetted.		
	Haskell Laboratory/DuPont/Kennedy, G.L. 1980 Acute Oral Test in Rats	HL 716-80	4:7
	Status: Vetted.		
	Haskell Laboratory/DuPont/Kennedy, G.L. 1980 Ten-Dose Subacute Test in Rats.	HL 1033-80	4:9
	Status: Vetted.		
	Haskell Laboratory/DuPont/Kennedy, G.L. 1983 Approximate Lethal Dose (ALD) in Dogs	HLR-309-83	20
	Status: Vetted.		
3.1.3	Dermal Toxicity		
	Haskell Laboratory/DuPont/Kennedy, G.L. 1982 Acute Skin Absorption LD50 Test on Rabbits	HL 321-82	4:11
	Status: Vetted.		

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1. Submission No. 84-0199 (technical) (Continued)

	REPORT NO.	VOLUME: PAGE NO.
PART 3 TOXICOLOGY		
3.1.4 Inhalation Toxicity		
Haskell Laboratory/DuPont/Kennedy, G.L. 1983 Inhalation Median Lethal Concentration (LC50) of INT-6376-25 by EPA Protocol	HL 784-82	4:16
Status: Vetted.		
3.3 Short Term Studies - Technical		
3.3.3 Dermal Toxity		
Haskell Laboratory/DuPont/Kennedy, G.L. 1983 Subchronic Dermal Toxicity (21-day) in Rabbits	HL 137-83	26
Status: Vetted.		
3.5 Long Term Studies		
3.5.2 Oral Toxicity		
Hazleton Laboratories/Burdock, G.A. 1984 A Combined Three-Month and One-Year Feeding Study in Dogs	HLO-330-84	19A, B
Status: Reviewed.		
3.6 Special Studies		
3.6.2 Reproduction		
1985 Chronic Feeding Study with Concurrent Two-Generation Reproduction Study in Rats - Final Report	HLO-61-85	14 A-M
Status: Reviewed.		

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1. Submission No. 84-0199 (technical) (Continued)

		REPORT NO.	VOLUME: PAGE NO.
PART 3	TOXICOLOGY		
3.6.3	Teratogenicity		
	Argus Research Laboratories/Hoberman, A.M. Feussner, E.L., Christian, M.S., Christian, G.D. 1982 Teratogenicity Study of INT-6376 in New Zealand White Rabbits (Segment II Evaluation)	HLO-663-82	7:1
	Status: Vetted.		
	Argus Research Laboratories/Hoberman, A.M. Feussner, E.L., Christian, M.S., Christian, G.D. 1982 Embryo-Fetal Toxicity and Teratogenicity Study of INT-6376 in Rats (Segment II Evaluation)	HLO-655-82	7:133
	Status: Vetted.		
3.6.5	Oncogenicity		
	Haskell Laboratory/DuPont/Stadler, J.C. 1984 Ninety Day and Long Term Feeding Study in Mice	HL-463-84	13 A-B
	Status: Reviewed.		
	Haskell Laboratory/DuPont/Frauss, W.C. 1985 Supplement to Pathology Report on Long-Term Feeding Study in Mice	HL-463-84	28
	Status: Reviewed.		
PART 4	METABOLISM STUDIES		
4.2	Animals		
	DuPont/Rapisarda, C. 1984 Metabolism of ^{14}C-Metsulfuron Methyl in the Goat	AMR-124-83	17
	Status: Reviewed.		

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1. Submission No. 84-0199 (technical) (Continued)

		REPORT NO.	VOLUME: PAGE NO.
PART 4	METABOLISM STUDIES		
4.2	Animals		
	DuPont/Hershberger, L.W. 1983 Fate of Metsulfuron Methyl Ingested by Dairy Cows Status: Reviewed.	AMR-167-83	17
4.4	Pharmacokinetics		
	DuPont/Hunt, Oliver R. 1984 Metabolism of ^{14}C-Metsulfuron Methyl in Rats Status: Vetted.	AMR-108-83	18
	DuPont/Hundley, S.G. 1985 Metabolism of (Triazine-2-^{14}C) Metsulfuron Methyl in the Rat Status: Vetted.	AMR-405-85	35
PART 6	ENVIRONMENTAL CHEMISTRY		
	DuPont/Hersherger, L.W. 1984 Determination of Metsulfuron Methyl Residues in Soil Status: Reviewed.	AMR-152-83 (Revised)	38
	DuPont/Zahnow, E.W. 1986 Analysis of Sulfonylureas in water by liquid chromatography Status: Reviewed.	AMR-356-85A (Revised)	38
6.2	Laboratory Studies		
	DuPont/McFetridge, R.D. and Cadwgan, G.E. 1985 Photodegradation of (Trizine-2-^{14}C) Metsulfuron Methyl in Water Status: Reviewed.	AMR-451-85	32

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PART 6	ENVIRONMENTAL CHEMISTRY		
6.2	Laboratory Studies		
	DuPont/Friedman, P.L. 1983 Anaerobic Aquatic Metabolism of (^{14}C-Phenyl) - Metsulfuron Methyl	AMR-134-83	25
	Status: Reviewed.		
PART 7	ENVIRONMENTAL TOXICOLOGY		
7.1	Birds and Mammals		
7.1.2	Acute		
	Wildlife International Ltd./Beavers, J.B. and Fink, R. 1981 Acute and LD50-Mallard Duck	HLO 359-81	11:1
	Status: Vetted.		
7.1.3	Short Term		
	Wildlife International Ltd./Beavers, J.B. and Fink, R. 1981 Eight-Day Dietary LC50 - Mallard Duck	HLO 455-81	11:7
	Status: Vetted.		
	Wildlife International Ltd./Beavers, J.B. and Fink, R. 1981 Eight-Day Dietary LC50 - Bobwhite Quail	HLO-460-81	11:31
	Status: Vetted.		

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1. Submission No. 84-0199 (technical) (Continued)

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PART 7	ENVIRONMENTAL TOXICOLOGY		
7.2	Aquatic Organisms		
	DuPont/Ackerson, R.C. 1987 Effects of Ally on Selected Aquatic Plants	6376/ME-5	39
	Status: Vetted.		
7.2.2	Acute		
	Haskell Laboratory/DuPont/Litchfield, C.D. 1982 96-Hour LC50 to Bluegill Sunfish	HL 154-82	11:46
	Status: Reviewed.		
	Haskell Laboratory/DuPont/Litchfield, C.D. 1982 48-Hour LC50 to Daphnia Magna	HL 157-82	11:50
	Status: Vetted.		
	Haskell Laboratory/DuPont/Litchfield, C.D. 1982 96-Hour LC50 to Rainbow Trout	HL 515-82	11:54
	Status: Reviewed.		
7.3	Non-Target Invertebrates		
7.3.4	Bees		
	Kmetz, K.T. 1984 Acute Contact LD50 Study in Honey Bees	ABM-84-4	31
	Status: Vetted.		

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2.	**Submission No. 84-0585 (formulation)**		
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3.2.3	Dermal Toxicity		
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PART 5	RESIDUE STUDIES		
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