TOWN OF WILMINGTON
DEPARTMENT OF PUBLIC WORKS

DRAFT

VEGETATION MANAGEMENT
YEARLY OPERATIONS PLAN

CALENDAR YEAR 2024

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APPENDIX

INTRODUCTION

The Town of Wilmington has developed a five year Vegetation Management Plan (VMP) to ensure compliance with Rights of Way (ROW) management regulations 333CMR11 for the control of hazard, detrimental, nuisance, and invasive vegetation in order to promote safe travel. The methods proposed by the VMP include mechanical, chemical, cultural (good housekeeping techniques), and developmental control (through ongoing Community Development Technical Review Committee reviews of proposed site projects throughout Town). The number one priority of the plan is public safety. The 5 Year VMP was approved in July of 2019 for years 2020 – 2024.

The VMP proposes an integrated approach whereby priority areas are identified for control, control methods are implemented in an environmentally responsible manner, and ongoing monitoring is performed in order to alter the treatment plans as needed.

This Yearly Operations Plan (YOP) was developed to comply with the requirements of 333CMR11 and to further define specific control strategies for calendar year 2024. A YOP must be submitted to the Massachusetts Department of Agricultural Resources (MDAR) every year herbicides are intended for use to maintain rights-of-way.

Upon receipt of this YOP, the MDAR publishes a notice in the Environmental Monitor for public comment. The Town must provide a copy of the proposed YOP and Environmental Monitor notice to the Board of Health, Conservation Commission, and the Town Manager's Office. The MDAR allows a 45-day comment period on the proposed YOP.

Public notification of herbicide application to the ROWs is made at least 21 days in advance of the treatment by a separate notice. Notice is made to the MDAR, Town Manager's Office, Board of Health, and the Conservation Commission in the Town of Wilmington.

A Request for Determination of Applicability (RDA) was filed with the Wilmington Conservation Commission to approve the wetlands boundary along Rights of Way pursuant to the requirements of 310CMR10.05. A public meeting for the RDA was held on March 6, 2019 and the Commission approved the GIS delineation with the understanding that it would be used only for the purposes of the VMP and that the Conservation Agent would have the option to walk areas of proposed treatment during pre-mark efforts to fine-tune delineation lines. A copy of the sensitive areas map has been included at the end of this YOP.

No spraying was conducted in 2023 and therefore a before and after photo comparison and spray logs have been omitted from the Appendix of this YOP.

IDENTIFICATION AND QUALIFICATIONS OF APPLICANT / INDIVIDUAL SUPERVISING PLAN

Jamie M. Magaldi, PE, MCA
Director of Public Works / Tree Warden
Wilmington Department of Public Works
121 Glen Road
Wilmington, MA 01887
978-658-4481

Mr. Magaldi currently serves as the Public Works Director for the Town of Wilmington Department of Public Works (DPW) and is charged with overseeing the Department's six operational divisions (Highway, Parks & Grounds, Tree, Cemetery, Garage, and Water & Sewer) consisting of approximately forty employees, two of whom are licensed pesticide applicators. Mr. Magaldi also serves as project manager for many of the DPW's internal projects and was appointed Tree Warden for the Town of Wilmington in 2013. He holds a Category 40 (Rights of Way) and 36 (Shade Tree) Certified Applicator's License #42472.

Mr. Magaldi is a professional civil engineer registered in Massachusetts and is also a Massachusetts Certified Arborist. He is a member of the Massachusetts Tree Wardens and Foresters Association, American Public Works Association, Massachusetts Highway Association, Massachusetts Arborists Association and the Society of Municipal Arborists. Mr. Magaldi also holds a Bachelors of Science degree in Civil Engineering from Merrimack College of North Andover, MA.

MUNICIPAL DEPARTMENT PERFORMING HERBICIDE TREATMENT

Wilmington DPW employees and potentially private contractors* will perform the herbicide treatment. Applicators are licensed by the Massachusetts Department of Agricultural Resources in the applicator category. The Town plans to have Mr. Magaldi or another individual on-site during the spray operation who is certified with a Category 40 Certified Applicator's endorsement (rights-of-way).

Certified Applicators: Various
Company or Department: Wilmington DPW
Address: 121 Glen Road, Wilmington, MA 01887
Telephone Number: (978)658-4481

*Private contractors are not expected to be used in 2024 but the Town reserves the right to use them if it is in the best interest of this YOP. Any private contractor who is utilized for application will be an applicator licensed through the State of Massachusetts.

PROPOSED HERBICIDES

Herbicides & Adjuvants	Active Ingredient	EPA Registration Number(s)	Mix Concentration (per 100 gals. water)
Rodeo	Glyphosate	62719-324	1-5%
Oust Extra	Sulfometuron Methyl and Metsulfuron-Methyl	432-1557	10 oz.
Induce, Clean Cut, Transport Ultra, or equivalent surfactant	not applicable (n.a.)	n.a.	0.125%-1%
Point Blank, Stay Put Plus, Border T&O, or equivalent drift retardant	n.a.	n.a.	4-16 oz.

Manufacturer's herbicide labels and the fact sheets for the above listed herbicides are attached to this YOP. Equivalent surfactants and drift retardants will be used in case those listed are no longer available or more effective alternatives become available.

HERBICIDE APPLICATION TECHNIQUES AND ALTERNATIVE CONTROL PROCEDURES

The herbicide(s) will be applied in accordance with the instructions in the manufacturer's label. Alternative control procedures, applicable at the designated "No Spray Zones" will consist of hand cutting, mowing, or selective trimming. Other alternative controls will include routine street sweeping along with crack and road repairs.

Wilmington DPW will generally utilize the two methods of herbicide application: foliar treatment and cut stump treatment.

Foliar Treatment is the application of water-diluted and drift controlled herbicides to fully developed leaves, stems, or blades of a plant. Proposed treatment used shall be low pressure, below 60 psi at the nozzle, and spray equipment will be calibrated according to the manufacturer's label. Low pressure nozzles will be used to produce the largest possible droplet size and a drift control agent shall be added at the rate recommended on the label to keep spray drift to an absolute minimum. Areas include roadside, in pavement cracks, along curb-line, traffic island perimeters, around drainage structures, sign posts and under and around guardrails. Applications will be made in accordance with manufacturer's recommendations.

For vegetation over 12 feet in height which cannot be effectively controlled by foliar treatment, mechanical means will be used along with possible cut stump treatment. It is not expected that this type of herbicide treatment will be used frequently within the limits of Wilmington right-of-ways as much of the target vegetation is under 12 feet in height. However, when cut stump treatment is utilized, a portable pressurized container or hand-paint method will be used to apply the herbicide to the freshly cut stump. Applications will be made in accordance with manufacturer's recommendations.

Foliar treatments will be made using a 50 gal hydraulic truck mounted sprayer, a 3-5 gal back pack style sprayer or 3.5 gal pump sprayers. The herbicide solution is applied to lightly wet the target plant.

All equipment used for vegetation management programs must be maintained in good working condition. Because the Town recognizes the vast variety and performance of herbicide application equipment, this YOP will not specifically dictate how the equipment should be calibrated. However, spray equipment will be calibrated per manufacturers' specifications to legally and effectively follow the requirements of 333CMR11 and the Town of Wilmington's VMP.

The Town of Wilmington will be responsible to ensure that vegetation management activities are conducted in a professional, safe, efficient manner, with special attention directed towards minimal environmental impact. All personnel applying herbicides to Rights of Way must be licensed in the Commonwealth and must work under the on-site supervision of a category 40 certified applicator. All Town and contracted personnel will also follow all label instructions regarding Personal Protective Equipment (PPE).

Applicators will exercise good judgment and common sense during herbicide treatment activities, and will immediately cease operations if adverse conditions or other circumstances warrant.

Herbicides will NOT be applied during the following adverse weather conditions:

A. During high wind velocity, per 333 CMR 11.03

B. Foliar applications during periods of dense fog, or moderate to heavy rainfall

C. Foliar applications of volatile herbicides during periods of high temperatures (90 plus degrees Fahrenheit) and low humidity

D. Cut Stump applications when deep snow (i.e. 6 inches plus or ice frozen on stem or stump) prevents adequate coverage of target plants to facilitate acceptable control

The Town of Wilmington or its contractor will complete daily vegetation management reports that include:

A. Date, name and address of applicator

B. Identification of site or work area

C. List of crew members

D. Type of equipment used

E. Method of application and description of target vegetation

F. Amount, concentration, product name of herbicide(s), adjuvants, and dilutants (EPA registration numbers must be on file)

G. Weather conditions

H. Notation of any unusual conditions or incidents, including public inquiries

IDENTIFICATION OF TARGET VEGETATION

Target vegetation along roadways falls into one or more of the following categories: hazard vegetation, detrimental vegetation, nuisance vegetation, and invasive vegetation.

TARGET VEGETATION CATEGORIES

1. *Hazard Vegetation*. This category represents the highest priority target vegetation as it related directly to public safety. Hazard Vegetation includes vegetation obscuring sightlines, growing over guardrails, creating obstacles to signs or vehicular movement, interfering with critical utilities such as traffic signals, posing windfall hazard over vehicular or pedestrian ways, or creating winter shade leading to icing conditions. In the winter, shadows cast on roadways by evergreen trees can delay melting (especially in "low salt" areas) resulting in possibility of hazardous road conditions and an increase in the amount of de-icing chemicals (road salt) applied.

2. *Detrimental Vegetation.* Vegetation including weeds, grasses, and woody plants that are destructive to or compromise the function of highway structures, including grasses in pavement and bridge joints, medians barriers and traffic islands, as well as vegetation growing in and along drainage structures thus compromising and clogging drainage ways.

3. *Nuisance Vegetation.* Vegetation along roadways that could potentially affect the general public and/or DPW employees maintaining the ROW, such as Poison Ivy (*Toxicodendron radicans*). Poison Ivy and other nuisance vegetation growing within 3 feet of the edge of roadway pavement or sidewalk or other infrastructure requiring maintenance within a Town right-of-way is considered a hazard and will be prioritized accordingly.

4. *Invasive Vegetation.* Non-native species that have spread into native or minimally managed plant systems. Because they tend to be non-native species, there are few local diseases or pests to help control them. Invasive vegetation tends to spread quickly and thrive in disturbed conditions, outcompeting and displacing native species. Specific target invasive plants include but are not limited to Tree of Heaven (*Ailanthus altissima*), Japanese Knotweed (*Polygonum cuspidatum*), Multiflora Rose (*Rosa multiflora*), Oriental Bittersweet (*Celastrus orbiculatus Thunb*.), and Russian Olive (*Eleagnus angustifolia*).

TABLE 1 - SUMMARY OF CONTROL METHODS

TARGET	CONDITIONS	CONTROL METHODS
Grasses	Where terrain and traffic conditions allow	Mechanical (mowing)
Grasses And Low Growth	Under guardrail; or Pavement Cracks; or Joints Where: -Traffic volumes and speeds pose a hazard to motorists and maintenance employees or contractors	Chemical (foliar treatment)
Low Growth	-Terrain allows; and -species are not persistent or invasive	Mechanical (mowing)
Low Growth	-Terrain prevents mowing; and -Species are not persistent or invasive	Mechanical (hand cutting)
Low Growth	Terrain prevents mowing, species are persistent and invasive	Chemical (foliar treatment)
Poison Ivy	Poison Ivy that is within three feet of pavement, or any town structure or appurtenance	Chemical (foliar treatment)
Tall Growth	-Individual trees or branches	Mechanical (selective trimming)
Tall Growth	-Plants >12 feet; or -Terrain too steep; and -Species are not persistent or invasive	Mechanical (hand cutting)
Tall Growth	Plants >12 feet; and -Species are persistent and invasive	Chemical (cut-stump treatment)

DESCRIPTION OF METHODS USED TO DESIGNATE SENSITIVE AREAS

The sensitive areas that are easily recognizable in the field as described and will be marked in the street. Other sensitive areas not easily recognizable in the field will be identified with the use of the Sensitive Areas GIS Map attached to this YOP entitled “Preliminary Resource Area Map for ROW Vegetation Management RDA” dated February 8, 2019.

The Town of Wilmington will pre-mark “spray” and “no spray” areas along the curb line using white or green paint to mark “spray” areas and red or pink paint to mark “no spray” areas. Pursuant to the requirements of the Conservation Commission, the Conservation Agent will be invited to attend the pre-mark in order to fine tune “no spray” areas and help to identify sensitive areas that the GIS map may have misidentified.

SENSITIVE AREA RESTRICTIONS

According to 333 CMR 11.04, sensitive areas are defined as “any areas within ROWs, including No-Spray and Limited-Spray Areas, in which public health, environmental or agricultural concerns warrant special protection to further minimize risks of unreasonable adverse effects”. These include, but are not necessarily limited to: public groundwater supplies, public surface water supplies, private drinking water supplies, surface waters, wetlands, rivers, inhabited areas and agricultural areas. A Sensitive Area Restriction Guide which defines specific areas follows.

TABLE 2 – SENSITIVE AREA RESTRICTION GUIDE

SENSITIVE AREA	NO-SPRAY AREA	LIMITED USE AREA	WHERE IDENTIFIED
Wetlands and Water over Wetlands	Within 10 feet (Unless provisions of 333 CMR 11.04(4)(c) are followed)	10 - 100 feet: 12 months must elapse between applications; selective, low pressure foliar techniques or by cut-stump applications	YOP Maps and identify on site
Certified Vernal Pool	Within 10 feet	10 feet to the outer boundary of any Certified Vernal Pool Habitat; 12 months must elapse between application; selective, low pressure foliar techniques or by cut-stump applications	YOP Maps and identify on site
Public Ground Water Supply	Within 400 feet (Zone I)	Zone II or IWPA (Primary Recharge Area): 24 months must elapse between applications; selective, low pressure foliar techniques or by cut-stump applications	Maps
Surface Waters	Within 10 feet from mean annual high water line	10 feet from the mean annual high water line and the outer boundary of the Riverfront Area; 12 months must elapse between applications; Selective, low pressure foliar techniques or by cut-stump applications	YOP Maps and Identify on site
Agricultural & Inhabited Areas	N/A	0 - 100 feet: 12 months must elapse between application; Selective low pressure foliar techniques or by cut-stump applications	Identify on site
State Listed Species Habitat: No application within habitat area except in accordance with a Yearly Operational Plan approved in writing by the Division of Fisheries and Wildlife			YOP Maps

TABLE 2 (Cont.) – SENSITIVE AREA RESTRICTION GUIDE

Private Water Supply	Within 50 feet	50 – 100 feet 24 months must elapse between applications; Selective low pressure, using foliar techniques or by cut-stump applications	In YOP well list and identify on site
Public Surface Water Supply	Within 100 feet of any Class A public surface water source --- Within 10 feet of any tributary or associated surface water body located outside of the Zone A --- Within 100 feet of any tributary or associated surface water body located within the Zone A of a Class A public surface water source --- Within a lateral distance of 100 feet for 400 feet upstream of any Class B Drinking Water Intake	100 feet to the outer boundary of the Zone A; 24 months must elapse between applications; Selective low pressure, using foliar techniques or basal or cut-stump applications --- 10 feet to the outer boundary of the Zone A; 24 months must elapse between applications; Selective low pressure, using foliar techniques or basal or cut-stump applications --- Within a lateral distance of between 100 – 200 feet for 400 feet upstream of intake; 24 months must elapse between applications; Selective low pressure, using foliar techniques or basal or cut-stump applications	YOP Maps

PROCEDURES / LOCATIONS FOR HANDLING, MIXING AND LOADING OF CONCENTRATES

The herbicide will be mixed in a controlled environment at the Wildwood Cemetery Garage, located at 233 Middlesex Ave, Wilmington, MA 01887, or at the contractor's facilities.

Although it is expected that all the mixed herbicide will be used, any remaining will be stored at the Cemetery Garage, or at the contractor's facilities in accordance with manufacturer's instructions.

The absorbent product "Speedi-Dri" will be available for use at the locations of application. If there is a leak in the hose, the pump will be immediately shutoff and equipment will be washed.

Herbicides will be handled and applied only in accordance with the label instructions. Town applicators and contractors will strictly adhere to all mandated safety precautions directed towards the public, the applicator, and the environment.

REMEDIAL PLAN TO ADDRESS SPILLS AND RELATED ACCIDENTS

All mixing and loading of herbicides will occur at the storage facility in amounts of herbicide necessary to carry out that day's work. This will minimize waste and the need of excess handling. The spray vehicle will be equipped with a clipboard log of the herbicides on board, a bag of adsorbent, absorbent booms, a broom and a shovel in case of a minor spill.

Major Spills
Major spills involve reportable quantities of hazardous materials as defined by the Department of Environmental Protection (DEP) 310 CMR 40.0000. Related accidents include fire, poisoning and automobile accidents. The following protocol will be followed for major spills and accidents:

1. Administer proper first aid and call an ambulance and/or Massachusetts Poison Information Center in cases involving injury due to poisoning.

2. Call the police and/or fire department in cases involving automobile accidents or fire.

3. Avoid breathing fumes of burning herbicides.

4. Put out all sources of fire. Do not light flares, cigarettes, etc. which can ignite certain herbicides.

5. If possible, control the spill by stopping the leak or source of spill.

6. Confine the spread of liquids with a dike composed of soil or other absorptive materials.

7. Call ChemTrec, Massachusetts Pesticide Bureau or chemical manufacturer for assistance (see phone listing below) if unable to handle the spill or the material is unfamiliar.

8. Notify the DEP if water bodies are contaminated, and for releases or threatened releases of reportable quantities of hazardous material.

9. Notify the District Hazardous Material Coordinator.

10. Clean up spill:

    a. If the spill occurs in a public location, isolate the spill areas and deny unauthorized entry until cleanup is complete.

    b. Absorb spilled liquids with sand, absorptive clay, spill control gel, vermiculite, pet litter, sawdust or other absorptive material. Wear proper protective clothing and equipment.

    c. Sweep or shovel contaminated absorbent into a leak proof, sealable container for proper disposal.

    d. Dry herbicides, such as dust, granular and pellets can be directly swept or shoveled into leak proof sealable containers without absorptive materials.

    e. Speedy-Dry or equivalent absorbent material.

    f. Dispose of contaminated material at an approved location.

Minor Spills
Minor spills involve less than reportable quantities of hazardous materials, but are treated similar in terms of personal exposure.

In the event of a spill, information on safety precautions and clean up procedures may be gathered from the following sources:

- Herbicide label
- Herbicide MSDS sheet
- Herbicide Manufacturers / Agencies
  Dow (517) 636-4400
  Corteva (800-992-5994
  Dupont (800) 441-3637
  Monsanto (314) 694-4000
  American Cyanamid Co. (201) 835-3100
  Massachusetts MDAR - Pesticide Bureau (617) 626-1700
  Massachusetts DEP Incident Response Unit (888) 304-1133
  ChemTrec (800) 424-9300
  Massachusetts Poison Control Center (800) 682-9211
  Massachusetts Department of Public Health (617) 624-5757
  Wilmington Department of Public Works (978) 658-4481
  Wilmington Public Safety (Police / Fire) (978) 658-5071

2023 EFFORTS

Vegetation management efforts for calendar year 2023 included various mechanical and cultural practices including roadside flail mowing, street sweeping (removing road crack weeds with the sweeper broom), trimming and pruning by the Town's Tree Division, and careful disposal practices at the Town's yardwaste and compost center. No chemical control of roadside vegetation was applied in 2023. The below table summarizes the multi-year spray history of the current Vegetation Management Plan.

Multi-Year Comparison of Total Volumes 2020 through 2023

VMP Year #	Year	Herbicide Used	Total Concentrate Volume (gallons)	Total Mix Volume (gallons)	Total Roadside Spraying Distance (Linear Feet)
1	2020	5% Glyphosate (DOW Rodeo)	10	200	29,138
2*	2021	5% Glyphosate (DOW Rodeo)	2.5	50	10,409
3	2022	None	0	0	0
4	2023	None	0	0	0

** Year 2 indicates shortened spray routes due to 24-month no spray restrictions in Zone 2 areas*

50-Gallon Lesco Sprayer

"No Spray" marker

"Spray" marker

excavator-mounted flail mower

THE COMMONWEALTH OF MASSACHUSETTS
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GLYPHOSATE

In addition to the review that is presented below, a comprehensive review available from USDA Forest Service provides information that incorporates more recent studies and data. The US Forest Service risk assessment report is available at: http://www.fs.fed.us/foresthealth/pesticide/risk.shtml

Review conducted by MDAR and MassDEP for use in Sensitive Areas of Rights-of-Way in Massachusetts

Common Trade Name(s): Roundup, Glyphosate VMF Round Up Pro, Rodeo, Accord, Accord Concentrate,

Chemical Name: N—(phosphonomethyl)glycine—isopropylamine salt
CAS No.: 1071-83-6

GENERAL INFORMATION
Glyphosate, n-phosphonomethyl glycine, is a systemic, broad spectrum herbicide effective against most plant species, including deep rooted perennial species, annual and biennial species of grasses, sedges, and broadleafed weeds. The major pathway for uptake in plants is through the foliage, however, some root uptake may occur. The presence of surfactants and humidity increases the rate of absorption of glyphosate by plants (15).

Foliarly applied glyphosate is readily absorbed and translocated from treated areas to untreated shoot regions. The mechanism of herbicidal action for glyphosate is believed to be inhibition of amino acid biosynthesis resulting in a reduction of protein synthesis and inhibition of growth (10, 15, 101).

Glyphosate is generally formulated as the isopropylamine salt in aqueous solution (122). Of the three products containing glyphosate considered here, Roundup is sold with a surfactant and Rodeo and Accord are mixed with surfactants prior to use (15). Glyphosate has been reviewed by US Forest Service (15), FAO (122), and EPA 00W (51).

ENVIRONMENTAL FATE

Mobility
Glyphosate is relatively immobile in most soil environments as a result of its strong adsorption to soil particles. Adsorption to soil particles and organic matter begins almost immediately after application. Binding occurs with particular rapidity to clays and organic matter (l5). Clays and organic matter saturated with iron and aluminum (such as in the Northeast) tend to absorb more glyphosate than those saturated with sodium or calcium. The soil phosphate level is the main determinant of the amount of glyphosate adsorbed to soil particles. Soils which are low in phosphates will adsorb higher levels of glyphosate (14, 15).

Glyphosate is classified as immobile by the Helling and Turner classification system. In soil column leaching studies using aged (1 month) Glyphosate, leaching of glyphosate was said to be insignificant after 0.5 inches of water per day for 45 days (14).

Persistence

It has been reported that glyphosate dissipates relatively rapidly when applied to most soils (14). However, studies indicate that the soil half-life is variable and dependent upon soil factors. The half-life of glyphosate in greenhouse studies when applied to silty clay loam, silt loam, and sandy loam at rates of 4 and 8 ppm was 3, 27 and 130 days respectively, independent of application rate (14). An average half-life of 2 months has been reported in field studies for 11 soils (15).

Glyphosate is mainly degraded biologically by soil micro-organisms and has a minimal effect on soil microflora (15). In the soil environment, glyphosate is resistant to chemical degradation such as hydrolysis and is stable to sunlight (15). The primary metabolite of glyphosate is aminomethyl phosphonic acid (AMPA) which has a slower degradation rate than glyphosate (15). The persistence of AMPA is reported to be longer than glyphosate, possibly due to tighter binding to soil (14). No data are available on the toxicity of this compound.

Glyphosate degradation by microorganisms has been widely tested in a variety of field and laboratory studies. Soil characteristics used in these studies have included organic contents, soil types and pHs similar to those that occur in Massachusetts (117).

Glyphosate degradation rates vary considerably across a wide variety of soil types. The rate of degradation is correlated with microbial activity of the soils and does not appear to be largely dependent on soil pH or organic content (117). While degradation rates are likely temperature dependent, most reviews of studies do not report or discuss the dependence of degradation rate on temperature. Mueller et al. (1981 cited in 117) noted that glyphosate degraded in Finnish agricultural soils (loam and fine silt soils) over the winter months; a fact which indicates that degradation would likely take place in similar soils in the cool Massachusetts climate. Glyphosate halflives for laboratory experiments on sandy loam and loamy sand, which are common in Massachusetts, range up to 175 days (117). The generalizations noted for the body of available results are sufficiently robust to incorporate conditions and results applicable to glyphosate use in Massachusetts.

TOXICITY REVIEW

Acute (Mammalian)

Glyphosate has reported oral LD5Os of 4,320 and 5,600 mg/kg in male and female rats (15,4). The oral LD5Os of the two major glyphosate products Rodeo and Roundup are 5,000 and 5,400 mg/kg in the rat (15).

A dermal LD5O of 7,940 mg/kg has been determined in rabbits (15,4). There are reports of mild dermal irritation in rabbits (6), moderate eye irritation in rabbits (7), and possible phototoxicity in humans (9). The product involved in the phototoxicity study was Tumbleweed marketed by Murphys Limited UK (9). Maibach (1986) investigated the irritant and the photo irritant responses in individuals exposed to Roundup (41% glyphosate, water, and surfactant); Pinesol liquid, Johnson Baby Shampoo, and Ivory Liquid dishwashing detergent. The conclusion drawn was that glyphosate has less irritant potential than the Pinesol or the Ivory dishwashing liquid (120).

Metabolism

Elimination of glyphosate is rapid and very little of the material is metabolized (6,106).

Subchronic/Chronic Studies (Mammalian)

In subchronic tests, glyphosate was administered in the diet to dogs and rats at 200, 600, and 2,000 ppm for 90 days. A variety of toxicological endpoints were evaluated with no significant abnormalities reported (15,10).

In other subchronic tests, rats received 0, 1,000, 5,000, or 20,000 ppm (57, 286, 1143 mg/kg) in the diet for 3 months. The no observable adverse effect level (NOAEL) was 20,000 ppm (1,143 mg/kg) (115). In the one year oral dog study, dogs received 20, 100, and 500 mg/kg/day. The no observable effect level (NOEL) was 500 mg/kg (116).

Oncogenicity Studies
Several chronic carcinogenicity studies have been reported for glyphosate including an 18 month, mouse study; and a two year rat study. In the rat study, the animals received 0, 30, 100 or 300 ppm in their diet for 2 years. EPA has determined that the doses in the rat study do not reach the maximum tolerated dose (112) and replacement studies are underway with a high dose of 20,000 ppm (123). The mice received 1000, 5000 or 30,000 ppm for 18 months in their diets. These studies were non-positive (112,109). There was a non-statistically significant increase in a rare renal tumor (renal tubular adenoma (benign) in male mice (109). The rat chronic study needs to be redone with a high dose to fill a partial data gap (112). The EPA weight of evidence classification would be D: not classified (51).

Mutagenicity Testing
Glyphosate has been tested in many short term mutagenicity tests. These include 7 bacterial (including Salmonella typhimurim and B. subtilis) and 1 yeast strain Sacchomyces cerevisiae as well as a mouse dominant lethal test and sister chromatid exchange. The microbial tests were negative up to 2,000 mg/plate (15), as were the mouse dominant lethal and the Chinese hamster ovary cell tests. EPA considers the mutagenicity requirements for glyphosate to be complete in the Guidance for the Registration of Pesticide Products containing glyphosate (112).

The developmental studies that have been done using glyphosate include teratogenicity studies in the rat and rabbit, three generation reproduction studies in the rat, and a reproduction study in the deer mouse. (15)

Rats were exposed to levels of up to 3,500 mg/kg/d in one rat teratology study. There were no teratogenic effects at 3,500 mg/kg/d and the fetotoxicity NOEL was 1,000 mg/kg/d. In the rabbit study a fetotoxicity NOEL was determined at 175 mg/kg/d and no teratogenic effects were observed at 10 or 30 mg/kg/d in one study and 350 mg/kg/d in the other study (15). No effects were observed in the deer mouse collected from conifer forest sprayed at 2 lbs active ingredient per acre (15).

Tolerances & Guidelines
EPA has established tolerances for glyphosate residues in at least 75 agricultural products ranging from 0.1 ppm (most vegetables) to 200 ppm for animal feed commodities such as alfalfa (8).

U.S. EPA Office of Drinking Water has released draft Health Advisories for Glyphosate of 17.50 mg/L (ten day) and 0.70 mg/L (Lifetime)(51).

Avian
Two types of avian toxicity studies have been done with glyphosate: ingestion in adults and exposure of the eggs. The species used in the ingestion studies were the mallard duck, bobwhite quail, and the adult hen (chickens). The 8 day feeding LC5Os in the mallard and bobwhite are both greater than 4,640 ppm. In the hen study, 1,250 mg/kg was administered twice daily for 3 days resulting in a total dose of 15,000 mg/kg. No behavioral or microscopic changes were observed (15).

Invertebrates
A variety of invertebrates (mostly arthropods) and microorganisms from freshwater, marine, and terrestrial ecosystems have been studied for acute toxic effects of technical glyphosate as well as formulated Roundup. The increased toxicity of Roundup compared with technical glyphosate in some studies indicates that it is the surfactant (MONO 818) in Roundup that is the primary toxic agent (117). Acute toxicity information may be summarized as follows:

Glyphosate (technical): Acute toxicity ranges from a 48 hr EC5O for midge larvae of 55 mg/L to a 96 hr TL5O for the fiddler crab of 934 mg/L (15).

Roundup: Acute toxicity ranges from a 48 hr EC5O for Daphnia of 3 mg/L to a 95 hr LC5O for crayfish of 1000 mg/L (15).

Among the insects tested, the LD50 for honeybees was 100 mg/bee 48 hours after either ingestion, or topical application of technical glyphosate and Roundup. This level of experimental exposure is considerably in excess of exposure levels that would occur during normal field applications (15).

Aquatic Species (Fish) Technical glyphosate and the formulation Roundup have been tested on various fish species. Roundup is more toxic than glyphosate, and it is the surfactant that is considered to be the primary toxic agent in Roundup:

Glyphosate (technical):
Acute 96 hr LC5Os range from 24 mg/L for bluegill (Dynamic test) to 168 mg/L for the harlequin fish (15).

Roundup: Acute lethal toxicity values range from a 96 hr LC5O for the fathead minnow of 2.3 mg/L to a 96 hr TL5O for rainbow trout of 48 mg/L (15).

Tests with Roundup show that the egg stage is the least sensitive fish life stage. The toxicity increases as the fish enter the sac fry and early swim up stages.

Higher test temperatures increased the toxicity of Roundup to fish, as did higher pH (up to pH 7.5). Above pH 7.5, no change in toxicity is observed.

Glyphosate alone is considered to be only slightly acutely toxic to fish species (LC5Os greater than 10 mg/L), whereas Roundup is considered to be toxic to some species of fish, having LC5Os generally lower than 10 mg/L (15,118).

SUMMARY
Glyphosate when used as recommended by the manufacturer, is unlikely to enter watercourses through run-off or leaching following terrestrial application (117). Toxic levels are therefore unlikely to occur in water bodies with normal application rates and practices (118).

Glyphosate has oral LD5Os of 4,320 and 5,600 in male and female rats respectively. The elimination is rapid and very little of it is metabolized. The NOAEL in rats was 20,000 ppm and 500 mg/kg/d in dogs. No teratogenic effect was observed at doses up to 3,500 mg/kg/d and the fetotoxicity NOELS were 1,000 mg/kg/d in the rat and 175 mg/kg/d in the rabbit.

The evidence of oncogenicity in animals is judged as insufficient at this time to permit classification of the carcinogenic potential of glyphosate. The compound is not mutagenic.

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METSULFURON METHYL

In addition to the review that is presented below, a comprehensive review available from USDA Forest Service provides information that incorporates more recent studies and data. The US Forest Service risk assessment report is available at: http://www.fs.fed.us/foresthealth/pesticide/risk.shtml

Review conducted by MDAR and MassDEP for use in Sensitive Areas of Rights-of-Way in Massachusetts

Common Trade Names: Escort, Escort XP (2)

Chemical Name: Methyl 2 E[C[(4-Methoxy—6-methyl-l,3,5-Triazifl—
2-yl) aminolcarbonyl] amino] sulfonyl.]benzoate] (9)

CAS NO.: 74223-64-6

GENERAL INFORMATION

Metsulfuron methyl is a sulfonyl urea herbicide initially registered by E.I. DuPont in 1986. It is a foliar herbicide registered for use on wheat and barley and non-cropland sites such as Right of Way (9).

ENVIRONMENTAL FATE

Mobility

Metsulfuron methyl is a relatively new herbicide. The studies reviewed here have been provided by the registrant, EI DuPont.

The soil water partition coefficients (Kd) of Metsulfuron Methyl have been determined in four different soils: Cecil sand, Flanagan silt loam, Fallsington silt loam, and keyport silt loam. The Kd values range from 0.36 for Cecil sand to 1.40 for Flanagan silt loam, and Kom values ranged from 29 for Fallsington silt loam to 120 for Cecil sand (100). The values for Kd and Kom indicate that metsulfuron methyl is not adsorbed well to soil and that the organic content of the soil is not the only adsorption component. The silt and clay contents appear to influence adsorption, but there are probably other factors also involved.

The previous study also determined the Rf values for soil. Thin layer chromatography was performed on four soils for metsulfuron methyl. The Rf values ranged from 0.64 to 1.00; only one value was less than 0.90 (100). This result confirms the validity of the Kd values, indicating that metsulfuron methyl is mobiie and that the organic matter content of the Soil is a significant component of adsorption.

Metsulfuron methyl was applied to tops of 12 inch columns [containing four different soils], and eluted with 20 inches of water in 20 hours. Following the percolation of the total volume of water, 106% of the metsulfuron

methyl was eluted from the Fallsington sandy loam, 96% from the Flanagan silt loam, 81% for Keyport silt loam and 93% for Myakka sand (100). The breakthrough volumes for the Fallsington, Flangan, Keyport and Myakka soils were 6.5, 4.5, 6.9 and 5.8 inches of water respectively (101).

Metsulfuron methyl is relatively mobile in most soils, but will be retained longer in soils with higher percentages of organic matter.

Persistence

There are two studies which have reviewed the persistence of metsulfuron methyl in the soil. One study was conducted in the southern United States and the second was in the northern United States and Canada. The results of the studies indicate a somewhat contradictory picture of the persistence of metsulfuron methyl.

The soil half-lives in Delaware, North Carolina, Mississippi and Florida were 1 week, 4 weeks, 3 weeks and 1 week respectively following an application in mid to late summer (102). The results are varied and indicate that either climatic or soil factors determine the persistence. The climate is sufficiently similar to be able to discount that as a factor. However, both of the locations where the shortest half-lives were observed had the highest organic matter content in the soils. Furthermore, the half—lives correspond with the organic matter content.

The half—lives following spring applications were 4 and 56 weeks for two sites in Colorado, 6 weeks in North Dakota and 28 weeks in Idaho (103). In contrast to the southern United States study there does not appear to be any correlation with climatic or soil characteristics. There appears to be a slightly shorter half—life in acidic soils in the same location.

Metsulfuron methyl was also applied in the fall and the half-lives determined in two sites in Colorado, North Dakota and Idaho. These half—lives were 8 weeks, 12 weeks, 42 weeks and 28 weeks respectively. As was expected there were longer half—lives following fall applications in North Dakota (6 weeks vs. 42 weeks) however, in Idaho there was no change at all, which is unexpected.

In Canada following spring applications the reported half-lives were 10 weeks, 4 weeks, 4 weeks and 6 weeks for Alberta, 2 locations in Saskatchewan and Manitoba (103). One would expect longer half lives in Northern locations due to the effects of temperature on degradation rates. The results from Canada are generally shorter than those in the U.S. locations, which is unexpected.

Therefore, the half-life of Metsulfuron methyl in the soil is variable and dependent on the location. It is shorter when applied in the spring but appears independent of other environmental factors in most locations.

TOXICITY REVIEW

Acute (Mammalian)

The toxicology database for Metsulfuron methyl has been reviewed and accepted by the EPA (9). DuPont supplied excerpts from their monograph on Ally herbicide (112). Summaries of studies were supplied by DuPont for subchronic, chronic and reproductive studies.

Technical metsulfuron methyl has been tested in two acute oral LD50 studies in Crl:CD Rats. In the first study the LD5O was greater than 5,000 mg/kg and in the second it was greater than 25,000 mg/kg (the maximum feasible dose) (112). Clinical signs included salivation, chromodacryorrhea, stained face, stained perineal area and weight loss (112).

In a 10—dose subacute study using male rats, a single repeated dose of 3,400 mg/kg/day for 10 days over a 2 week period was administered. This was followed by a two week recovery period. No deaths occurred and slight weight loss was the only clinical sign observed. In addition, no gross or microscopic changes were observed (112). The dermal LD50 is greater than 2,000 mg/kg in male and female rabbits (112). Technical metsulfuron methyl caused mild erythema as a 40% solution in guinea pigs. There was no reaction observed at the 4% concentration. No response occurred when treated animals were challenged (112).

In rabbits, moderate areas of slight corneal clouding and severe to moderate conjunctivitis were observed in both washed and unwashed eyes following treatment with technical metsulfuron methyl. The unwashed eyes were

normal in 3 days and the washed eyes in 14 days (112).

Metabolism
Elimination of metsulfuron methyl in the rat is rapid, with 91% of a radioactive dose excreted over 96 hours (9). The routes of elimination were not specified within the report.

Subchronic/Chronic (Mammalian)
Ninety day feeding studies have been done with metsulfuron methyl in rats and mice. The rat study was done in conjunction with a one generation reproduction study (see Developmental Study Section). In this study rats received 0, 100, 1000, or 7500 ppm (0, 5.7, 57, 428 mg/kg/d) (a) in their diets. Effects observed at the high dose were: a decrease in body weight and an increase in total serum protein in the females, and a decrease in liver weight and a decrease in cytoplasmic clearing of hepatocytes in the males the NOEL in this study was 1000 ppm (104).

The 90 day mouse study was done in conjunction with the 18 month mouse study. Groups of 90 mice per sex per dose received 0, 5, 25, 500, 2500 or 5000 ppm (0, 0.66, 3.3, 66.6, 333.3, 666.6 mg/kg/d) in their diets. Clinical evaluations were made at 1, 2, 3, 6, 12 and 18 months. Ten animals per group were sacrificed at the 90 day time point for pathological evaluation. The 2500 ppm group was sacrificed at 12 months. Sporadic effects were observed on the body weight, food consumption, and organ weights. These were not dose related, resulting in a NOEL of 5000 ppm in diet for mice (111).

In the twenty-one day dermal rabbit study, the intact skin of male and female New Zealand White Rabbits received doses of 0, 125, 500 and 2,000 mg/kg for 6 hrs/day for 21 days. Clinical signs observed were sporadic weight loss and diarrhea in a few rabbits. These effects were not dose related. Non dose related histological effects were observed in male rabbits. This effect was characterized as mild testicular atrophy occurring sporadically at all doses (112, 108).

Feeding studies in dogs have been done with purebred beagles. The animals received metsulfuron methyl in diets at dose levels of 0, 50, 500 and 5000 ppm (0, 0.2, 2, 20 mg/kg/d) for one year. There was a decrease in food consumption in the high dose males. There was a decrease in serum lactate dehydrogenase in all groups of both sexes at two or more doses these values were within the historical controls. The NOEL was 500 ppm in the males and 5000 ppm in females (112).

In a chronic feeding study in rats, the animals received metsulfuron methyl at doses of 0, 5, 25, 500, 2500 or 5000 ppm (0, 0.28, 1.4, 28.6, 143 or 286 mg/kg/d. Interim sacrifices were done at 13 and 52 weeks (105).

At the 13 week sacrifice there was a decrease in body weight in the 2500 and 5000 ppm groups; there was a decrease in absolute liver weight at 2500 and 5000 ppm males. There was a decrease in the relative liver weights in the 2500 and 5000 ppm females.

(a) In these discussions the assumptions made for estimated conversion of ppm (diet) to mg/kg/D were:
Species Body weight (kg) Intake (kg)
Rat 0.35 0.020 Mouse 0.03 0.004 Dog 10 0.4
When data were presented as ppm, the dose was estimated in mg/kg and is presented in parenthesis.

Findings at the 52 week sacrifice included increase in kidney weight (2500 ppm males) and increased absolute brain weights (at doses of 25, 500, 2500 and 5000 ppm) in males and at doses of 2,500 and 5000 ppm in females. There was an increase in absolute heart weight at 2500 ppm in males and at 2500 and 5000 ppm in females. The absolute organ weights were back to normal at termination. Relative brain weights of the 2500 and 5000 ppm groups were increased (105)

Oncogenicity Studies
There were no gross or histopathological changes observed in mice receiving up to 5000 ppm metsulfuron methyl in their diets (112. 111). Similar results were obtained in the 104 week rat study; there were no histopathological changes observed which were attributable to metsulfuron methyl (105, 112). EPA concludes that there were no

oncogenic effects in rats or mice at the highest dose tested; 5000 ppm in both cases (9).

Mutagenicity Testing

Metsulfuron methyl was negative in the unscheduled DNA synthesis assay; in vivo bone marrow cytogenic assay in rats (doses were 500, 1,000, and 5,000 mglkg bw); CHO/HGPRT Assay; Salmonella typhimurium reverse mutation assay four strains with and without S9 metabolic activation; and also in the in vivo mouse micronucleus assay at doses of 166, 500, 1666, 3000 and 5000 mg/kg (112). 'T¶e only positive mutagenicity assay was in the in vitro assay for chromosome aberrations in Chinese Hamster Ovary at high doses (greater than 2.63 mM, 1.0 mg/mL)). In this assay no increases in structural aberrations were observed at 0.13 or 1.32 mM(0.05 or 0.5 mg/mL) (112).

Developmental Studies

Several studies have been done to investigate the effects of Metsulfuron methyl on reproduction and development in rats and rabbits.

Pregnant Cr1: COBS CD(SD) BR rats received metsulfuron methyl at doses of 0, 40, 250 or 1000 mg/kg by the oral route on days 5 to 14 of gestation. There were 25 rats per group. Maternal toxicity was observed at doses of 250 and 1000 mg/kg/d. The maternal toxicity NOEL was 40 mg/kg/d. There was no evidence of "teratogenic" response or embryo fetal toxicity (112).

In the rabbit study, New Zealand white rabbits received 0, 25, 100, 300 or 700 mg/kg/d on days 6 to 18 gestation. There was a dose related increase in maternal deaths; 1, 2 and 12 deaths at doses of 100, 300 and 700 mg/kg respectively. The maternal toxicity NOEL was 25 mg/kg/d and there was no evidence of teratogenic or embryolethal effects observed in this study (112).

Several multigenerational studies have been done with Metsulfuron methyl. A four litter reproduction study was done concurrently with the chronic bioassay. Rats from each treatment were separated from the main study and bred. The doses were 0, 5, 25, 500, 2500, and 5000 ppm (0, 0.28, 1.4, 28.6, 143 and 286 mg/kg/d). There was a dose dependent decrease in body weight in the parental (P1) generation at doses of 25 ppm and greater in males and females. This effect was not present in dams during gestation or lactation (106).

Overall fertility in the P1 and filial (Fl) matings was low in both control and treated groups with no apparent cause. There was a decrease in pup size in the Fla but not the Flb, F2a, or F2b litters. The gestation index was 100% for all groups in both filial generations with the exception of F2a when it was 90%. On the basis of the lower body weights and lower growth rates, the NOEL was 25 ppm for this study (106).

In a 90 day, 2 generation 4 litter protocol, rats received 0, 25, 500 or 5000 ppm (0, 1.4, 28.6, 286 mg/kg/d) Metsulfuron methyl in their diets for 90 days prior to mating. In this protocol the parental generation was bred twice first to produce the Fla and then the FiB. The FiB rats were then fed the appropridte diet for 90 days (after weaning). There was a decrease in litter size in the 5000 ppm group in the F2a generation, but not in any other generation. The NOEL for this study was 500 ppm (107).

In a 90 day feeding, one generation rat study, 16 male and 16 female rats received 0, 100, 1000 or 7500 ppm in their diet prior to mating. There were no differences observed in reproduction and lactation performance or litter survival among groups. There was an overall low fertility in the control and treated groups. This result made the effects of metsulfuron methyl on fertility difficult to assess from this study (104).

Tolerances and Guidelines

Tolerances have been set for metsulfuron methyl in barley wheat (from 0.05 to 20 ppm, depending on the commodity) and in meat and meat byproducts (0.1 ppm). The tolerance in milk is 0.05 ppm (8, 9). The acceptable daily intake is 0.0125 mg/kg/d based on a one year dog NOEL of 1.25 mg/kg/d using a safety factor of 100 (9).

Avian

Metsulfuron methyl has been tested in two species of birds, the mallard duck and the bobwhite quail. The acute oral LD5O is greater than 2150 mg/kg in the duck. Two, 8 day dietary studies have been done. The 8 day LC5O is greater than 5620 ppm in both the duck and the quail (9).

Invertebrates

The 48 hour LC5O for Daphnia is greater than 150 ppm and the acute toxicity in the honeybee is greater than 25 mg/bee (9).

Aquatic

Metsulfuron methyl has acute LC5O of greater than 150 ppm in both the rainbow trout and the bluegill sunfish (9).

Summary

Metsulfuron methyl has a moderate to high mobility in the soil profile and is relatively persistent in the environment, especially when applied in the fall. These factors would be of concern under most circumstances. However, metsulfuron methyl is applied at very low rates (3-4 ozs./A) and therefore the amounts which reach the soil are quite low. Consequently, Metsulfuron methyl should not impact groundwater as a result of leaching or migrate from the target area. Metsulfuron methyl has low toxicity (EPA Toxicity Category III) for acute dermal exposure and primary eye irritation and is category IV for all other acute exposures. The chronic studies indicate no oncogenicity response and the systemic NOEL's are 500 ppm in rats and 5000 ppm in mice. There was no evidence of teratological effects in the rat or the rabbit at the highest dose tested in both species. While there was evidence of maternal toxicity at 40 mg/kg/d in the rat and 100 mg/kg/d in the rabbits.

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SULFOMETURON METHYL

In addition to the review that is presented below, a comprehensive review available from USDA Forest Service provides information that incorporates more recent studies and data. The US Forest Service risk assessment report is available at: http://www.fs.fed.us/foresthealth/pesticide/risk.shtml

Review conducted by MDAR and MassDEP for use in Sensitive Areas of Rights-of-Way in Massachusetts

COMMON TRADE NAME(S): Oust

CHEMICAL NAME : N-[4,6-dimethylpyrimidin-2-yI) amino-carbonyl -2-methoxycarbonylbenzenesulfonaflhide

CAS NO: 74222-97-2

GENERAL INFORMATION

Sulfometuron methyl, the active ingredient in the herbicide Oust, is a member of the group of sulfonylurea herbicides. Sulfometuron Methyl is a broad-spectrum selective weed control agent used in non-crop areas. Oust is applied pre- or post-emergence which provides control against many broad-leaf weeds and grasses through contact and residual activity. (15)

ENVIRONMENTAL FATE

Mobility

The mobility of sulfometuron methyl has been reported in literature and the database available is complete. Sulfometuron methyl is a weak acid (pKa 5.2) and consequently, adsorption coefficients were calculated for various soils at pH values of 5, 6, and 7. In a low organic matter I soil (1%) the adsorption coefficients were 2.0, 0.8 and 0.3 at the respective pH values. This study indicates that sulfometuron methyl is more strongly adsorbed to soil as the pH decreased, and as organic matter increases. (15)

Soil thin layer chromatography and adsorption coefficients were performed and calculated for four standard soils. Kd values ranged from 0.71 to 2.85 and Rf values ranged from 0.33 to 0.85 indicated a moderate mobility. In addition, soil column studies using the same four soils indicate a moderate to moderately high mobility pesticide. Koc values calculated from the soil Kd values range from 61 to 122 which is lower than the EPA guideline of 400. (101)

In a field mobility study, sulfometuron methyl was applied to soil tubes in five locations (Delaware, North Carolina, Oregon, Colorado, and Saskatchewan, Canada) at a rate of 1 lb a.i./Acre. There was no report of rainfall at these sites. Each application was made at a different time making it difficult to compare results. Samples were taken for a minimum of a year and at some for two years, and at 8 cm (3 in) intervals to 32 cm (12 inches). Results indicate that sulfometuron methyl is moderately mobile under most conditions. One surprising fact is that immediately after application, all locations had detectable residues in a layer below the top layer of soil, and in two locations (Colorado and Oregon) in the deepest layer sampled. All locations except Delaware also had detectable residues at the 24-32 cm layer at other times during the study. There are also indications that sulfometuron methyl would leach further than the deepest soil layer which was sampled. (102)

Persistence

Sulfometuron methyl is degraded by microbial action, photo-decomposition and by hydrolysis at acidic pH's. The photolysis half-life on soil is between 1 to 2 weeks and in distilled water, approximately 160 hours. The hydrolysis half-life at pH 2 and 5 is 100 and 475 hours respectively. At neutral or basic pH's, sulfometuron methyl is stable to hydrolysis. (15,100, 101)

Reports indicate that the overall rate of sulfometuron methyl degradation in soil depends on pH and soil moisture content. Half-lives of one week were reported under laboratory conditions, but field studies at neutral pH revealed greater persistence. Increased soil moisture content resulted in increased degradation rates, but only approximately 10%. (15, 101)

The soil half-life is reported as four weeks with longer times in colder conditions. A review of available studies, however reveals that the shortest half-life was six weeks in Delaware. In the same study the half-life ranged from six weeks to one year in Oregon. (15, 102)

The reported half-life of four weeks is relatively short and would not be cause for concern. However, it seems evident that in most circumstances it may be significantly longer. In all cases reported in this study, the half-life was six weeks or longer and a more realistic estimate may be closer to two months. Another point discussed in the literature is the lack of any significant degradation during the cold periods of the year. Applications in the late fall could lead to longer half-lives and thereby more potential for increased leaching.

The field study discusses the faster degradation rates of sulfometuron methyl in the east as possibly attributable to the more acidic and moister soils in the east. This is certainly true and may in fact have contributed to shorter half-lives, but a point which is not discussed was the timing of the applications. The two western sites were treated in early to mid-July, whereas the western sites were treated in the fall. Saskatchewan was treated in late July, but the climate at that location is cooler and becomes much colder.

TOXICITY REVIEW

Five animals per sex per group were gavaged with sulfometuron methyl suspended in corn oil at a dosage of 5,000 mg/kg. Gross pathological examination revealed slight weight increase in the lungs that were pale red with grey foci in males and similar lung effects in one female. In addition, four females had a pink thymus and one had a slight liver weight. The oral LD50 in male and female ChR-CD rats was determined to be greater than 5,000 mg/kg. (110)

The inhalation LC5O was tested in groups of five male and five female Crl:CD rats. Rats were exposed to control air or test concentrations of either 6.4 or 11 mg/L. There were no clinical or pathological differences between controls or test groups. The inhalation LC5O was greater than 5.0 mg/L (111) while sulfometuron methyl was tested at 6.4 and 11 mg/L. The EPA cutoff for LC5O concentration is 5 mg/L.

Acute skin absorption LD5O tests were performed on five male and five female New Zealand white rabbits. Doses of 2,000 mg/kg of pesticide were applied to abraded skin on the back of the rabbit. Clinical signs in males were sporadic weight loss, slight erythema 1 to 2 days after treatment and diarrhea at 11 days. Gross pathological examination showed no changes due to the test material. The dermal LD5O in rabbits was greater than 2,000

mg/kg. (112)

In a separate acute dermal LD5O test, four groups of five adult male and one group of five adult female New Zealand rabbits were used. Groups of males were dosed at the following levels: 1,500 mg/kg, 2,000 mg/kg, and 8,000 mg/kg and the females were dosed at 2,000 mg/kg. Clinical signs in all the groups of males were moderate to mild redness and sporadic weight loss. The animals in the two highest dose experienced mild swelling, the 2,000 mg/kg group showed moderate swelling while the 1,500 mg/kg group had slight swelling. Clinical signs in the females were severe to mild redness, severe to slight swelling and sporadic weight loss. There were no compound related pathological observations. There was one death in the male 2,000 kg/mg group, but it was not believed to be related to the compound. The LD5O for the acute skin absorption in rabbits was greater than 2,000 mg/kg. (116)

Eye irritation studies were performed by placing 10 mg of solid test material in the conjunctival ac of each of two albino rabbits. There were no corneal or iritic effect. However, there was redness (1 hour to 1 day; not washed eyes and mild for 1 hour unwashed eyes); swelling (1 to 4 hours unwashed eyes) and no discharge was observed. Both washed and unwashed eyes were normal within 1 to 2 days. (113)

In guinea pigs, both primary skin irritation and sensitization tests were run. Ten animals per group were exposed to 0.05 ml of either a 50% or a 5% suspension of sulfometuron methyl. The 50% suspension showed mild to no skin irritation response in 24 hours and no irritation at 48 hours. The 5% suspension reproduced no skin irritation. There was no sensitization response. (114)

The oral LD5O test was conducted with the formulation using young male and female adult Crl:CD rats, five rats per group. 5,000 mg/kg was administered by gavage in a 25% suspension in corn oil. The only clinical finding was alopecia in males. Gross pathological examination showed in both males and females slightly heavy lungs that were pale to pale red with red to dark red foci and white mottling in 1 to 3 animals. The LD5O is greater than 5,000 mg/kg. Additionally in a range finding study, no mortalities were seen in doses from up to 7,500 mg/kg. (115)

Nine male albino rabbits were tested for eye irritation studies. The right eyes were treated with 0.1 ml (61.8 mg) of test material. The left eyes served as untreated controls. Results indicated a transient localized area of slight corneal cloudiness in 2 of the 6 unwashed eyes. The eyes returned to normal in 2 to 3 days. Two of the three eyes treated and washed showed a transient localized area slight corneal cloudiness and mild conjunctivitis with no iritic effects. The washed eyes returned to normal within 3 to 4 days. This compound was considered a slight to mild irritant. (117)

Skin irritation tests were conducted on six male albino rabbits. Doses of 0.5 g of solid pesticide (moistened with saline) were applied to two intact and two abraded skin areas on each rabbit. Each rabbit serves as its own control; treated areas were compared to adjacent untreated areas. Observations and scoring were done by the method of Draize (118) and at 24 and 72 hours after exposure. The compound was not found to be a primary irritant on either intact or abraded skin of rabbits. (119)

Primary skin irritation tests were performed on ten guinea pigs. The procedure was the same as used in testing the technical sulfometuron methyl. Doses of 0.05 ml of a 50% suspension of the pesticide in dimethyl phthalate were used. The 50% suspension caused mild to no irritation in five of the animals. No irritation was caused by the 5% suspension. No sensitization response was observed. (120)

Subchronic and Chronic Studies (Mammalian)

Male and female CD-i mice were fed diets to which had been added 0, 100, 1,000, or 7,500 ppm (0, 13.3, 133, or 997 mg/kg) (a) sulfometuron methyl for 90 days. Hematological evaluations were conducted on all mice (tail cut bleeding at approximately 1, 2 and 3 months after study initiation. All mice were sacrificed and necropsied at 90 days. Organs were weighed and examined histologically. Male mice fed the diet containing 7,500 ppm pesticide showed reduced mean body weights and weight gains. Growth of the 100 and 1,000 ppm groups of males and all treated females was the same as that in the control group. No mortalities occurred. (121)

Hemolytic effects were seen as a result of dietary exposure to sulfometuron methyl in all groups. Significant increases in leukocyte count were found in the 7,500 ppm (997 mg/kg) males. There were statistically significant changes in other blood parameters that were not dose related. Mean absolute and relative liver weights were elevated in all male treatment groups. Histological examination revealed bile stasis in five of ten males in the 7,500 ppm group. In the females, a slight increase in relative liver weight and increased hepatocellular cytoplasmic granularity was observed. Decreases in both mean and relative thymus weights were observed in all treated male groups. Thymic cortical atrophy occurred in three males in the 7,500 ppm group and one male in the 100 ppm group. Because of low frequency of occurrence 7,500 and 100 ppm and absence in the 1,000 ppm group, the thymic cortical atrophy is not considered to be related to the decreased thymus wrights. Based on the observed hemolytic effect, there was no NOEL from this study.

In a second mouse study, five groups of 80 males and 80 female Crl:CD-1 (1 CR)BR mice were fed diets containing one of the following concentrations of sulfometuron methyl: 0. 5, 20, 100, or 1,000 ppm (0, 0.66, 2.66, 13.3,133 mg/kg) for 18 months. Food consumption was monitored throughout the study, mice were weighted and hematological evaluations were performed at regular intervals. At 18 months, mice were sacrificed and necropsied. Mean body weights and mean body weight gains in all treatment groups except for the 1,000 ppm female group were comparable to control groups. Sporadic changes in weight gain were observed in that group.

(a) In these discussions the assumptions made for conversion of ppm (diet) to mg/kg/D were:

SPECIES BODYWEIGHT (kg) INTAKE ((kg)
Rat 0.35 0.020 Mouse 0.03 0.004 Dog 10 0.4
(133)
When data was presented as ppm the does was estimated in mg/kg and is presented in parenthesis.

Mild anemia was observed in the female 1,000 ppm group as evidenced by statistically significant decreases in erythrocyte count, hemoglobin concentration and hematocrit. There was also a significant increase in mean corpuscular volume and platelet count. While the hematological results appear to differ from those in the 90 day mouse study, the data indicate that there were several statistically significant changes in some blood parameters at the three month (90 day) sampling time which were not apparent at other sampling times. However, although reticulocyte smears were made, they were not evaluated and it cannot be ascertained that a response to a hemolytic effect actually occurred. If it did, a NOEL in this strain of mice for a hemolytic effect at 90 days in the 18 month study would be 5 ppm. There was a non-dose related but, statistically significant increase in the incidence of amyloidosis in the female 1,000 ppm groups, but no specific target organ was identified. The overall NOEL for dietary intake of sulfometuron methyl for male and female mice was 1,000 ppm (133 mg/kg) and 100 ppm (13.3 mg/kg) respectively under the conditions of this study based on body weight, body weight gain, clinical pathology and pathological findings. (124)

Groups of 16 male and 16 female CD rats were fed diets containing 0, 100, 1,000, 5,000 ppm (0, 5.7 57, 285 mg/kg) sulfometuron methyl. At 1, 2 and 3 months after the study initiation, hematological, urological and clinical chemistry evaluations were performed. At the end of the study, ten rats from each group were sacrificed and evaluated pathologically. There were no differences between treatments and controls in body weight, weight gain, food consumption and food efficiency. There were no mortalities. The only clinical sign observed was alopecia in three males in the 100 ppm group. The male 5,000 ppm treatment group showed slightly elevated mean leukocyte counts, increased mean relative number of lymphocytes and decreased mean relative number of neutrophils. Due to the effects of white blood cells in male 5,000 ppm group, the NOEL dietary concentration i this study was 1,000 ppm (56 mg/kg/D). (122)

Four groups of five male and five female New Zealand white rabbits were dermally exposed to either 1, 125, 500, or 2,000 mg/kg, six hours per day for 21 consecutive days. After the exposure period, three male and three female rabbits per group were sacrificed for pathological evaluation. The remaining two males and two females from each group were sacrificed and evaluated pathologically following a two week recovery period. Clinical signs observed in rabbits from all test groups including controls were sporadic weight loss and diarrhea. Histopathological and clinical pathological examination showed no compound-related effects. One rabbit did after the eighth dose from

causes not related to the test substance. (123)

Groups of 80 male and 80 female Crl:CD (SD) BR rates were fed diets containing 0, 50, 500 or 5,000 ppm (0, .8, 28.5, or 285 mg/kg) sulfometuron methyl for approximately two years. Hematological, clinical chemistry and urological testing was conducted a 3, 6, 9,12,18, and 24 months. After 12 months, ten male and ten female rats per group were randomly selected, sacrificed and pathologically examined. At 24 months, all surviving rats were sacrificed, necropsied, and examined pathologically.

In the female 5,000 ppm group, food consumption throughout the study was slightly depressed and overall mean weight gain during the first year and mean body weights during the second year were significantly depressed. There were no abnormalities in appearance or behavior observed during the study.

Decreased erythrocyte count and hematocrit in the male 500 and 5,000 ppm groups were observed at the 24 month clinical evaluation suggesting a minimal dose-related hemolytic effect. There were no other compound related hematological, clinical chemistry or urological abnormalities observed. Mean absolute brain weights were significantly lower in the male 5,000 ppm group at both one and two sacrifice times. However, no abnormal gross or histological observation were noted. Mean relative and absolute thymus weight of the 500 and 5,000 ppm males was decreased compared to controls at terminal sacrifice. Mean testes weights of rats in the 5600 and 5,000 ppm groups were less than controls.

Histological examinations revealed dose-dependent increases in the incidence of bile duct hyperplasia and fibrosis in the female 500 and 5,000 ppm groups at the two year sacrifice. Severity of the lesions were minimal to mild, suggesting a slightly toxic effect of sulfometuron methyl on the livers of these female rats.

The NOEL in this strain of rat under these study conditions was 50 ppm (2.8 mg/kg/D). (125)

Oncogenicity Studies

Oncogenic endpoints were evaluated in the chronic mouse and rat studies for sulfometuron methyl. Cr1: CD-i (1 CR) BR mice received 0, 5, 20, 100, or 1,000 ppm sulfometuron in the diet of 18 months. There were no compound related increases in tumor incidence (124). CRL:CD (SD) BR rats received 0, 50, 500, or 5,000 ppm sulfometuron in the diet for two years. There was no increase in frequency of occurrence of tumors in these rats (125). Sulfometuron methyl is not carcinogenic in rats and mice under these conditions.

Mutagenicity Testing

The Ames Salmonella/microsome assay tested the ability of Sulfometuron methyl to revert four strains of Salmonella typhimurium from histidine dependence to histidine independence. The assay was performed both with and without a rat liver homogenate (S-9) activation system. The test substance was found not to be mutagenic for these strains of bacteria under the test conditions at doses from 2.5 to 1,000 mg/plate. (129)

Frequency of chromosome aberrations was tested in CHO cells both with and without metabolic activation (S-9). The doses tested ranged from 300 ug/mI to 10 ng/ml in a half log series. No increase in chromosome aberrations was observed in culture exposed under the test conditions to these concentrations of the test material. (130)

The CHO cell line was used to test mutations in the gene coding for the enzyme hypoxanthineguanine phosphoribosyl transferase (HGPRT) both in the presence and absence of an activation (S-9) system. Concentration of the test material ranged from 0 to .1 mM. No mutagenic activity was detected. (131)

The ability of sulfometuron methyl to induce unscheduled DNA (UDS) synthesis in freshly isolated rat hepatocytes was tested. Concentrations of test material ranged for 1 X 10 -5 to 1.0 mM in half log increments. Under these test conditions, no induction of UDS was detected. (132)

Developmental Studies

Groups of 17 female artificially inseminated rabbits wee gavaged with test material on days 6 to 18 of gestation. Dosage levels were 0, 30, 100, and 300 mg/kg suspended in 0.5% methylcellulose in water. Animals were sacrificed on day 29 of gestation and fetuses wee removed by cesarean section. No treatment-related effects were observed in the maternal clinical observations or gross pathology. There were no statistically significant differences between control and treatment groups in any of the other parameters measured (maternal body weight changes, clinical observations, survival, gross pathology pregnancy rates, numbers and percentages of corpora lutea, implantations, resorptions in each maternal animal, fetal sex, viability and development). Under the conditions of this study, sulfometuron methyl was not considered to be teratogenic in New Zealand white rabbits. (127)

A teratology study was conducted using female Crl:CD (SR) BR rats which were fed a diet containing sulfometuron methyl. Concentrations of 0, 50, 1,000, and 5,000 ppm were used. Thirty-five rats were used as controls, 25 rats were assigned to the 50 and 1,000 ppm group and 15 rats were assigned to the 5,000 ppm group. Rats were fed the test diet on days 6 to 15 of gestation and sacrificed on day 21 of gestation for gross and histological examination. (128)

Rats on the highest dose level gained significantly less weight and ate significantly less feed than controls. The fetuses of this exposure group weighted significantly less than those of the control dams. No other adverse effects were noted in the lower exposure groups. No teratogenicity was demonstrated in this study. The minimum effect level of maternal toxicity and embryofetal toxicity was 5,000 ppm (286 mg/kg) and the NOEL under these study conditions was 1,000 ppm (57 mg/kg). (128) Reproductive studies were performed in conjunction with the 90 day feeding study in rats and the two year feeding study in rats.

In the 90 day feeding study (122), six male and six female rats which had been fed diets obtaining 0,100,1,000, and 5,000 ppm of sulfometuron methyl (for 90 days) were mated and delivered litters. No adverse effects were observed as indicated by fertility, gestation, viability and lactation indies. In addition, there wee no differences between treatment and controls in the mean body weights and survival of weaning pups.

In the two year feeding study (125), 20 rats per group were used in a two generation, four litter reproduction study, initiated 90 days after the start of the long-term feeding study. Fo rats were mated. Females were allowed to give birth and Fla pups wee followed until weaning (21 days) at which time they were sacrificed. Fo females wee again mated, but to different Fo males. Fib pups were delivered and observed. At weaning, 20 males and 20 females were selected from each dietary level (0, 50, 500, and 5,000 ppm) and continued on the treatment for 90 days. Fib rats were bred twice within their respective group, producing F2a and F2b litters. Ten males and ten females from the F2b litters were sacrificed and examined histologically. (125)

During the 90 day feeding period for Fl b rats, body weight and diet consumption were decreased in the female 5,000 ppm group. The number of pus born and the number of pups born alive to the 5,000 ppm groups was consistently lower in both the Fl and F2 generations and was statistically significant for F2b litters. Decreased pup counts may reflect the general health status of the mother as evidenced by decreased body weight and diet consumption of the Fl b 5,000 ppm group. No gross or histopathological changes or effects on organ weights were observed in the weaned F2b rats. The NOEL established, based on this sub-study was 500 ppm (28 mg/kg). (125)

Avian Toxicity

Sulfometuron methyl has been tested in the bobwhite quail and the mallard duck. The **8** day dietary LC5O's were greater than 5,620 and 5,000 ppm respectively. The acute oral LD5O in the mallard duck was greater than 5,000 mg/kg. (101)

Invertebrate Toxicity

The aquatic invertebrate, Daphnia magna was tested and the 48 hour LOSO was greater than 12.5 ppm sulfometuron methyl. (15)

Aquatic Toxicity

Species tested on the aquatic toxicity studies include bluegill sunfish (96 hour) and rainbow trout (96 hour). In both cases the LC5O was greater than 12.5 ppm.

A life stage study was done using the fathead minnow. There were no effects observed on embryo hatch, larval survival or growth at concentrations of 1.2 mg/L or less. (15)

SUMMARY

Sulfometuron methyl is a material both moderately mobile and moderately persistent. A closer look at the material however, reveals that the Oust is applied at the average rate of five ounces of product (3.75 oz a.i.)/acre or 106 grams per acre. These studies were conducted with applications of 1 lb a.i./acre. The lower application rates both minimize the persistence of sulfometuron methyl in soil and thereby diminish the amount of material which is available to leach through the soil. Therefore, sulfometuron may be used if the application rates are kept sufficiently low. This is because the soil organic material and soil microorganisms are able to absorb and degrade lower rates of pesticides.

The oral LD50 in rats for sulfometuron methyl is greater than 5,000 mg/kg and the dermal LD5O is greater than 2,000 mg/kg in rabbits.

The sub-chronic and chronic NOELS are 50 ppm (2.8 mg/kg/D) in rates; 200 ppm (i mg/kg/D) in dogs; and 5 ppm (0.66 mg/kg/D) at 90 days for the reversible hemolytic effect and 100 ppm (13.3 mg/kg/D) at two years in the mouse. This makes the mouse at 90 days the most sensitive species with a transient hemolytic effect, to sulfometuron methyl exposure.

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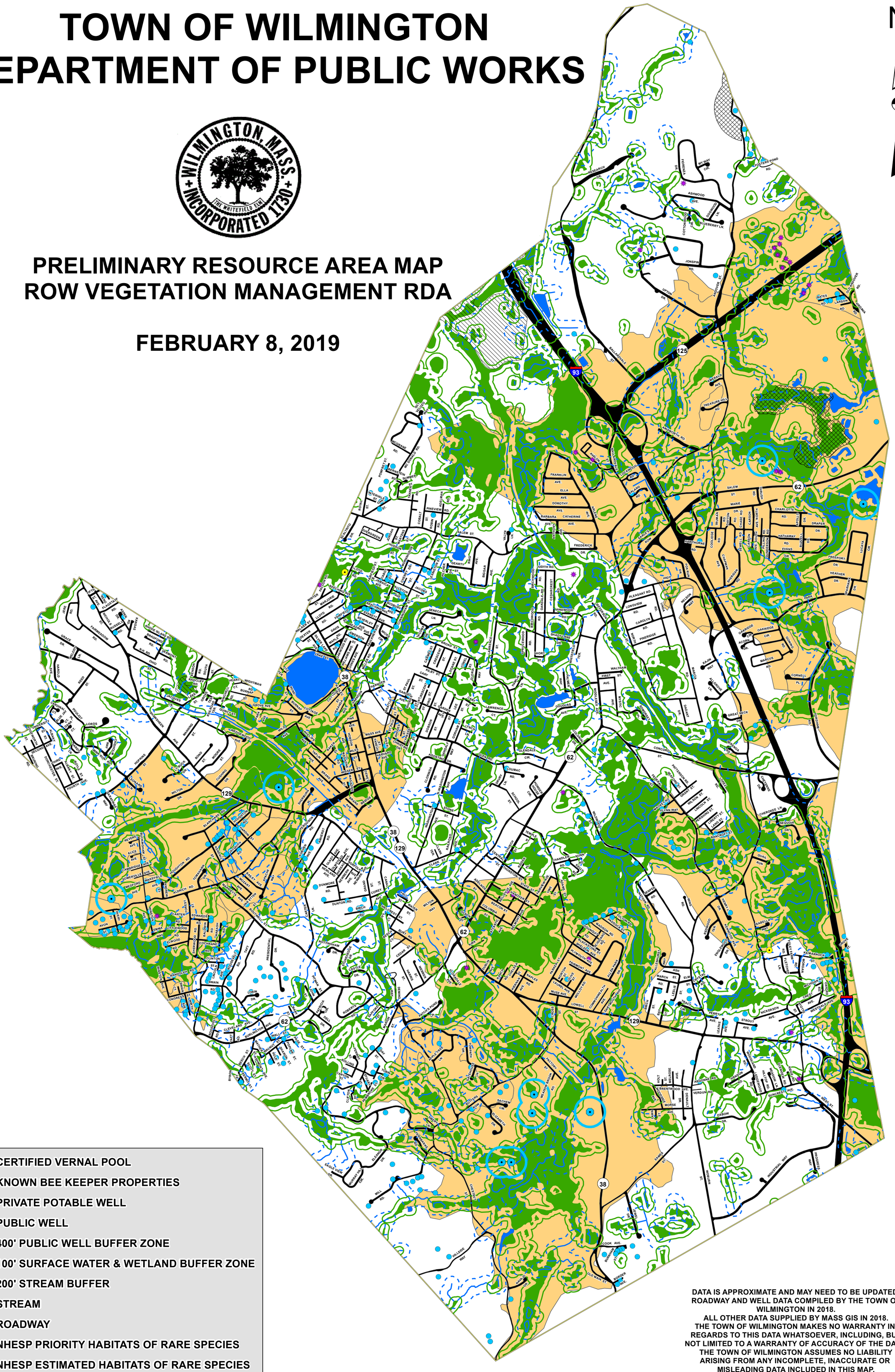
TOWN OF WILMINGTON
DEPARTMENT OF PUBLIC WORKS

PRELIMINARY RESOURCE AREA MAP
ROW VEGETATION MANAGEMENT RDA

FEBRUARY 8, 2019



- CERTIFIED VERNAL POOL
- KNOWN BEE KEEPER PROPERTIES
- PRIVATE POTABLE WELL
- PUBLIC WELL
- 400' PUBLIC WELL BUFFER ZONE
- 100' SURFACE WATER & WETLAND BUFFER ZONE
- 200' STREAM BUFFER
- STREAM
- ROADWAY
- NHESP PRIORITY HABITATS OF RARE SPECIES
- NHESP ESTIMATED HABITATS OF RARE SPECIES
- POND
- WETLAND
- DEP APPROVED ZONE II AREAS

DATA IS APPROXIMATE AND MAY NEED TO BE UPDATED.
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3,000 1,500 0 3,000 Feet