



COMMONWEALTH OF MASSACHUSETTS  
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS  
DEPARTMENT OF FOOD AND AGRICULTURE  
100 CAMBRIDGE ST., BOSTON, MA 02202 617-727-3000 FAX 727-7235

ARGEO PAUL CELLUCCI  
Governor

TRUDY COXE  
Secretary

JONATHAN L. HEALY  
Commissioner

NOTICE

Pursuant to the provisions of the Rights-of-Way Management Regulation, 333 CMR 11.00, in order to apply herbicides to control vegetation along railroad rights-of-way, a five-year Vegetation Management Plan (VMP) and a Yearly Operational Plan (YOP) must be approved by the Department of Food and Agriculture. Therefore, notice of receipt of a YOP and procedures for public review are hereby given as required by Section 11.06 (3).

A Yearly Operational Plan has been submitted for: MBTA Massachusetts Bay Transportation Authority, Rapid Transit Lines.

This plan has been prepared and submitted to the Department of Food and Agriculture by: TEC Associates of South Portland, Maine.

Municipalities identified in the MBTA YOP as locations where the rights-of-way will be treated with herbicides during the 1998 calendar year are:

Boston, Braintree, Cambridge, Everett, Malden, Medford, Quincy, Revere, Somerville.

One selective application of a DFA approved herbicide mixture is proposed to occur in the 1998 calendar year within approved areas along MBTA Rapid Transit Lines rights-of-way. Public notification (by certified mail) will be provided to the chief elected official, Board of Health, and Conservation Commission in each affected municipality at least twenty-one days prior to any herbicide application.

Herbicide applications to yards, the roadbed, and areas around switches, signals, and signs will be conducted with a spray truck and/or a backpack sprayer according to the guidelines set forth in the VMP and YOP. Sensitive areas as defined by the Rights-of-Way Management Regulations will receive the full protection afforded by those regulations. All herbicide applications will be done by an applicator properly licensed by the DFA Pesticide Bureau and fully trained in herbicide mixing, handling, and application methods. Applications will commence following approval of the YOP by the DFA. This post-emergent application is scheduled for late July and August.

offices which have received copies of the YOP have completed their review and corrections have been duly made by the applicant and approved by the Department.

A failure by the city/town to respond to the applicants submission of the YOP within the forty five (45) day public review period, will automatically be considered by the DFA to indicate agreement by municipal officials with the sensitive area demarcations as provided by the applicant in their YOP.

Any questions or comments on the information provided in this Notice and the procedures established for the municipal review as outlined above, should be addressed to:

Dennis Guastalli  
Supervisory Inspector  
Massachusetts Pesticide Bureau  
100 Cambridge Street  
Boston, Massachusetts 02202

## PUBLIC REVIEW

The Department of Food and Agriculture (DFA) in particular seeks the verification of sensitive area locations reported in the Yearly Operational Plan (YOP). The Department itself has a limited ability to survey the geography, land use, and the water supplies, in all the communities through which the rights-of-way are located. Municipalities, however, have most of this information readily available, and the particular knowledge with which to better certify the sensitive areas in their communities. Therefore, the Department requests, and urges, the assistance of the affected municipalities, in reviewing the completeness and accuracy of the maps contained in the submitted document. The DFA has established the following procedures for this review.

Yearly Operational Plans (YOP) and a copy of this notice will be sent by the applicant to the Conservation Commission, Board of Health (or designated health agent), and to the Head of Government (Mayor, City Manager, Chair of the Board of Selectman) of each municipality where herbicides are to be applied along the Rights-of-Way during the calendar year. Municipal agencies and officials will have (45) forty-five days, following receipt of the Yearly Operational Plan to review the maps contained in the document that indicate the location of "sensitive areas not readily identifiable in the filed" for inaccuracies and omissions. "Sensitive Areas" will be defined as in Section 11.01 a-f.

Municipal agencies and officials are requested to forward the YOP to the appropriate officials(s) in their municipality qualified to certify the accuracy of sensitive area locations as indicated on the maps. The maps should be "corrected" and returned to the applicant, also a copy of the maps with these corrections indicated should be sent to the Department of Food and Agriculture at the address listed below within the forty-five day review period. If a city or town needs more time to carry out this review, it should send a written request for an extension to the DFA and cite why there is a "good cause" for requesting additional time.

All corrections will be required to be made by the applicant, and corrected maps sent back to the city/town before the YOP can be considered "approved" by the Department for vegetation maintenance in that municipality. Any dispute on the part of the applicant regarding corrections made by the municipal authorities, should be indicated in writing to the Department and to the city/town which requested the disputed changes within (15) fifteen days of receipt of the request. The Department will decide whether or not the YOP should be approved without the requested changes. The DFA will consider the "final approval" of a YOP individually for each municipality.

The final (21) twenty one days of the public review period may serve concurrently to provide public notification as required by section 11.07 of the Rights-of-Way Management regulation, if the applicant has an approved VMP and if all the requisite city/town

The YOP contains the names and application rates of the herbicides proposed for use along with DFA approved herbicide fact sheets for each product. Additionally, the YOP contains the names of the herbicide applicator and YOP supervisor, and procedures for mixing and handling herbicide concentrates. A description of sensitive area flagging methods is included along with updates of sensitive area maps for each town.

# Yearly Operational Plan

1998

---

## MASSACHUSETTS BAY TRANSPORTATION AUTHORITY RAPID TRANSIT LINES

21 Arlington Avenue  
Charlestown, MA 02150

---

Prepared by:

TEC Associates  
46 Sawyer Street  
South Portland, Maine 04106

### ABSTRACT:

This Yearly Operational Plan (YOP) describes the vegetation management operations for the Railroad's rights-of-way (ROW) scheduled for vegetation maintenance during this calendar year in compliance with the Commonwealth of Massachusetts ROW Management Regulations 333 CMR 11.00.

*This YOP is a companion document to the Vegetation Management Plan (VMP) which has been approved by the Department of Food and Agriculture.*

## INTRODUCTION

Both Federal and State laws require railroads to manage vegetation to help insure the safe passage of people, material, and goods.

The Code of Federal Regulations mandates the safety of the railroad must be guaranteed by regular inspection and maintenance. Vegetation must be controlled so that it does not become a fire hazard, does not interfere with visibility, or impede direct visual inspections of the track structure. Vegetation must also be managed to allow for proper drainage of the track and ballast structure, to prevent tree and branch damage to cargo and to provide safe footing and working conditions for trackage personnel. Vegetation growing along side the rails can prevent effective and adequate braking, especially in emergency situations.

The purpose of 333 CMR 11.00, Rights of Way Management, is to promote the implementation of Integrated Pest management techniques and to establish standards, requirements, and procedures necessary to minimize the risk of unreasonable adverse effects on human health and the environment associated with the use of herbicides to maintain rights-of-way. These regulations establish procedures which guarantee ample opportunity for public and municipal agency review and input on right-of-way maintenance plans.

A Yearly Operational Plan or YOP must be submitted to the Department of Food and Agriculture every year herbicides are intended for use to maintain Rights of Way. The YOP provides a detailed program for vegetation management for the year. This YOP is a companion document to the Vegetation Management Plan (VMP) approved by the Department. The VMP is the long term management plan for the railroad which describes the intended program for vegetation control over a five year period.

Upon receipt of this YOP, the Department publishes a notice in the Environmental Monitor. The applicant has provided a copy of the YOP and Environmental Monitor notice to the Board of Health, Conservation Commission and the chief elected municipal official for the city or town in which the herbicide treatment is proposed.

The Department allows a 45 day comment period on the proposed YOP beginning with publication of the notice in the Environmental Monitor and receipt of the YOP and Environmental Monitor notice by each municipality.

Public notification of herbicide application to the right of way is made by certified mail under separate cover at least 21 days in advance of the treatment. Notice is made to the Department of Food and Agriculture; the Mayor, City Manager or chairman of the Board of Selectman; the Board of Health; and the Conservation Commission of the municipality where the right-of-way lies.

Any comments on this YOP should be directed to the railroad contact person listed on page 2.

MUNICIPALITIES WHERE TREATMENT DESCRIBED IN THIS YOP WILL BE MADE.

Boston

Braintree

Cambridge

Everett

Malden

Medford

Quincy

Revere

Somerville

## YOP REQUIREMENTS AND TABLE OF CONTENTS

	Page
I. The company which will perform any herbicide treatment	1
II. Individual representing applicant and supervising the YOP	1
III. Herbicides proposed including application rates, carriers, and adjuvants	2
IV. Herbicide application techniques and alternative control procedures	3
V. Identification of target vegetation	4
VI. Flagging methods to designate sensitive areas on the ROW	5
VII. Procedures and locations for handling, mixing and loading of herbicide concentrates	6
VIII. Emergency contacts	7

### APPENDICES

- A. Herbicide Fact Sheets as approved by the Department of Food and Agriculture
- B. Maps locating the ROW and Sensitive areas not readily identifiable in the field

I. THE COMPANY WHICH WILL PERFORM ANY HERBICIDE TREATMENT

This company or contractor will perform the herbicide treatment. Applicators are certified by the Department of Food and Agriculture in the applicator category Right of Way Pest Control.

Company Name RWC, INC.  
Lockhouse Road  
Address P.O. Box 876  
Westfield, MA 01086

Telephone # (413) 562-5681

Contact Person(s) John B. Roy

II. INDIVIDUAL REPRESENTING APPLICANT AND SUPERVISING THE YOP

Individual supervising execution of the YOP and representing the railroad.

Name and Title Jerry Ramano, Supt.  
Rail Fabrication and Equipment Service  
Address 21 Arlington Avenue  
Charlestown, MA 02150

Phone Number (617) 222-3243

### III. HERBICIDES PROPOSED INCLUDING APPLICATION RATES, CARRIERS, ADJUVANTS, AND APPLICATION TECHNIQUES

#### Weed Control Herbicide Program for the Roadbed

The post-emergent herbicide program is aimed primarily toward keeping the ballast section and shoulder, yards, switches, signals, and highway grade crossings weed free. Areas scheduled for weed control treatments have been inspected for density of target vegetation to determine appropriate control methods. Herbicide Fact Sheets for the herbicides proposed are found in Appendix A.

Location	Herbicide(s)	Carriers or Adjuvants	Application Technique	Application Rate
Sensitive area buffer zone	Rodeo	Incite 80 More	Foliar Foliar Foliar	3 qts/acre 3 oz/acre 2-4 oz/acre
Non-sensitive areas	Rodeo	Incite 80 More	Foliar Foliar Foliar	3 qts/acre 3 oz/acre 2-4 oz/acre
Touch-up applications	None			

#### Brush Control Program For Areas Adjacent To The Roadbed

The brush control program is designed to prevent the regrowth of trees and other woody vegetation in areas adjacent to the roadbed. Areas scheduled for brush control treatments are limited to target vegetation which obscures visibility or interferes with railroad signs, signals, or communication wires. Herbicide Fact Sheets for herbicides proposed may be found in Appendix A.

Location	Herbicide(s)	Carriers or Adjuvants	Application Technique	Application Rate
Non-sensitive areas	None			
Touch-up applications	None			

#### IV. HERBICIDE APPLICATION TECHNIQUES AND ALTERNATIVE CONTROL PROCEDURES

Herbicide application within the Railroad ROW will be performed using low pressure application from a specialized high rail track equipped with a spray boom. This method is suitable for application within the buffer zone, or restricted application zone, of sensitive areas, as defined in 333 CMR 11.04. The spray vehicle is equipped with spray nozzles and controls to allow for treatment of the entire roadbed, or to selectively treat individual sections of the ballast and ballast shoulders. Within sensitive areas, a "container" will be used to catch any accidental dripping of herbicide. It is a trough-shaped apparatus mounted just behind and above the boom, and will be hydraulically lowered to sit underneath the spray nozzles while the vehicle is traveling through areas where herbicide spraying is prohibited.

In order to assist in rapid identification of sensitive areas in the field, a pilot vehicle will proceed approximately 1/4 mile ahead of the applicator vehicle in order to signal ahead the location of sensitive areas.

In order to provide greater mobility and decrease the amount of time required to apply the herbicide mixture in the railroad yard areas, a vehicle equipped with hoses will be used in these areas. In compliance with the Regulations for herbicide application in Sensitive Areas, the spray pressure from the hoses will not exceed 60 psi.

#### ALTERNATIVE CONTROL PROCEDURES

No alternative vegetation control methods are feasible within the track areas of the ROW. No vegetation control is proposed in ballast areas where herbicide use is prohibited. Areas not treated or prohibited from herbicide application will be maintained mechanically and manually.

Touch-up techniques controls any target vegetation within the ballast that may have been missed or not treated during the initial phase. Control of vines and other vegetation that might creep onto the ballast from roots growing outside the original treatment boundaries can be managed as a selective, foliage, or spot spray. No more than 10% of the initially identified target vegetation on the ROW in any municipality may be treated during a touch-up application and the total amount of herbicide applied in any one year shall not exceed the limits specified by the label of YOP [per 11.03(8)(C)].

## V. IDENTIFICATION OF TARGET VEGETATION

Whenever and wherever possible an integrated approach to vegetation management will be implemented by encouraging plant communities that hinder the growth of target vegetation. Prior to a herbicide application, a review will be made noting location, density, and type of vegetation present. This information will be used to develop a herbicide application program that will be effective against target vegetation and minimize the amount of herbicide used.

All vegetation growing in the ballast and ballast shoulder; in yards; and around switches, signals, signs and highway grade crossings is considered target vegetation and must be controlled so that it does not:

- a) become a fire hazard to track-carry structures;
- b) obstruct visibility of railroad signs and signals;
- c) interfere with railroad employees performing normal trackside duties;
- d) prevent proper functioning of signal and communication lines; and
- e) prevent railroad employees from visually inspecting moving equipment from their normal duty stations.

Woody vegetation growing in areas adjacent to the shoulder will be managed to promote the growth of low growing shrubs. Targeted woody vegetation will be that which has the potential to block visibility or invade the roadbed and/or overhead communication lines. Target vegetation will include but not be limited to the following:

Ailantus	Black Walnut	Honey Locust
American Basswood	Buckthorn	Maple
American Beech	Butternut	Northern Catalpa
American Hornbeam	Cherry	Oak
Apple	Eastern Hophornbeam	Pine
Ash	Eastern Redcedar	Poplar
Aspen	Elm	Sassafras
Birch	Flowering Dogwood	Shadbrush
Black Locust	Hawthorn	Spruce
Black Tupelo	Hickory	Sumac

## VI. FLAGGING METHODS TO DESIGNATE SENSITIVE AREAS ON THE ROW

Sensitive areas are defined in the Rights-Of-Way Management Regulations(333 CMR 11.02) as those areas within the ROW in which public health, environmental, or agricultural concerns warrant special protection to further minimize risks of unreasonable adverse effects. These include but are not limited to the following:

- Within the primary recharge area of a public drinking water supply well.
- Within 400 feet of any surface water used as a public water supply.
- Within 100 feet of any identified private drinking water supply.
- Within 100 feet of any standing or flowing water.
- Within 100 feet of any inhabited or agricultural area.
- Within 100 feet of any wetlands.

No-spray areas are those in which herbicide spraying is prohibited. It includes track within 400 feet of a public water supply wellhead, 100 feet from a public surface water supply, a 50 foot radius around a private well, and 10 feet from the edge of standing or flowing water or wetlands.

Limited-spray areas are those in which spraying is restricted to one annual application of an herbicide through low pressure foliar techniques. This includes track between 10 and 100 feet from the edge of standing or flowing water or wetlands. Lengths of track within the primary recharge area around a public water supply wellhead, between 100-400 feet from the edge of a public surface water supply, and between 50 and 100 foot radius around a public well, spraying is restricted to one application every other year of an herbicide through low pressure foliar techniques.

Non-sensitive areas which are upland areas and/or lengths of track without proximate sensitive areas do not require specific precautions or herbicide restrictions.

Sensitive areas, no-spray areas, limited-spray areas and non-sensitive areas will be marked at their boundaries with permanent color-coded markers. Sensitive areas considered to be readily identifiable in the field (i.e. agricultural and inhabited areas) will not be marked. The markers will be one or any combination of the following:

- color-coded signs attached to posts
- color-coded signs attached to the railroad ties
- color-coded painted rail sections

Sensitive and non-sensitive areas will be designated by the following color-codes:

- white non-sensitive areas
- blue sensitive area in which a minimum of 12 months shall elapse between herbicide applications
- yellow no spray zone
- double blue sensitive areas in which a minimum of 24 months shall elapse between herbicide applications

## VII. PROCEDURES AND LOCATIONS FOR HANDLING, MIXING AND LOADING OF HERBICIDE CONCENTRATES

The herbicide application crew will wear protective clothing and personal safety equipment when mixing, handling, loading or applying herbicide, including standard work clothing or coveralls, work gloves and work boots. Latex or nitrile rubber gloves, as well as eye goggles are recommended to be worn during mixing of herbicide concentrate as ARSENAL and ROUNDUP herbicides may cause mild eye and skin irritations.

Mixing and use of herbicide shall be consistent with the labeling instructions included on the packaging. The herbicide mix will be prepared from herbicide concentrate and water. In compliance with the regulations, the handling, mixing and/or loading of this material will not occur within 100 feet of any Sensitive Area. Wherever and whenever possible, the herbicide applicator will prepare the herbicide mix on non-porous surfaces, such as pavement or concrete.

### Sources of Water and Safeguards to Prevent Contamination

Water used for herbicide mix will be obtained from hydrants and freshwater sources. During the herbicide mix preparations and during herbicide application, strict adherence to the following safeguards will be maintained:

- 1) Water will be obtained using hoses equipped with anti-siphon devices to eliminate herbicide backflow.
  - a) Hoses used to extract water from waterbodies will be equipped with two such devices: one will be found directly behind the mouth of the hose and another will be at the coupling which joins the hose to the mix tank.
  - b) Hoses used to extract water from the hydrant will utilize the same setup as described above, except that a third anti-siphon device will be found within the coupling joining the hose to the hydrant.
- 2) The herbicide concentrate will not be added to the tank until the water has been obtained and the application apparatus is at least 100 feet outside a Sensitive Area.

### Disposal of Herbicidal Wastes

Disposal of all herbicidal wastes will be the responsibility of the licensed applicator. It is the applicator's responsibility to ensure that such disposal will be carried out in an environmentally sensitive manner, in compliance with all Federal and State regulations and guidelines.

## VIII. EMERGENCY CONTACTS

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

Herbicide Label

Herbicide Fact Sheet

Herbicide Material Safety Data Sheet

Herbicide Manufacturer

DuPont

(800) 424-9300

Monsanto

(314) 694-4000

Massachusetts Pesticide Bureau

(617) 727-3020

Massachusetts Department of Environmental Protection

(617) 292-5500

Chemtrec

(800) 424-9300

EPA Pesticide Hotline

(800) 858-7378

Massachusetts Poison Control Center

(800) 682-9211

Local Community Chief of Police and/or Fire Chief

---

Boston	(617) 247-4200
Brookline	(617) 730-2222
Cambridge	(617) 498-9300
Everett	(617) 389-2120
Malden	(781) 322-1212
Medford	(781) 395-1212
Quincy	(617) 479-1212
Revere	(781) 284-1212
Somerville	(617) 625-1600

## **APPENDICES**

**A. Herbicide Fact Sheets as approved by the Department**

**B. Maps locating the ROW and Sensitive areas not readily identifiable in the field.**

**Maps provided with the Yearly Operational Plan shall remain effective for the duration of the YOP unless modified. Subsequent YOPs will contain any modifications to the maps made during the previous year.**

APPENDIX A  
HERBICIDE FACT SHEETS

# HERBICIDE FACT SHEET

MASSACHUSETTS DEPARTMENT OF FOOD & AGRICULTURE

100 Cambridge Street, Boston MA 02202 (617) 727-7112 August Schumacher Jr., Commissioner



## GLYPHOSATE

Common Trade Name(s): Roundup, Rodeo, Accord

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 deeprooted 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 ODW (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 (15). 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 half-lives 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 LD50s of 4,320 and 5,600 mg/kg in male and female rats (15,4). The oral LD50s of the two major glyphosate products Rodeo and Roundup are 5,000 and 5,400 mg/kg in the rat (15).

A dermal LD50 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 two year rat study. In the rat study, the animals received 0, 30, 100 or 300 ppm in 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).

## Developmental Studies

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 LC50s 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 EC50 for midge larvae of 55 mg/L to a 96 hr TL50 for the fiddler crab of 934 mg/L (15).

Roundup: Acute toxicity ranges from a 48 hr EC50 for Daphnia of 3 mg/L to a 96 hr LC50 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 LC50s 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 LC50 for the fathead minnow of 2.3 mg/L to a 96 hr TL50 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 (LC50s greater than 10 mg/L), whereas Roundup is considered to be toxic to some species of fish, having LC50s 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 LD50s 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.

### REFERENCES

1. The Agrochemicals Handbook: 1983  
Reference manual to chemical pesticides  
Pub. by the Royal Society of Chemistry  
The University, Nottingham NG7 2RD, England
4. RTECS Registry of Toxic Effects of Chemical Substances: 1982  
NIOSH, US Dept. of Health and Human Services  
Ref QV 605 T755 Vol. 1,2,&3 1981-1982
6. The FDA Surveillance Index and Memorandum: Aug. 1981 and up  
Review and recommendations of the US Food & Drug Admin.  
Pub. by NTIS, US Dept. of Commerce

7. NTP Technical Report Series  
U.S. Dept. of Health and Human Services  
Pub. by The National Institute of Health
8. BNA Chemical Regulation Reporter: starts 1977  
A weekly view of activity affecting chemical users and  
manufacturers.  
Pub. by The Bureau of National Affairs, Inc. 0148-7973
9. Dept. of Justice - Drug Enforcement Administration  
Memo dated September 26, 1985
10. The Herbicide Handbook: 1983 Fifth Ed.  
Handbook of the Weed Science Society of America  
Pub. by the Weed Science Society of America, Champaign, Ill.
14. GEIR Generic Environmental Impact Report: 1985  
Control of vegetation of utilities & Railroad Rights of Way  
Pub. by Harrison Biotec, Cambridge, MA
15. Pesticide Background Statements: Aug. 1984  
USDA Forest Service Agriculture Handbook #633 Vol. 1
51. Office of Drinking Water Health Advisories, USEPA
101. IUPAC Advances In Pesticide Science (1978) V-2 p. 139.
106. Hietanen, E., Linnainmaa, K. and Vainco, H. (1983) Effects of  
Phenoxyherbicides and Glyphosate on the Hepatic and Intestinal  
Biotransformation Activities in the Rat Acta Pharmacol et Tox  
53 p. 103-112.
109. Dept. of Justice - Drug Enforcement Administration Memo dated Septem  
26, 1985.
112. Guidance for the Re-registration of Pesticide Products Containing  
Glyphosate, June 1986
115. Monsanto-Memo-Rat Feeding Study 3 Month.
116. Monsanto-Memo-RE: Day 1 year oral
117. The Herbicide Glyphosate  
Grossbard, E. and Atkinson, D. (19)
118. Non-Target Impacts of the Herbicide Glyphosate  
Mammal Pest Management, LTD.
120. Maibach, H.I. (1986) Irritation, Sensitization, Photo Irritation and  
Photosensitic assays with a Glyphosate Herbicide. Contact  
Dermatitis 15 152-156.
122. Pesticide Residues in Food - 1986  
FAO Plant Production and Protection Paper 77.
123. Personal communication with Bill Heydens of Monsanto 2/16/89.

## APPENDIX B

### MAPS

**NOTE:** Maps of sensitive areas along the right-of-way have been provided as part of the Request for a Determination process and in previous Yearly Operational Plans. Please refer to these maps. New maps will continue to be provided only as they are updated or modified.

26 June 1998

Cambridge Conservation Commission  
57 Inman Street  
Cambridge, MA 02139

RE: MBTA Rapid Transit Lines  
1998 Vegetation Control Program

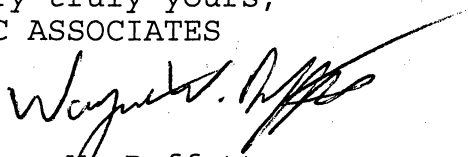
Dear Commission Members:

Enclosed is the MBTA Rapid Transit Lines' 1998 Yearly Operational Plan prepared in accordance with the Massachusetts Rights-of-Way Management Regulations (333 CMR 11.00). Maps of the affected rights-of-way were provided to you as part of the Request for a Determination process. These maps continue in effect unless modified and should be retained in your files. The indication on the maps of public and private drinking water supplies remains an on-going process. Please notify TEC Associates and the Department of Food and Agriculture of any omissions.

The herbicide application as proposed in the 1998 Yearly Operational Plan is scheduled for the period of 22 August through 4 September 1998.

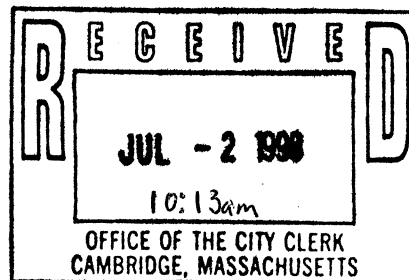
The location of signs marking the limited and no spray zones will be verified prior to the application. Please call TEC Associates with any questions about this Plan.

Very truly yours,  
TEC ASSOCIATES

  
Wayne W. Duffett

Enclosure

cc: Board of Health  
Board of Selectmen  
Dennis Guastalli, DFA  
Jerry Ramano, MBTA



Comm and Rpts from City *5455*  
Officers #1

A communication was received from D. Margaret Drury, City Clerk, transmitting notice from the Dept. of Food and Agriculture regarding the MBTA Yearly Operational Plan to apply herbicides to locations including Cambridge and Massachusetts Department of Food and Agricultural Notice of Plan Submission.

In City Council July 27, 1998

**PLACED ON FILE**

