



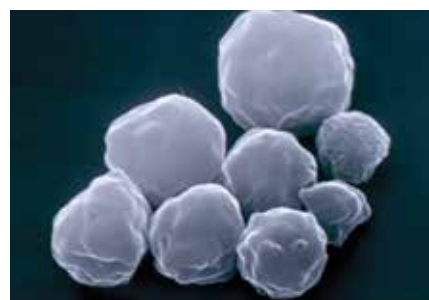
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Bioinsecticide

GYPCHEK

*Bioinsecticide for Gypsy Moth Control in Forested Ecosystems
and Urban Communities*



Tank Mixes and Directions for Use

Richard Reardon, John Podgwaite, Roger Zerillo



Forest Service

Forest Health Technology
Enterprise Team

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Tank Mixes and Directions for Use

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PREFACE

This handbook is an update of handbook FHTET-2012-01, *Gypchek - Environmentally Safe Viral Insecticide for Gypsy Moth Control*, printed in May, 2012. This update contains information on virus production, safety evaluations, results of efficacy and deposition evaluations, commercial production, and a copy of the revised registration label, safety data sheet, and technical bulletin.

ACKNOWLEDGEMENTS

Many individuals in various government organizations, universities and industry have contributed to laboratory and field research and development of Gypchek as a safe and efficacious bioinsecticide. We acknowledge and sincerely appreciate their efforts. USDA APHIS for the maintenance of an in vivo production system and pilots for assistance in aerial application trials. USDA ARS, the Canadian Forest Service and their technical staffs for assistance with ground-based and aerial evaluations of Gypchek formulations.

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INTRODUCTION

Gypsy moth

The gypsy moth, *Lymantria dispar dispar* (L.), is a non-native insect, brought to the United States from Europe and accidentally released in eastern Massachusetts in the late 1860s. The larvae (caterpillars) are polyphagous defoliators (leaf-eaters) that can exploit over 300 tree species as well as cause indirect harm to native invertebrate and vertebrate species. Historically, populations of this insect pest have undergone periodic outbreaks to extremely high densities that resulted in widespread defoliation to an average of 3 million forested acres per year. More recently (1992 through 2011) populations have been declining to levels that result in an average of 1 million defoliated forested acres per year and present a continuous threat to the ecological integrity of forested ecosystems and to our urban and cultural landscapes. Since the introduction of the gypsy moth and its associated infectious diseases, it has spread south and west and continues to spread along the leading edge of infestation at the rate of approximately 12 miles per year (Figure 1). Control efforts are necessary in order to manage the gypsy moth and to protect natural resources and forest integrity.

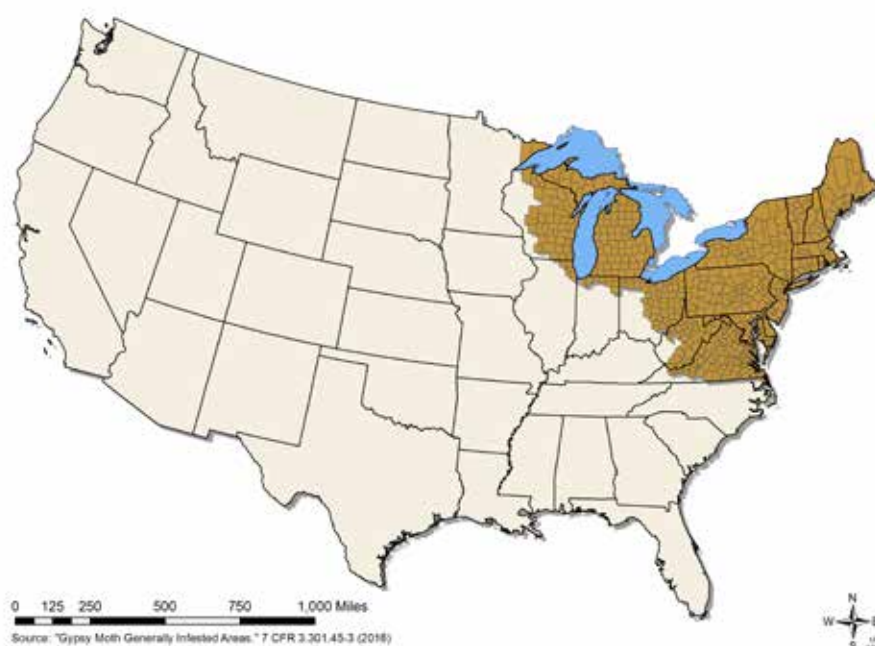


Figure 1. Distribution of the gypsy moth in the eastern United States, 2011. (Map: Laura Blackburn, Northern Research Station)

Virus

In eastern North America, the gypsy moth is subject to a variety of naturally occurring infectious diseases caused by several kinds of bacteria and fungi as well as a virus (Campbell and Podgwaite 1972). The naturally occurring viral disease (Doane 1970, Campbell and Podgwaite, 1972) often has been referred to as “wilt” due to the soft, limp appearance of the diseased larvae (Figure 2). The disease is caused by a nucleopolyhedrovirus (LdMNPV) and can reach epizootic (outbreak) proportions as gypsy moth population densities increase. These epizootics result from increased transmission rates, within and between generations of the gypsy moth, as small larvae become infected and die on leaves in the crowns of trees. These larval cadavers disintegrate and serve as inocula for healthy feeding larvae. The larva ingests the viral occlusion bodies (OB) (Figure 3) along with the foliage, and the rod-shaped virus particles (virions) are liberated as the polyhedral protein matrix dissolves in the gut. The virions invade through the gut wall and attack internal tissues and organs of the larva, eventually causing a general viral infection. The virus multiplies rapidly in cell nuclei, eventually causing disintegration of internal tissues and death of the larva (Figure 4). The entire process takes 10 to 14 days, depending upon the size of the larva, virus dose, and ambient temperature.



Figure 2. Gypsy moth larva infected with the nucleopolyhedrovirus (UGA 1301021 www.forestryimages.org).

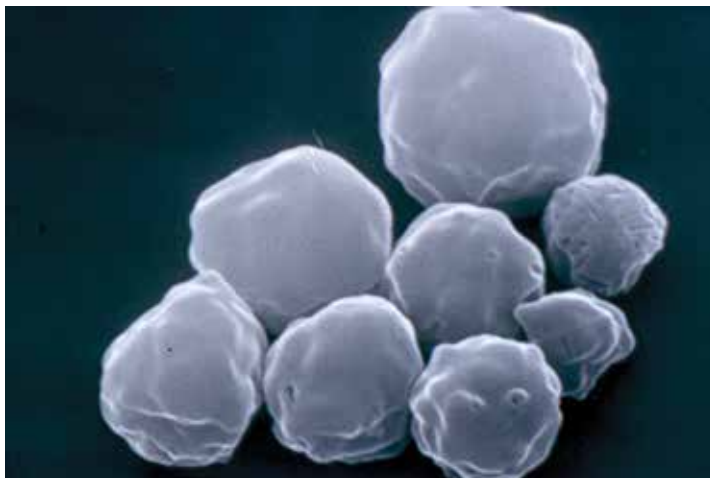


Figure 3. Occlusion bodies of the gypsy moth nucleopolyhedrovirus under magnification. (Roger Zerillo)

Larvae about to die have a characteristic oily-shiny appearance. Virus-killed larvae typically hang in an inverted-V, turn brownish-black, are fragile to the touch, and often rupture releasing a brownish-black liquid that contains millions of occlusion bodies. Larvae killed by the fungus *Entomophaga maimaiga* do not typically hang in an inverted-V, retain their normal color and are not fragile to the touch (Hajek 1994). The addition of NPV to the environment at dosages consistent with those used for control of the gypsy moth does not raise NPV levels above those that would occur naturally. Virus transmission also occurs

when adult females deposit their egg masses on NPV – contaminated surfaces (transovum transmission); larvae hatching from these contaminated eggs the following spring have a high risk of contracting the disease. The virus will persist at high levels in soil, litter, and on bark for at least 1 year following natural epizootics (Podgwaite *et al.* 1979). Virus infection is probably initiated at low gypsy moth densities and as the host density increases the virus spreads due to density-dependent processes (Woods and Elkinton 1987). Birds and mammals have the ability to pass and disperse active gypsy moth NPV (Lautenschlager and Podgwaite 1979), and parasites and invertebrate predators may play a role in the transmitting of gypsy moth NPV within natural populations. Reardon and Podgwaite (1976) found significant positive correlations between the incidence of NPV disease and the incidences of the parasites *Cotesia* (= *Apanteles*) *melanoscela* and *Parasetigena silvestris*. Further, Raimo *et al.* (1977) showed that *Cotesia* females could transmit NPV from infected to healthy gypsy moth larvae. In many dense gypsy moth populations, the virus kills up to 90 percent of the larvae and reduces populations to levels where they cause only minimal defoliation and tree damage in the following year.

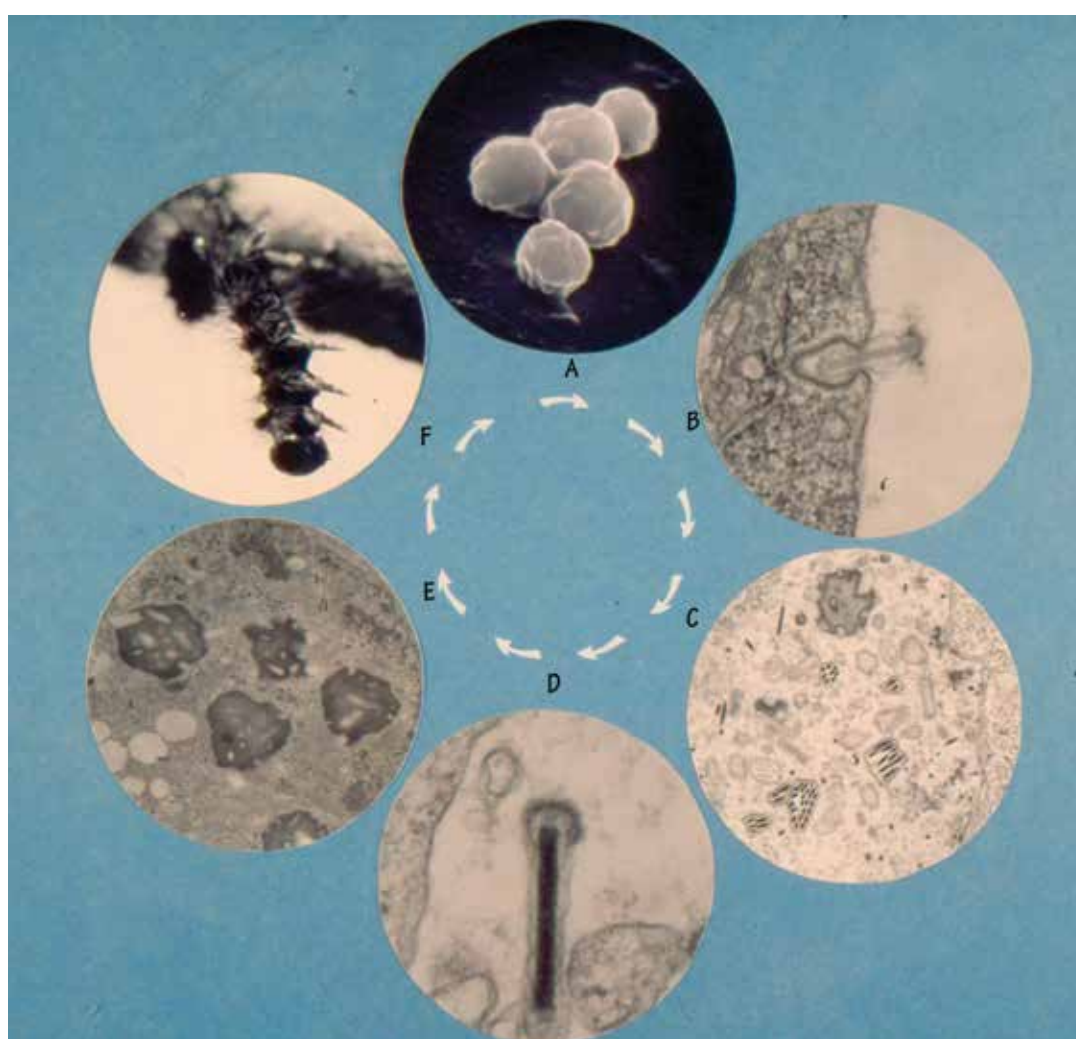


Figure 4. Gypsy moth virus life cycle: viral occlusion bodies (OB) (A) dissolve in the insect's gut liberating nonoccluded virus (NOV) that enters the midgut (B) and eventually passes through to the hemocoel. There NOV enters hemocytes and other cell types and replicates (C), producing more NOV (D) and OB (E). Cells eventually rupture releasing NOV and OB into the hemocoel. The insect dies (F) 10–14 days after consuming the virus. (Roger Zerillo)

VIRUS PRODUCT DEVELOPMENT

Registration

In the late 1950s, the USDA Forest Service began to explore the feasibility of developing the naturally occurring virus as an alternative to chemical insecticides for suppressing gypsy moth populations (Podgwaite 1999). In April 1978, after many years of research and development, the gypsy moth nucleopolyhedrovirus product Gypchek (Figure 5) was registered by the U.S. Environmental Protection Agency (EPA) as a general use insecticide for aerial and ground application to control gypsy moth. In 1996, the product satisfied all re-registration requirements established by the EPA. A similar product, Disparvirus, was developed and registered in Canada (Nealis and Erb 1993, Zhang et. al 2010). Current labeling (Appendix A) does NOT require that the product be used under Forest Service supervision but used in managing gypsy moth infestations in public pest control programs sponsored by government entities.



Figure 5. The gypsy moth nucleopolyhedrovirus product, Gypchek

Identity and Safety

The Hamden strain of the gypsy moth LdMNPV (isolated from a Connecticut population of NPV-killed larvae) contains the active ingredients in the currently registered Gypchek product. These active ingredients are a mixture of genotypes of the gypsy moth nucleopolyhedrovirus; a member of the family Baculoviridae, a diverse family, primarily pathogens of Lepidoptera. The most common baculoviruses are called nucleopolyhedroviruses because they replicate in the nucleus of host cells and because the virions that contain the viral DNA are surrounded by a polyhedral-shaped protein crystal occlusion body that forms during virion production in the host cell. A recent reclassification of the family (Jehle et al. 2006) places the gypsy moth-specific virus in the genus *Alphabaculovirus* which includes all lepidopteran-specific nucleopolyhedroviruses. It is generally known that wild Baculovirus isolations are mixtures of genotypes because of the genetic recombinations and minor mutations occurring within viral DNA during replication in infected larvae. Gypsy moth nucleopolyhedrovirus is no exception to this process and thus Gypchek's active ingredients, sourced from field collected larvae are, and will continue to be, a mixture of very closely related genetic variants (Slavicek and Podgwaite 1991). Based upon biochemical and biophysical analyses, serological and immunological testing, and enzymic analysis of viral DNA, the variants have been shown to be unrelated to human and other mammalian viruses and only distantly related to other insect viruses (USDA 1995). Appendix B is the Gypchek Safety Data Sheet.

Toxicological and pathogenicity testing of Gypchek on laboratory animals, wild mammals, birds and fish in support of registration have, with one exception, revealed no effects. That exception is that the product has been shown to be an irritant when applied in massive amounts to the eyes of laboratory rabbits. The irritation was caused by the finely ground insect parts that are a natural component of the product. Even though technical grade Gypchek is an eye irritant, it is extremely unlikely that any mammalian or avian species would ever encounter such high dosages (irritating levels) of product following application. Nevertheless, mixers are required to wear protective eye wear (goggles or face shield) when handling the technical powder.

The remote possibility that gypsy moth NPV might be related to the arthropod-borne (arbo) viruses and other viruses that infect man has been investigated. In studies carried out at Yale University, all of the known arboviruses were found to be serologically unrelated to gypsy moth NPV. Other viruses, including *Herpes* spp. were also found to be serologically unrelated to gypsy moth NPV (Mazzone *et al.* 1976). In addition, extensive testing of NPV on aquatic and terrestrial invertebrates has confirmed the extremely narrow host range of gypsy moth NPV. Specificity testing by Barber *et al.* (1993) and Glare *et al.* (1995) has revealed that the virus is non-pathogenic to beneficial insects.

In 1994, a project was initiated to evaluate the impacts of two biological insecticides, *Bacillus thuringiensis kurstaki* (Btk) and Gypchek on nontarget arthropods and selected vertebrate predators (Strazanac and Butler 2005). Eighteen 500-acre plots were established: nine in the George Washington National Forest in Virginia and nine in the Monongahela National Forest in West Virginia. During the first two study years (1995 and 1996) baseline (pre-treatment) data was collected including richness, abundance, and productivity of Lepidoptera and other insects and arthropods, songbirds, and salamanders. During 1997 and 1998 there were aerial applications of Btk to six plots, and Gypchek to six plots. Six plots as untreated controls. Nontarget impacts were evaluated throughout the treatment years and for the subsequent three post-treatment years (1999–2001).

There was no significant direct impact on macrolepidoptera attributable to Gypchek. Btk treatments caused significant declines of Lepidoptera, but Btk's impact was dependent on the caterpillar stage being exposed through feeding on treated foliage. Full recovery of caterpillar populations in the Btk plots took 1–2 years beyond the treatment years. The authors state that “Gypchek is the preferred option in gypsy moth control because it is environmentally benign and its toxicity is specific to gypsy moth.”

Production

Gypchek is produced using an in-vivo (in whole animal) process in a collaborative effort with the Animal and Plant Health Inspection Service (APHIS), Otis ANGB, Massachusetts (Bernon *et al.* 1991, Podgwaite 1991). Before 1986 Gypchek was a “whole cadaver” product that was difficult to formulate and apply. The current process (Figure 6) described below results in the production of a finely ground powder in which the active ingredient is highly concentrated and easily blended into commercial spray additives.

A standard laboratory strain of the gypsy moth (New Jersey) is reared year-round to provide egg masses which are held for 150 days at 6° C to complete diapause (quiescence). The egg masses are dehaired and the eggs are mechanically placed onto diet in 6 oz. cups. Larvae emerging from eggs are reared for 14 days at 26° C. When larvae reach early fourth instar, the cups are inoculated with 1 ml of a suspension containing 5×10^6 viral occlusion bodies (OB) per milliliter. Larvae are reared on the inoculated diet at 29° C. Fourteen days after inoculation more than 70 percent of the larvae are dead and the remainder are moribund.

Larvae are harvested into plastic bags and held at -30°C until they are processed. Frozen larvae are thawed for 24 hours at 4°C and then blended with water at high speed for 10 seconds to release the occlusion bodies. The crude concentrate is poured through a vibrating mesh screen and then through layers of cheesecloth to remove hairs and large body parts. The concentrate is then subjected to continuous-flow centrifugation. The solids are removed, layered onto trays, and frozen at -35°C. The frozen solids are lyophilized (72 hours) and finely ground to yield the final product (Figure 5), which contains about 11 percent occlusion bodies and 89 percent inert material. The final product is subjected to quality assurance testing before packaging and distribution.

In general, it takes between 500 and 1,000 infected gypsy moth larvae to produce enough Gypchek to treat one acre. Under a Forest Service-APHIS cooperative agreement about 3,500 acre equivalents (AE) were produced annually ($1 \text{ AE} = 4 \times 10^{11} \text{ OB}$). Research has been conducted toward developing enhanced viral strains for cell culture production (Slavicek 1995). So-called in-vitro (in tissues) production is an alternate to the costly in-vivo technology, and continues to be researched with university and private industry cooperators.



Figure 6. In-vivo production and processing of gypsy moth nucleopolyhedrovirus. (Roger Zerillo)

Research and Development

Since its registration, Gypchek has been the subject of intense research primarily aimed at maximizing efficacy through the development of tank mixes that enhance viral persistence and application systems

that efficiently deliver effective doses to target foliage. Numerous field trials have been conducted using Gypchek aerially applied at various doses, rates, number of applications, and tank mixes in an effort to maximize its efficacy with fewer studies to evaluate deposition and potential nontarget impacts. The acres that have been treated with Gypchek during field experiments, pilot tests, and suppression and eradication programs from 1974 through 2015 are presented in Figure 7.

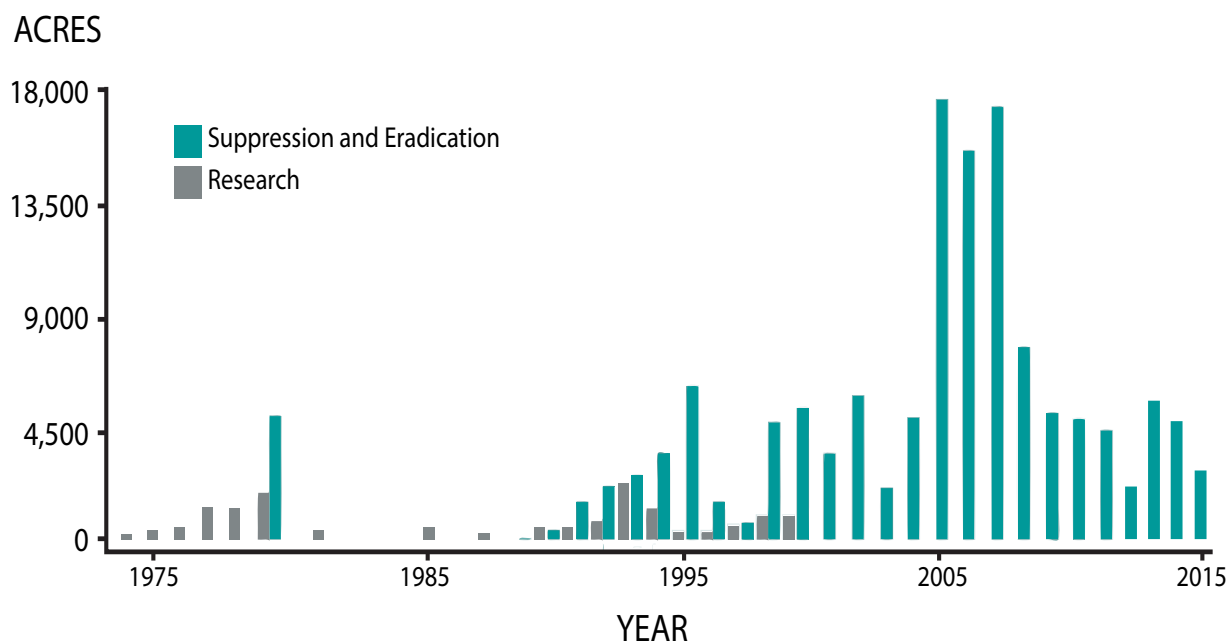


Figure 7. Acres treated with Gypchek 1974 - 2015 (Vincent D'Amico)

Before 1987 – Early Virus Product

The “early” Gypchek product was applied twice, 7–10 days apart, using conventional aircraft delivery systems. It was tested at various dosages and volumes, and applied in the evening and morning using various types of aircraft and nozzles. The early field dosage was 1×10^{11} occlusion bodies (OB) per acre per application. Tank mixes contained a sunscreen (to protect the virus from ultraviolet light 290–380 nm), a feeding stimulant (to increase gypsy moth consumption of treated foliage) and a sticker (to adhere spray droplets to foliage). Efficacy results from testing the “early” product were often inconsistent, due to several factors: physical characteristics of the product, low activity, marginal dosages, inadequate sunscreen in the tank mix, and poor timing of application.

The Maryland Integrated Pest Management (IPM) Gypsy Moth Project conducted by the USDA Forest Service sponsored a series of yearly (1983 through 1987) field evaluations of various formulations, sunscreens (e.g., folic acid, Dipel 6L carrier), dosages, rates and numbers of applications of Gypchek (Reardon *et al.* 1987). In 1986, a lignosulfonate product Orzan LS (ITT Rayonier Inc., Seattle, WA), which is a by-product of the tree-pulping process, was demonstrated to be an effective sunscreen in the laboratory assays (Podgwaite and Shapiro 1986). It displayed strong absorbance of ultraviolet light in the range of 290–340 nm, those wavelengths considered most deleterious to NPV. A Gypchek-Orzan formulation was field tested using ground hydraulic equipment against gypsy moth populations in east-

ern Maryland. Results indicated that larval mortality was significantly higher in treated than in untreated woodlots. Most encouraging was the extended persistence of Gypchek activity – foliage collected 14 days after treatment still retained sufficient activity to kill 25 percent of larvae in a laboratory bioassay.

1987 to 1989 – Improved Virus Product

In 1987, a new Gypchek tank mix was evaluated in northern and eastern Maryland as part of the Maryland IPM Gypsy Moth Project. This improved tank mix contained fewer inert ingredients (to eliminate nozzle clogging), more active ingredient, and Orzan LS to prolong virus activity on foliage. Results of these tests were encouraging with greater than 90-percent reduction in egg masses in northern Maryland and 80-percent reduction in egg masses in eastern Maryland (Podgwaite *et al.* 1992a). This tank mix was also evaluated on similar population densities in the mountainous terrain of the George Washington National Forest in Virginia (Figure 8). Results were again positive with a greater than 90-percent reduction of egg masses in five of six treated plots. Defoliation in the untreated plots averaged 67 percent compared with only 22 percent in the Gypchek-treated plots (Podgwaite *et al.* 1992b).



Figure 8. Gypchek application in mountainous terrain of the George Washington National Forest.

8

Several factors contributed to the effectiveness of the 1987 and 1988 Gypchek treatments: (1) the tank mix itself and its attributes as previously described; (2) a lyophilized Gypchek powder prepared from an aqueous extract of larval cadavers; (3) two applications 3 days apart allowed more active NPV to be continuously available to the target insect for a 5–6-day period and (4) favorable weather conditions during and immediately after application (Reardon and Podgwaite 1994).

1989 to 1992 – Modified Application Parameters

Standard tank mix – The standard tank mix of Gypchek consisted of molasses and lignosulfonate (Orzan LS) at 2 gal/acre/application, and required two applications 3 days apart. These parameters coupled with a limited supply of product, high production costs, and increased demand led to a series of field studies designed to maximize efficacy while minimizing application costs. These studies were conducted over 5 years (1989–1993) as part of the Appalachian Integrated Pest Management (AIPM) Gypsy Moth Demonstration Project by Federal, State, and county agencies, in 38 counties in Virginia and West Virginia (Reardon 1991).

In 1989, two studies were conducted in Virginia. One was in areas of low-density populations (30 to 100 egg masses per acre) on the George Washington National Forest to evaluate the standard tank mix of Gypchek applied twice at 2 gal/acre and 5×10^{11} OB/acre. The other was on the Shenandoah National Park to evaluate one (1×10^{12} OB/acre) versus two (each 5×10^{11} OB/acre) applications of the standard tank mix of Gypchek. The results from one application were not encouraging, although the test was compromised by rainy weather during and immediately after application and the collapse of gypsy moth populations in the untreated plots. In the low-density plots, egg mass populations were

reduced 92 percent by Gypchek (i.e., an overall 55-fold increase in egg mass density in untreated plots compared with 4.5-fold increase in Gypchek plots). These results represented the initial evaluation of aerially applying Gypchek against low-level gypsy moth populations (Podgwaite *et al.* 1993).

In 1990, field evaluations were conducted in central Pennsylvania using the Gypchek standard tank mix at three dosages: 5×10^{11} OB/acre, 2.5×10^{11} OB/acre, 1.25×10^{11} OB/acre. The results were as follows:

Dosage (OB/acre)	Population Reduction (percent)	Foliage Protection (percent)
5×10^{11}	84	50
2.5×10^{11}	85	46
1.25×10^{11}	46	47

The favorable results using the mid-range dosage provided the basis for additional evaluation of similar doses.

Modified tank mix – In Virginia in 1991, Gypchek in a modified tank mix (higher concentrations of Orzan and molasses) was applied twice at 2×10^{11} OB/acre (40 percent of the standard dosage of 5×10^{11} OB/acre) and 0.5 gal/acre (25 percent of the standard volume of 2.0 gal/acre). Results were compared with a single and double application of the standard tank mix at a dosage of 5×10^{11} OB/acre in 2 gal/acre/application. Results showed that egg mass populations were reduced 68 percent by the standard double applications, 66 percent by the standard single application, and 61 percent by the modified tank mix double application. Defoliation in all the Gypchek treatments averaged 25 percent compared with 80 percent in the untreated plots. Defoliation in the standard treatment plots (two applications) was marginally lower than in either the standard (one application) or the modified Gypchek treatment plots. These results indicated that the 2×10^{11} OB/acre/application dose of the modified tank mix of Gypchek would be operationally acceptable.

1992 to 1996 – Commercial Formulations and Carriers: Efficacy and Deposition

In 1992, two applications of the modified tank mix (10 percent Orzan, 25 percent molasses and 2 percent sticker) at 2×10^{11} OB/acre/application in 0.5 gal/acre/application was pilot tested in Pennsylvania. Three 200 acre plots (each paired with a corresponding untreated plot) were treated, but interpretation of the results was complicated by an area-wide collapse of the gypsy moth population. Collections of larvae before and after treatment indicated that the dose was adequate for desired mortality (greater than 60 percent) but that the rate of 0.5 gal/acre as applied in that spray system was probably marginal for the desired droplet distribution on foliage with this reduced dose.

In 1992, the USDA Forest Service collaborated with American Cyanamid Company in the development and evaluation of a commercial wettable powder formulation of Gypchek, and with Entotech, Inc. (Davis, CA) in the development and evaluation of an aqueous flowable spray carrier for Gypchek, to replace the standard lignosulfonate-molasses tank mix. After numerous laboratory and spray tower evaluations of efficacy and weatherability, one ready-to-use formulation and one flow-

able from each company was selected for field testing. Field tests were conducted in Pennsylvania in cooperation with the Pennsylvania Bureau of Forestry and the USDA Agricultural Research Service. The treatments were (1) standard Gypchek tank mix applied twice at 5×10^{11} OB/acre and 2 gal/acre; (2) American Cyanamid wettable powder formulation of Gypchek applied twice at 5×10^{11} OB/acre and 1 gal/acre; (3) American Cyanamid formulation tank mixed with an optical brightener (0.5 percent Blankophor BBH), an enhancer of viral activity manufactured by Burlington Chemical Co., Burlington, NC, applied twice at 5×10^{11} OB/acre and 2 gal/acre; (4) Gypchek in the Entotech spray-carrier, applied twice at 5×10^{11} OB/acre in 1 gal/acre; and (5) untreated. The evaluation of results was again complicated by a natural area-wide NPV epizootic. However, treatment effects were evident for all treatments from the mortality of early stage larvae (Reardon and Podgwaite 1994).

In 1993, the two ready-to-use products were reevaluated in separate projects in Michigan (Onken 1996). One project tested the efficacy of the American Cyanamid ready-to-use formulation with and without brightener. There were five treatments: (1) two applications (1 gal/acre/application) $\times 2 \times 10^{11}$ OB/acre with; and (2) without the brightener, (3) two applications of 2×10^{10} OB/acre with the brightener; (4) one application of 4×10^{10} OB/acre with the brightener, and (5) untreated. The second project evaluated the Entotech spray carrier at two dosages (2×10^{11} OB/acre and 5×10^{11} OB/acre) and 1 gal/acre, the standard tank mix at 5×10^{11} OB/acre and 2 gal/acre. All treatments were applied twice.

None of the American Cyanamid treatments protected foliage nor reduced populations when compared with untreated. These negative results were not anticipated based on the favorable results from the previous year's field test. Formulation "changes" just before field application were part of the problem as determined by post spray laboratory bioassays. Both Entotech treatments provided foliage protection and population reduction compared with the standard tank mix. Therefore, two applications of the Entotech tank mix at 2×10^{11} OB/acre and 1.0 gal/acre was recommended for use in the 1994 Federal and State Cooperative Suppression Program.

Optical (fluorescent) brighteners can provide both UV protection and intrinsically enhance the biological activity of baculoviruses. The stilbene disulfonic acid optical brightener Blankophor BBH was applied by air in two formulations of gypsy moth nucleopolyhedrovirus to gypsy moth populations in plots established in Maryland and West Virginia to determine if the enhancer could compensate for reduced rates of virus. The addition of Blankophor BBH did not significantly increase the larval mortality over Gypchek without Blankophor BBH treatments although additional testing with higher doses of Blankophor BBH was recommended (Podgwaite *et al.* 2013).

In 1994, additional field trials were conducted in Virginia using the Entotech carrier. Three treatments were evaluated: (1) two applications, each at 2×10^{11} OB/acre in 0.5 gal/acre, (2) two applications, each at 2×10^{11} OB/acre in 1.0 gal/acre, and (3) untreated. Neither population levels based on egg mass counts nor defoliation differed significantly between the treated and untreated plots. Treatments reduced populations based on collections of early stage larvae and comparison with untreated plots. However, results were severely compromised by three major factors: (1) 80–100 percent foliage expansion at the time of treatment, (2) the majority of larvae were in late second and early third instars, and (3) due to cold, rainy weather, applications had to be staggered over a period of 7 days. However, results from 1993 and 1994 studies still supported the continued use of a double application of the Entotech carrier, although

additional evaluation was needed to determine whether 0.5 gal/acre was as effective as 1.0 gal/acre.

To provide supporting data for a specific level of efficacy, foliage deposition evaluations were conducted in 1993–1994 on companion plots not evaluated for efficacy. This was necessary due to the uncertainty concerning the impact on efficacy of UV-protective dyes added to the tank mix to allow quantification of deposit. In the earliest deposit evaluations, it was determined that the standard tank mix at 2.0 gal/acre and the Entotech tank mix at 1.0 gal/acre provided similar deposition on oak foliage. However, deposit from the standard tank mix persisted longer after rainfall than did deposit from the Entotech tank mix. In 1993, the results from deposition on oak foliage in Michigan for the Entotech and standard tank mixes indicated an average volume median diameter (VMD) of 382 microns and 8.3 drops/cm². For the 1994 spray trials in Virginia, the average VMD was 280 microns and 4.1 drops/cm². The differences in deposit per unit area of leaf surface (8.3 and 4.1 drops/cm²) was attributed in part to the minimal (less than 25 percent) leaf expansion in 1993 and maximum expansion (80–100 percent) in 1994.

In 1995, field tests were conducted in southwestern Virginia (Webb *et al.* 1999a). There were five treatments: (1) Entotech tank mix, applied twice at 2×10^{11} OB and 1.0 gal/acre and (2) 0.5 gal/acre, (3) the standard tank mix applied twice and at 2×10^{11} OB and 2 gal/acre, (4) the Entotech tank mix applied once at 4×10^{11} OB and 1 gal/acre, and (5) untreated. Results indicated that the Entotech tank mix of Gypchek applied twice at either 1.0 gal/acre or 0.5 gal/acre provided a level of efficacy comparable to the standard tank mix applied twice at 2 gal/acre. These results supported the recommendation of the Entotech tank mix (instead of the standard tank mix) for use against gypsy moth, although further evaluation of the number of applications, the dose, and the rate of application were needed.

In 1996, a pilot test of the Entotech tank mix applied once at 1×10^{12} OB/acre in 1 gal/acre was conducted in Maryland and West Virginia (Webb *et al.* 1999b). This increased dose was used to compensate for the need for two applications (3 days apart), which is an undesirable option for operational use. The results indicated that the treatments provided significant larval reduction when compared with the untreated plots. Once again, however, results were complicated by a general population collapse in the treated and untreated plots.

Also, in 1996 an American Cyanamid produced in-vitro strain of the gypsy moth nucleopolyhedrovirus was tank mixed at a low dose with an optical brightener and applied to individual trees using ground application equipment. Although the results were favorable, additional field testing was recommended before conducting aerial applications on small replicated plots. This 1996 test followed several years of testing various strains of gypsy moth NPV and spray adjuvants with ground hydraulic equipment for the purpose of developing protocols for spraying small acreages and individual trees (Webb *et al.* 1990, 1993, 1994a, 1994b, 1996). These tests, conducted cooperatively with USDA Agriculture Research Service scientists, have shown that it is possible to lower the current recommended dose and rate for ground application (1×10^{12} OB/100 gal/acre) tenfold and still maintain comparable efficacy by including an optical brightener in the tank mix as an enhancer of viral activity.

1996 to 2012—Low density populations, in-vitro strains

In 1999, five mixed-oak stands (each average 400 acres) supporting low density gypsy moth populations were treated with Gypchek during the State of Wisconsin gypsy moth control program. These five plots were paired with untreated control plots, all with gypsy moth populations based on adult male moths caught in pheromone traps. The treatments were evaluated using the “bugs-in-bags” approach developed by D’Amico and Elkinton (1995). Recorded levels of efficacy (24–67 percent) though promising, indicated that additional testing is needed against low density populations (Webb *et al.* 2004).

During this period much research has been focused on the development and evaluation of virus strains that can be produced in cell culture (in vitro). The goal is to replace the current in vivo-produced Gypchek with a single, high-potency, strain amenable to large-scale production in culture. Results from a continuum of ground-based and aerial application studies (Webb *et al.* 2001, 2003, 2005, D’Amico *et al.* 2003, 2004, 2007, 2008, Podgwaite *et al.* 2004, Podgwaite and Reardon 2006) have indicated which strains that are acceptable for further evaluation in large-scale bioreactors (Slavicek, 2008, Slavicek and Gabler 2007). Also, cooperative studies with scientists at the Institute of Systematics and Ecology of Animals, Novosibirsk, Russia, were initiated to study the response of Asian gypsy moth (*L. dispar asiatic*) to Gypchek. The Russian product, Virin NSh, and Gypchek were evaluated for their activities against a western Siberian population and a U.S. population of the gypsy moth. In bioassays on foliage in Russia, there were no differences in potency between the two products. In a diet incorporation assay in the U.S., Gypchek was slightly more active than Virin NSh. Both products were more active against insects reared on artificial diet than those reared on foliage and both products were equally effective when tested against a given strain of gypsy moth (Bakhvalov et al. 2005, Podgwaite et al. 2007). Current studies are underway to assess the potencies of a number of viral genotypes isolated from Gypchek for both Asian and European gypsy moth larvae. A similar study was conducted with scientists at the Agricultural College ,Inner Mongolia Agricultural University field testing Chinese and Japanese gypsy moth nucleopolyhedrovirus and disparvirus against a Chinese population of *Lymantria dispar* (Duan 2012).

2012 - 2015 — Modified tank mixes

The aqueous flowable spray carrier for Gypchek originally developed by Entotech has been field tested and improved. It provides UV protection for the virus, feeding stimulants for gypsy moth larvae, pH modifiers, a lignosulfonate, preservatives, and a flowable tank mix. It is now designated Carrier 038-A and manufactured by Omnova Solutions (Chester, SC). The carrier costs \$11.00/gallon.

As an option to the commercially produced Carrier 038-A, the standard tank mix has been modified by removing the lignosulfonate component and increasing the molasses component from 10% to 25%. This tank mix was evaluated in the 1980s and 1990s in numerous trials conducted by the Canadian Forest Service and the U. S. Forest Service. It cost \$1.00/gallon and provides UV protection for the virus and a feeding stimulant for gypsy moth larvae.

Commercial Production

Prior to 2008, there were several attempts by private industry to produce and market Gypchek. In 2008 and 2010, the Forest Service – Forest Health Protection (FS-FHP) contracted with Sylvar Technologies, Inc. (New Brunswick, Canada) to produce 1,500- and 2,000-acre equivalents of Gypchek, respectively for FS-FHP. Production was successful, and a five-year contract was initiated to produce 25,000-acre equivalents of Gypchek. In 2016, that contract will be completed and hopefully a new 5-year contract will be initiated.

RECOMMENDED APPLICATION PROTOCOLS

Two tank mixes are recommended for aerial application: (1) the standard tank mix consisting of molasses, a sticker, and water (Appendix C); and a tank mix consisting of Carrier 038-A (marketed by Omnova Solutions, Chester, SC), a sticker, and water (Table 1). The current recommendations for aerial suppression programs are (1) either two treatments 3-5 days apart of the standard tank mix, each applied at 2×10^{11} OB/application or one applied at 4×10^{11} OB and 0.5-2 gal/acre/application or (2) either two treatments 3-5 days apart of the Carrier 038-A tank mix, each applied at 2×10^{11} OB or one applied at 4×10^{11} OB and 0.5 to 1.0 gal/acre application (Appendix). The Gypchek tank mixes can be applied using various atomizers and hydraulic nozzles with a recommended VMD of 100 to 350 microns. It is recommended that Gypchek be tank mixed with Carrier 038-A at the mixing and loading site but will stay viable for several weeks following mixing with the carrier, if kept out of direct sunlight and below 70° F.

A water tank mix is recommended for ground hydraulic application (Table 1). For ground hydraulic application, the recommendations are: (1) one application of a water tank mix (Appendix) at 1×10^{12} OB and 100 gal/acre for woodlots, roadsides, and small acreages and (2) one application of 15–25 gallon of the same tank mix for individual trees in yards.

Gypchek is especially active against smaller larvae and it is recommended that applications be made as soon as hatch is complete, all larvae are off the egg masses and actively feeding, and the majority of the larvae are in the late-first to early-second instar. Since Gypchek must be ingested to be effective, leaf expansion should be at levels consistent with larval development (e.g., white oak at least 20 percent expanded).

Table 1. Gypchek tank mixes for aerial and ground application.

Aerial Application**Standard Tank Mix**

Ingredient		
1987-1992	Current	Amount per 3.9 liters (1gal.)
Pro Mo Liquid Supplement ¹ or MO MIX ¹ (Southern States Cooperative, Richmond, VA)	Refined (filtered) feed-grade molasses (Southern States Cooperative)	940 ml (32 fl. oz.) (25% v/v)
Bond ² (Loveland Industries, Greeley, CO)	Tactic ² (Loveland Industries)	77.6 ml (2.5 fl. oz.) (2%)
Nonchlorinated Water pH 5.5–7.5	Nonchlorinated Water pH 5.5–7.5	2.85 liters (93 fl. oz.) (73% v/v)
Gypchek	Gypchek	100-500 billion OB

Carrier 038-A Tank Mix

Ingredient	Amount per 3.9 liters (1 gal.)
Carrier 038-A (Omnova Solutions, Inc.)	3.60 liters (120 fl. oz) (94% v/v)
Tactic ² (Loveland Industries)	1 fl. oz (1% v/v)
Nonchlorinated water (pH 5.5–7.5)	0.19 liters (7 fl. oz.) (5% v/v)
Gypchek	200-500 billion OB

¹ Mixture of condensed molasses and corn extracts² Synthetic latex**Ground Hydraulic Application****Water Tank Mix**

Ingredient	Amount per 3.9 liters (1 gal.)
Tactic ²	77.6 ml (2.5 fl. oz) (2% v/v)
Nonchlorinated water	3.71 liters (125 fl. oz.) (98% v/v)
Gypchek	10 billion OB

SUMMARY

Gypchek is one of two biological insecticides (the other being the bacterium *Bacillus thuringiensis kurstaki*) currently registered for use against the gypsy moth. Gypchek is the only specific product that was developed for use in areas where the application of broad-spectrum pesticides are not appropriate, e.g., where nontarget Lepidopteran species are of special concern, natural areas. Its use is not limited to “environmentally sensitive areas” but is the preferred use due to limited production. Gypchek does **NOT** have to be used under the supervision of the Forest Service, but is for use in public pest control programs sponsored by government entities.

The successful field trials with the commercially produced Carrier 038-A and Gypchek and the environmental concerns over the effects of broad-spectrum insecticides on nontarget organisms have again stimulated commercial interest. Sylvar Technologies (New Brunswick, Canada) has a contract with the Forest Service to produce 25,000-Acre Equivalents of Gypchek. Forest Service Research will continue to identify, develop and test both natural and genetically engineered strains of gypsy moth NPV that are more virulent than the Connecticut strain that is used in the current Gypchek product.

Future efforts will continue toward developing new, ready-to-use spray adjuvants that will extend NPV persistence on foliage. The use of Blankophor or other optical brighteners is **NOT** recommended for operational use with Gypchek because of the unidentified role they play in the induction of disease.

Gypchek with the standard or with Carrier 038-A tank mix is recommended for use against moderate to high density gypsy moth population (300–5,000) egg masses per acre. For healthy gypsy moth populations, one can expect population reduction in the range of 60–80 percent with sufficient foliage protection to prevent defoliation. For populations in decline, one can expect population reduction in the >90 percent and foliage protection >85 percent. However, testing in low level populations (less than 100 egg masses per acre), though encouraging, has been limited. Therefore, future field efforts will focus on the evaluation of Gypchek against low density populations (less than 100 EM/acre) as a component tactic in an integrated pest management (IPM) approach to slow the spread of the gypsy moth. Also, additional effort is needed to more fully evaluate the effectiveness of Gypchek for use in eradication programs, where the need is to reduce a population to undetectable levels.

DISTRIBUTION PROTOCOL

The administrative protocol for distributing Gypchek for use is as follows: In September a letter is forwarded by Richard Reardon, Gypchek Product Manager for Forest Health Protection, Forest Service (rreardon@fs.fed.us), to potential cooperators stating the quantity of Gypchek available for the coming year, and the price for Carrier 038-A. Requests for Gypchek are submitted to Richard Reardon and this information is summarized. In late January or early February, cooperators are contacted to reconfirm their requests and this information is forwarded to John Podgwaite at the Gypchek processing facility in Ansonia, CT, where Gypchek is packaged and shipped. The Forest Service-FHP acquires the annual state registrations for Gypchek. This usually involves a renewal of a registration with the fee waived or paid by the Forest Service FHP.

For contact information see Appendix H.

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GypchekBiological Insecticide
for Gypsy Moth

Wettable Powder

EPA Reg. No. 27586-2

EPA Establishment No. 27586-CT-1

ACTIVE INGREDIENT:*

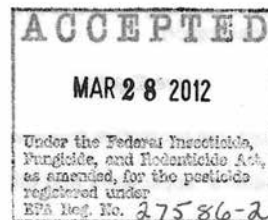
Occlusion bodies (OB) of the gypsy moth

nucleopolyhedrovirus (LdMNPV)..... 11.0%

(*equivalent to at least 8.5×10^{11} OB/oz. avoirdupois)**OTHER INGREDIENTS:**

insect parts/inert solids..... 89.0%

Total.....100.0%



KEEP OUT OF REACH OF CHILDREN

WARNING**AVISO**

Read First Aid Treatment Before Use

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle.
(If you do not understand the label, find someone to explain it to you in detail.)

FIRST AID TREATMENT

IF IN EYES: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing.

IF ON SKIN: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes.

IF INHALED: Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible.

Call a poison control center or doctor for treatment advice. Have the product container or label with you when calling a poison control center or doctor or going in for treatment. For emergency information on product (including health concerns or pesticide incidents), call the National Pesticides Information Center at 1-800-858-7378, 6:30 AM to 4:30 PM Pacific Time (PT), seven days a week. During other times, call the poison control center 1-800-222-1222.

Note to Physician: Some individuals may exhibit symptoms of allergies and hypersensitivity. Virus contained in this product is non-pathogenic to human beings and other warm-blooded animals.

USDA Forest Service, 180 Canfield Street, Morgantown, WV 26505

Net Weight: _____ pounds _____ ounces avoirdupois

Lot No. _____

PRECAUTIONARY STATEMENTS**Hazards to Humans & Domestic Animals****WARNING**

Causes substantial but temporary eye injury. Do not get in eyes or on clothing. Wear goggles or a face shield. Harmful if absorbed through the skin. Avoid contact with skin. Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco or using the toilet. Remove and wash contaminated clothing before reuse. Repeated exposure to high concentration of microbial proteins can cause allergic sensitization.

Personal Protective Equipment (PPE)

Mixers must use protective eyewear (goggles or face shield).

Mixers, loaders, applicators and other handlers must wear:

- Long-sleeved shirt and long pants
- Shoes plus socks
- Waterproof gloves
- a dust/mist filtering respirator meeting NIOSH standards of at least N-95, R-95 or P-95, when working outside of a protective enclosed cab or aircraft cockpit.

After product is diluted in accordance with directions for use, protective eyewear is not required. Follow manufacturer's instructions for cleaning and maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

User Safety Recommendations

Wash the outside of gloves before removing. Remove PPE immediately after handling this product. As soon as possible, wash thoroughly and change into clean clothing. Work in open or well-ventilated areas. Users should remove clothing/PPE immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.

Environmental Hazards

For terrestrial uses: Except under the forest canopy, do not apply directly to water or to areas where surface water is present or to intertidal areas below the mean high water mark.

Do not contaminate water when cleaning equipment or disposing of equipment washwaters or rinsate.

Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans, or other waters unless in accordance with the requirements of a National Pollutant Discharge Elimination System (NPDES) permit and the permitting authority has been notified in writing prior to discharge. Do not discharge effluent containing this product to sewer systems without previously notifying the local sewage treatment plant authority. For guidance contact your State Water Board or Regional Office of the EPA.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

Product Information: Gypchek contains a virus specific to the gypsy moth, *Lymantria dispar* (L.). Maximum effectiveness is exhibited against early instar larvae after consumption of a lethal dose. Spray application should occur soon after egg hatch is complete and all larvae have migrated from the egg mass; the majority of late-first instar are actively feeding; and when the target foliage is at least 20% expanded.

Best results are expected when applications are made onto dry foliage with winds less than 10 mph. Eradication projects and/or rainy weather may necessitate more than 2 applications per year. Spray application is not recommended if rain is predicted within 12 hours.

Use Restrictions: Only for use as a biological insecticide to manage gypsy moth infestations in wide-area public pest control programs sponsored by government entities. Application of this product is limited to forest trees and ornamental or non-commercial trees in urban parks, golf courses, lawns and landscapes. Tree species include but not limited to oak, hickory, basswood, birch, cherry, elm, blackgum, larch, sassafras, hemlock, cedar, spruce, black walnut, American chestnut, willow, ash, boxelder, hawthorn, butternut, catalpa, locust, and sycamore.

This product is sensitive to environmental conditions. Store product in a cool dark place prior to use (read STORAGE AND DISPOSAL section).

Mixing Instructions: Add Gypchek to recommended carrier in the proper ratio for per acre dosages and agitate to maintain suspension. Consult USDA Forest Service, Northeastern Research Station, Hamden, CT, tel: (203) 230-4325 for currently recommended adjuvants in tank mix. Use clean water as a diluent, but **never use chlorinated water in the spray formulation**. If pH of diluent water for mixing is less than 5.5 or greater than 7.5, add appropriate amount of acid or base with products available for swimming pools to adjust to within acceptable pH range.

Observe the most restrictive of the labeling limitations and precautions of all products used in mixtures if product is mixed with other pesticides. Consult USDA Forest Service (tel: (203) 230-4325) for information on compatibility and effectiveness prior to mixing this pesticide with any other.

Application Instructions

Ground Application: Apply up to 1.174 oz., or 33.3 g, of Gypchek (i.e. 1.0×10^{12} OB) per acre, one or more times, with high volume hydraulic sprayers at a rate of 100 gallons of tank mix per acre to woodlots and small acreages. Individual large trees should be sprayed once to runoff.

Aerial Application: For single application to a site, apply 0.469 oz., or 13.3 g, of Gypchek (i.e. 4.0×10^{11} OB) per acre for suppression, and 1.174 oz., or 33.3 g, of Gypchek (i.e. 1.0×10^{12} OB) per acre for eradication. For two or more applications to a site, apply up to 0.236 oz., or 6.7 g, of Gypchek (i.e. 2.0×10^{11} OB) per acre per application for suppression, and 0.589 oz., or 16.7 g, of Gypchek (i.e. 5.0×10^{11} OB) per acre per application for eradication, with 2 to 4 days between applications. Depending upon type of carrier, use $\frac{1}{2}$ to 2 gallons of tank mix volume per acre.

Aerial Spray Drift Reduction: Avoiding spray drift from the application site is the responsibility of the applicator. The interaction of many equipment- and weather-related factors determine the potential for spray drift. The applicator is responsible for considering these factors when making application decisions. Observe local regulations for spray drift reduction.

STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage and disposal.

Storage & Transport: Activity will be impaired by exposure to direct sunlight or temperatures above 90° F. Store in sealed containers in cool dry place. Temperatures below 32° F are advantageous for long-term storage. Locked storage should provide separation of pesticides and prevent cross-contamination of other pesticides, fertilizer, food, and feed. Transport in sealed storage container and locate in a compartment separate from passengers and driver.

Pesticide Disposal: Wastes resulting from the use of this product must be disposed of on site or at an approved waste disposal facility.

Container Handling: Nonrefillable container. Do not reuse or refill this container. Completely empty bag into application equipment by shaking and tapping sides and bottom to loosen clinging particles. When completely empty, offer for recycling if available, or dispose of bag in a sanitary landfill or by incineration or, if allowed by State and local authorities, by burning. If burned, stay out of smoke.

NOTICE

USDA Forest Service neither makes, nor authorizes any agent or representative to make any warranty, guarantee, or representation, express or implied, of merchantability and/or fitness concerning this material except those contained on the label.



Safety Data Sheet (SDS)

OSHA HazCom Standard 29 CFR 1910.1200(g) and GHS Rev 03.

Issue date 08/07/2015

Reviewed on 08/07/2015

* 1 Identification

• **Product identifier**

• **Trade name:** Gypchek

• **Product number:** EPA REGISTRATION #27586-2

• **Relevant identified uses of the substance or mixture and uses advised against:**

• **Product description**

A biological insecticide for use to manage gypsy moth infestations in wide-area public pest control programs sponsored by government entities.

• **Details of the supplier of the safety data sheet:**

• **Manufacturer/Supplier:**

Forest Service
Forest Health Technology Enterprise Team
180 Canfield Street
Morgantown, WV 26505
Phone: 304-285-1566
Fax: 304-285-1564
www.fs.fed.us

• **Emergency telephone number:** 304-282-8373

2 Hazard(s) identification

• **Classification of the substance or mixture:**

The substance is not classified according to the Globally Harmonized System (GHS).

• **Label elements:**

• **GHS label elements** Non-Regulated Material

• **Hazard pictograms:** Non-Regulated Material

• **Signal word:** Non-Regulated Material

• **Hazard statements:** Non-Regulated Material

• **Classification system:**

• **NFPA ratings (scale 0 - 4)**



Health = 0
Fire = 0
Reactivity = 0

• **HMIS-ratings (scale 0 - 4)**



HEALTH 0 Health = 0
FIRE 0 Fire = 0
REACTIVITY 0 Reactivity = 0

• **Hazard(s) not otherwise classified (HNOC):** None known

* 3 Composition/information on ingredients

• **Chemical characterization: Substance**

• **CAS No. Description**

Nucleopolyhedrovirus of the Gypsy Moth, Lymantria dispar 11%

• **Impurities and stabilizing additives:** Insect parts and inert solids 89%

* 4 First-aid measures

• **Description of first aid measures:**

• **General information:** No special measures required.

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Safety Data Sheet (SDS)

OSHA HazCom Standard 29 CFR 1910.1200(g) and GHS Rev 03.

Issue date 08/07/2015

Reviewed on 08/07/2015

Trade name: Gypchek

- **After inhalation:**
Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible.
- **After skin contact:**
Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes.
- **After eye contact:**
Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing.
- **After swallowing:** If swallowed and symptoms occur, consult a doctor.
- **Information for doctor:**
- **Most important symptoms and effects, both acute and delayed:** No further relevant information available.
- **Indication of any immediate medical attention and special treatment needed:**
Note to physicians: Some individuals may exhibit symptoms of allergies and hypersensitivity.

5 Fire-fighting measures

- **Extinguishing media:**
- **Suitable extinguishing agents:**
CO₂, extinguishing powder or water spray. Fight larger fires with water spray or alcohol resistant foam.
- **Special hazards arising from the substance or mixture:** No further relevant information available.
- **Advice for firefighters:**
- **Protective equipment:**
As in any fire, wear self-contained breathing apparatus pressure-demand (NIOSH approved or equivalent) and full protective gear to prevent contact with skin and eyes.

6 Accidental release measures

- **Personal precautions, protective equipment and emergency procedures:** Not required.
- **Environmental precautions:**
Dilute with plenty of water.
Do not allow to enter sewers/ surface or ground water.
- **Methods and material for containment and cleaning up:**
Containment and cleanup by placing in a sealable container for transport to an approved landfill or other disposal site.
- **Reference to other sections:**
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.

* 7 Handling and storage

- **Handling**
- **Precautions for safe handling:**
Keep out of the reach of children. Do not contaminate water, food, or feed by inappropriate storage and disposal.
- **Information about protection against explosions and fires:** No special measures required.
- **Conditions for safe storage, including any incompatibilities:**
- **Storage**
- **Requirements to be met by storerooms and receptacles:**
Avoid heat and sunlight. Store in a cool, dark place. Freezing temperatures are recommended for long-term storage.
- **Information about storage in one common storage facility:** Not required.
- **Further information about storage conditions:** None.

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Issue date 08/07/2015

Reviewed on 08/07/2015

Trade name: Gypchek

- **Specific end use(s):** No further relevant information available.

* 8 Exposure controls/personal protection

- **Additional information about design of technical systems:** No further data; see section 7.
- **Control parameters:**
- **Components with occupational exposure limits:**
- **Additional information:** The lists that were valid during the creation of this SDS were used as basis.
- **Exposure controls:**
Provide general ventilation in processing and storage. Provide local exhaust if necessary to reduce dust levels below acceptable limits.
- **Personal protective equipment:**
- **General protective and hygienic measures:**
The usual precautionary measures for handling chemicals should be followed.
- **Breathing equipment:**
Handlers must wear a dust/mist filtering respirator meeting NIOSH standards of at least N-95, R-95, or P-95 when working outside of a protective enclosed cab or aircraft cockpit.
- **Protection of hands:**



Protective gloves

- **Eye protection:**



Safety glasses

* 9 Physical and chemical properties

- **Information on basic physical and chemical properties**
- **General Information**
- **Appearance:**

Form:	Powder
Color:	Light brown
Odor:	Slightly musty
Odor threshold:	Not determined.
- **pH-value:** Acidic
- **Change in condition**

Melting point/Melting range:	Not determined.
Boiling point/Boiling range:	Not determined.
- **Flash point:** Not applicable.
- **Flammability (solid, gaseous):** Not applicable.
- **Ignition temperature:**

Decomposition temperature:	Not determined.
Auto igniting:	Not determined.
Danger of explosion:	Product does not present an explosion hazard.

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Trade name: Gypchek

- **Explosion limits:**
 - Lower:** Not determined.
 - Upper:** Not determined.
- **Vapor pressure:** Not determined.
- **Density:**
 - Relative density:** Not determined.
 - Vapor density:** Not determined.
 - Evaporation rate:** Not determined.
- **Solubility in / Miscibility with:**
 - Water:** Fully miscible.
- **Partition coefficient (n-octanol/water):** Not determined.
- **Viscosity:**
 - Dynamic:** Not determined.
 - Kinematic:** Not determined.
 - Organic solvents:** 0.0 %
- **Other information:** No further relevant information available.

* 10 Stability and reactivity

- **Reactivity:** No further relevant information available.
- **Chemical stability:** Stable under normal conditions.
- **Thermal decomposition / conditions to be avoided:** No decomposition if used according to specifications.
- **Possibility of hazardous reactions:** No dangerous reactions known.
- **Conditions to avoid:** Do not store in direct sunlight or at temperatures above 80 °F.
- **Incompatible materials:** No further relevant information available.
- **Hazardous decomposition products:** No dangerous decomposition products known.

* 11 Toxicological information

- **Information on toxicological effects:**
- **Acute toxicity:**
- **Primary irritant effect:**
- **On the skin:** Mild irritant effect.
- **On the eye:** Mild irritant effect.
- **Other information (about experimental toxicology):**
The acute oral LD50 is greater than 5000 mg/kg-b.w. in rats; indicating that the product is practically non-toxic by ingesting a single dose. The acute dermal LD50 is greater than 2000 mg/kg-b.w. in rabbits; indicating that the material is no more than slightly toxic from exposure to the skin. The acute inhalation is greater than 2 mg/L, indicating that the product is practically non-toxic if inhaled. This product was found to be a temporary eye irritant to rabbits.
- **Additional toxicological information:**
When used and handled according to specifications, the product does not have any harmful effects according to our experience and the information provided to us.
The substance is not subject to classification.
- **Carcinogenic categories:**
- **IARC (International Agency for Research on Cancer):** Substance is not listed.

· **NTP (National Toxicology Program):**

Substance is not listed.

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Issue date 08/07/2015

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Trade name: Gypchek

· OSHA-Ca (Occupational Safety & Health Administration):

Substance is not listed.

12 Ecological information

- **Toxicity:**
- **Aquatic toxicity:** No further relevant information available.
- **Persistence and degradability:** No further relevant information available.
- **Behavior in environmental systems:**
- **Bioaccumulative potential:** No further relevant information available.
- **Mobility in soil:** No further relevant information available.
- **Additional ecological information:**
- **General notes:** Avoid direct application to water.
- **Results of PBT and vPvB assessment:**
- **PBT:** Not applicable.
- **vPvB:** Not applicable.
- **Other adverse effects:** No further relevant information available.

13 Disposal considerations

- **Waste treatment methods:**
- **Recommendation:**
Observe all federal, state and local environmental regulations when disposing of this material.
Wastes from this product may be disposed of on site or at an approved waste disposal facility.
- **Uncleaned packagings:**
- **Recommendation:**
Do not reuse empty containers but arrange for disposal in a sanitary landfill or by incineration
- **Recommended cleansing agent:** Water, if necessary with cleansing agents.

14 Transport information

- **UN-Number:**
- **DOT, ADN, IMDG, IATA** Non-Regulated Material
- **ADR** Non-Regulated Material
- **UN proper shipping name:** Not Regulated
- **DOT, ADR, ADN, IMDG, IATA** Non-Regulated Material
- **Transport hazard class(es):**
- **DOT, ADR, ADN, IMDG, IATA** Non-Regulated Material
- **Class:** Non-Regulated Material
- **Packing group:**
- **DOT, ADR, IMDG, IATA** Non-Regulated Material
- **Environmental hazards:** Not applicable.
- **Special precautions for user:** Not applicable.
- **Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code:** Not applicable.
- **UN "Model Regulation":** Non-Regulated Material

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Issue date 08/07/2015

Reviewed on 08/07/2015

Trade name: Gypchek

15 Regulatory information

- **Safety, health and environmental regulations/legislation specific for the substance or mixture:**
- **SARA (Superfund Amendments and Reauthorization):**

- **Section 355 (extremely hazardous substances):**

Substance is not listed.

- **Section 313 (Specific toxic chemical listings):**

Substance is not listed.

- **TSCA (Toxic Substances Control Act):**

Substance is not listed.

- **California Proposition 65:**

- **Chemicals known to cause cancer:**

Substance is not listed.

- **Chemicals known to cause reproductive toxicity for females:**

Substance is not listed.

- **Chemicals known to cause reproductive toxicity for males:**

Substance is not listed.

- **Chemicals known to cause developmental toxicity:**

Substance is not listed.

- **Carcinogenic categories:**

- **EPA (Environmental Protection Agency):**

Substance is not listed.

- **TLV (Threshold Limit Value established by ACGIH):**

Substance is not listed.

- **NIOSH-Ca (National Institute for Occupational Safety and Health):**

Substance is not listed.

- **GHS label elements** Non-Regulated Material

- **Hazard pictograms:** Non-Regulated Material

- **Signal word:** Non-Regulated Material

- **Hazard statements:** Non-Regulated Material

- **National regulations:**

Non-Regulated Material

- **State Right to Know:**

None of the ingredients are listed

- **Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

16 Other information

The information and recommendations in this safety data sheet are, to the best of our knowledge, accurate as of the date of issue. Nothing herein shall be deemed to create warranty, expressed or implied, and shall not establish a legally valid contractual relationship. It is the responsibility of the user to determine applicability of this information and the suitability of the material or product for any particular purpose.

- **Date of preparation / last revision:** 08/07/2015 / 4

- **Abbreviations and acronyms:**

ADR: The European Agreement concerning the International Carriage of Dangerous Goods by Road

ADN: The European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways

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IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
ACGIH: American Conference of Governmental Industrial Hygienists
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
PBT: Persistent, Bioaccumulative and Toxic
vPvB: very Persistent and very Bioaccumulative

· *** Data compared to the previous version altered.**

SDS created by MSDS Authoring Services www.msdsauthoring.com +1-877-204-9106

USDA Forest Service

March, 2016

TECHNICAL BULLETIN**GYPCHEK, BIOLOGICAL INSECTICIDE FOR THE GYPSY MOTH**

Gypchek is a powder that consists of occlusion bodies (OBs) (polyhedra) of the gypsy moth nucleopolyhedrovirus and inert insect parts from the gypsy moth larvae in which the virus was produced. Care must be taken in the storage, mixing and application of the technical powder. The virus is very sensitive to sunlight and temperatures above 55° C (131° F) and the powder should be stored under cool conditions, preferably refrigeration, and in the dark prior to use. Temperatures below freezing are recommended for long-term storage. Since Gypchek is especially active against smaller larvae it is recommended that applications be made as soon as hatch is complete, all larvae have dispersed off the egg masses and are actively feeding, and the majority of larvae are in the late-first or early-second instar. Further, the majority of the target foliage, should be at least 20 percent expanded at the time of spray. The two tank-mixtures described below are for aerial application and should be applied in sufficient volume for thorough foliar coverage.

1. MIXING AND APPLICATION FOR AERIAL TREATMENTS

A spray adjuvant (Carrier 038-A, Omnova solutions, Inc., 803-377-2204) has been specifically developed for use with Gypchek. Carrier 038-A possesses sunlight-shielding and antievaporative properties superior to a molasses tank-mix that is also used with Gypchek. For suppression of gypsy moth populations and the protection of foliage in treatment areas where egg hatch is synchronous and most larvae are at the same stage of development, the current recommendation for the Carrier 038-A tank-mix is a single application of 400 billion (4×10^{11}) OBs or a double application of 200 billion (2×10^{11}) OBs in one-half to one gallon (U.S.) finished spray per acre per application. In treatment areas where hatch is not synchronous (e.g., along elevational gradients) two applications each of 200 billion (2×10^{11}) OBs, three to five days apart, in one-half to one gallon (U.S.) finished spray per acre per application is recommended. For operational suppression there are more data to support the use of one gallon of finished spray per acre per application.

The current recommendation for suppression using the standard tank-mix is one or two applications, three to five days apart, at the rate of 200 billion OBs in one-half to two gallons (U.S.) of finished spray per acre for each application. Use hydraulic nozzle systems (e.g., flat fans with 8006 tips) or rotary atomizers (e.g., Micronair AU 5000) designed to result in a droplet $D_{v,5}(=VMD)^3$ of 100 to 350 microns. It is recommended that applications be made under favorable weather conditions (winds <10 mph, relative humidity at least 50 percent, and temperatures below 80° F.) which is usually early in the morning or early in the evening. Do not spray if rain is predicted within 12 hrs. of the planned application.

CARRIER 038-A TANK MIX (PER GALLON)²

Gypchek	200-500 billion OBs
Carrier 038-A	0.94 gallon (120 fl. oz.)
Water	0.05 gallon (7 fl.oz)
Tactic ²	0.01 gallon (1 fl. oz.)

The finished tank-mix should be prepared 94 parts Carrier 038-A, 1 part foliar adhesive and 5 parts Gypchek-water slurry (vol/vol). For example, a 5 gallon slurry of Gypchek would be used with 94 gallons of Carrier 038-A and 1 gallon of Tactic® (Loveland Industries) to treat 100 acres at one gallon per acre.

Important: Check the pH of water from a field source. If the pH exceeds 7.5 or is below 5.5, add sufficient acid or base to adjust⁴ the pH to approximately 7.0. **NEVER USE CHLORINATED WATER TO PREPARE THE GYPCHEK SLURRY.**

MIXING INSTRUCTIONS

1. For every 100 gallons of tank mix, add the appropriate amount of Gypchek to 5 gallons of water in a clean pail. Mix into a slurry until the powder is evenly dispersed and there are no clumps. Whenever practical, shield the powder from direct sunlight while preparing the slurry. **DO NOT ADD THE POWDER DIRECTLY TO THE TANK MIX IN THE AIRCRAFT HOPPER.**

2. Add the appropriate amount of Carrier 038-A to the mix tank and while circulating pour in the Gypchek-water slurry. Rinse the slurry pail(s) with a small amount of water and add the rinsate(s) to the tank. Continue to mix thoroughly for at least 5 minutes. Finally, add the Tactic® and continue to mix thoroughly for at least 10 minutes before loading the aircraft.

STANDARD TANK MIX (PER GALLON)

Gypchek	100-500 billion OBs
Feed-grade molasses ⁵	0.26 gallon (32 fl.oz.)
Tactic® (Loveland Industries)	0.02 gallon (2.5 fl. oz.)
Water	0.73 gallon (93 fl. oz.)

MIXING INSTRUCTIONS

1. Fill the mix- tank with the amount of nonchlorinated water (pH 5.5-7.5)⁴ necessary for the desired acreage.
2. While circulating, slowly add the molasses and mix thoroughly for about 5 minutes. The molasses mix can stand overnight, perhaps two nights if cool.
3. Just before spray add the Gypchek and finally the Tactic. The Gypchek powder should be added slowly to avoid clumping. Gypchek can also be added as a slurry described above. Circulate for 15-20 minutes and load as per aircraft specifications.

WATER TANK MIX (PER GALLON)⁶

Gypchek	10 billion OBs
Water	0.98 gallon (125 fl.oz)
Tactic®	0.02 gallon (2.5 fl. oz.)

This tank mixture is for ground application using hydraulic equipment and should be applied in sufficient volume for thorough and uniform foliage coverage. For spraying roadsides, woodlots or small acreages, it is recommended that one application be made at the rate of 100 gallons (U.S.) finished spray per acre. For individual trees in homeowner situations it is recommended that trees be sprayed once to runoff (For example: 15-25 gallons per tree for large oaks).

MIXING INSTRUCTIONS

1. Fill hydraulic sprayer tank mix with the amount of nonchlorinated water (pH 5.5-7.5.)⁴ necessary for the desired acreage. While circulating, slowly add the Gypchek, either as the powder or as a slurry. Finally, add the Tactic and circulate for 15-20 minutes before spraying.

¹ Read label thoroughly before using and follow all cautions and directions.

² The addition of 1 percent Tactic® (vol/vol) may enhance the adhesive properties of Carrier 038-A.

³ The droplet size that divides the spray volume in half; 50 percent of the droplets are above the $D_{v,5}$ and 50 percent are below.

⁴ Use products that are available for adjusting the pH of swimming pool water.

⁵ Use refined products that contain minimal amounts of plant material, e.g., Mo-Mix (Southern States Cooperative), Triple Crown Pure Cane Molasses (Equine Specialty Feed Co.), or similar products.

⁶ Ground-based hydraulic sprays without UV protectants have been found to be as efficacious as sprays containing UV protectants presumably because virus applied to the undersides of leaves is protected from direct sunlight and remains active long enough for larvae to acquire lethal doses.

TACTIC™

STICKER • SURFACTANT • DEPOSITION AID

Principal Functioning Agents:

Synthetic latex, 1,2-propanediol, Alcohol ethoxylate, silicone polyether copolymer63.4%

Constituents ineffective as spray adjuvant36.6%

TOTAL100.0%

CA Reg. No. 34704-50041; WA Reg. No. 34704-05008

KEEP OUT OF REACH OF CHILDREN



WARNING

Precautionary Statements: Harmful if inhaled. Avoid breathing dust/fume/gas/mist/vapours/spray. Use only outdoors or in a well-ventilated area. **Environmental Precautions:** Prevent further leakage or spillage if safe to do so. Do not contaminate water. Do not allow to enter drains, sewers, or watercourses.

NET CONTENTS: 1 GAL. (3.78 L)



G0814

Loveland Products, Inc. • PO Box 1286 • Greeley, CO 80632-1286



Personal Protective Equipment: Wear protective gloves/protective clothing/eye protection.

FIRST AID: If in **Eyes:** Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice. If on **Skin or Clothing:** Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice. If **Swallowed:** Call a poison control center or doctor immediately for treatment advice. Have a person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by the poison control center or doctor. Do not give anything by mouth to an unconscious person. If **Inhaled:** Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably by mouth-to-mouth, if possible.

GENERAL: TACTIC™ combines the adherence ability of a latex polymer with super coverage of organosilicone surfactants. TACTIC will increase deposition, reduce run-off and secure spray from rain or overhead irrigation. TACTIC will decrease surface tension, resulting in better coverage. TACTIC promotes rapid spreading for a uniform protective film. TACTIC can be used in terrestrial or aquatic settings. Apply sprays containing TACTIC at least 30 minutes before an anticipated rain or overhead irrigation.

THIS PRODUCT CAN BE USED IN THE FOLLOWING SETTINGS: AGRICULTURAL, AQUATIC, FORESTRY, INDUSTRIAL, MUNICIPAL, NON-CROPLAND, ORNAMENTAL, RIGHTS-OF-WAY AND TURF.

DIRECTIONS FOR USE: Fill spray tank 1/2 full with water and begin agitation. Add pesticides as directed by label, while maintaining agitation. After pesticides are thoroughly mixed, eliminate any existing foam with approved defoamer (UNFOAMER®). To minimize foam from organosilicone surfactant, fill tank to desired water volume before adding TACTIC. For tank mix compatibility concerns, conduct a jar test of the proposed mixture to ensure compatibility of all components. Mix components in the same ratio as the proposed tank mix.

**Suggested Use Rates
Ground and Air Application**

Volume / acre	Fluid oz. / 100 gallons
Above 50 GPA	8 to 16
10 to 50 GPA	16 to 24
Below 10 GPA	24 to 32

Rinse tank, pump, lines and nozzles with water immediately after spraying. Observe the pre-harvest interval on the pesticide label when using TACTIC. No time limitations apply to non-food crops.

STORAGE AND DISPOSAL

STORAGE: Store in cool, dry place. Store in original container. Keep container tightly closed. Do not reuse empty container.

DISPOSAL: Do not contaminate water, food, or feed by storage or disposal. Dispose of contents/container on-site or at an approved waste disposal facility. Triple rinse (or equivalent) adding rinse water to spray tank. Offer container for recycling or dispose of container in sanitary landfill, or by other procedures approved by appropriate authorities. Recycling decontaminated containers is the best option of container disposal. The Agricultural Container Recycling Council (ACRC) operates the national recycling program. To contact your state and local ACRC recycler visit the ACRC web page at www.acrcycle.org.

CONDITIONS OF SALE AND LIMITATION OF WARRANTY AND LIABILITY

BEFORE BUYING OR USING THIS PRODUCT, read the Directions for Use and the following Conditions of Sale and Limitation of Warranty and Liability. By buying or using this product, the buyer or user accepts the following Conditions of Sale and Limitation of Warranty and Liability, which no employee or agent of LOVELAND PRODUCTS, INC. or the seller is authorized to vary. LOVELAND PRODUCTS, INC. warrants that this product conforms to the chemical description on the label and is reasonably fit for the purposes stated in the Directions for Use, when the product is used in accordance with such Directions for Use under normal conditions of use. LOVELAND PRODUCTS, INC. MAKES NO OTHER WARRANTY, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. THE BUYER'S OR USER'S EXCLUSIVE REMEDY FOR ANY INJURY, LOSS, OR DAMAGE RESULTING FROM THE HANDLING OR USE OF THIS PRODUCT SHALL BE LIMITED TO ONE OF THE FOLLOWING, AT THE ELECTION OF LOVELAND PRODUCTS, INC. OR THE SELLER: DIRECT DAMAGES NOT EXCEEDING THE PURCHASE PRICE OF THE PRODUCT OR REPLACEMENT OF THE PRODUCT. LOVELAND PRODUCTS, INC. AND THE SELLER SHALL NOT BE LIABLE TO THE BUYER OR USER OF THIS PRODUCT FOR ANY CONSEQUENTIAL, SPECIAL, OR INDIRECT DAMAGES, OR DAMAGES IN THE NATURE OF A PENALTY.

TACTIC 1GL [G0814]

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FOR CHEMICAL EMERGENCY, SPILL, LEAK, FIRE, EXPOSURE OR ACCIDENT, CALL CHEMTREC - DAY OR NIGHT 1-800-424-9300**1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER****1.1 PRODUCT IDENTIFIER:****TRADE NAME:** TACTIC™**1.2 RECOMMENDED USE:** STICKER - SURFACTANT – DEPOSITION AID**1.3 SUPPLIER DETAILS:**

LOVELAND PRODUCTS, INC.

P.O. Box 1286 • Greeley, CO 80632-1286

1.4 24 Hour Emergency Phone: 1-800-424-9300 - **Medical Emergencies:** 1-866-944-8565

U.S. Coast Guard National Response Center: 1-800-424-8802

2. HAZARDS IDENTIFICATION**2.1 Classification of the substance or mixture****Classification according to 29 CFR 1910.1200**

Eye Irritation

Category 2B

H320

Acute Toxicity (Dermal)

Category 5

H313

Acute Inhalation

Category 4

H332

2.2 Label elements

Signal word:

WARNING

Hazard Statement:

H320 – Causes eye irritation.

H313 – May be harmful in contact with skin

H332 – Harmful if inhaled

Precautionary

Statement:

P261 – Avoid breathing dust / fume / gas / mist / vapors / spray.

P271 - Use only outdoors or in a well-ventilated area.

(Prevention):

Precautionary

Statement:

(Response):

P305+P351+P338 – IF IN EYES: Rinse with water for 15 to 20 minutes. Remove contact lenses, if present, and continue rinsing eyes.

P302+P352 – IF ON SKIN: Wash with plenty of water for 15 to 20 minutes

P301+P310 – IF SWALLOWED: Immediately call a poison control center or doctor/physician.

P304+P341 – IF INHALED: If breathing is difficult, remove victim to fresh air and keep at rest in position comfortable for breathing.

Precautionary

Statement:

(General):

P101+P102+P103 – If medical advice is needed, have product container or label available. Keep out of reach of children. Read label before use

2.3 Other hazards

None known

KEEP OUT OF REACH OF CHILDREN –

Appearance and odor: Pale green liquid with mild odor.

WARNING**Potential Health effects****Routes of exposure**

Eye contact, skin contact, inhalation. Avoid breathing spray mist.

Eyes

Causes eye irritation.

Skin

May be harmful if in contact with skin.

Inhalation

Harmful if inhaled.

Ingestion

May be harmful if swallowed.

Target organs

Skin. Eyes. Inhalation.

Signs and symptoms

May be harmful if absorbed through skin.

Potential environmental effects

This product is not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have harmful or damaging effect on the environment.

3. COMPOSITION, INFORMATION ON INGREDIENTS**3.1 Substances**

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3.2 Mixtures**Classification according to 29 CFR 1910.1200**

Chemical Name:	CAS No.	Classification	Concentration [%]
Synthetic Latex Copolymer	52831-07-9	Eye Irrit. 2B; H319	
1,2-propanediol	57-55-6	Skin 5; H315	
Alcohol ethoxylate	34398-01-1	Inh. 4; H332	
Silicone polyether copolymer	67762-90-7		63.40
Other ingredients			36.60

4. FIRST AID MEASURES**4.1 Description of First Aid Measures**

General Advice: Get medical attention if symptoms occur.

Eye contact: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice.

Skin contact: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice.

Ingestion: Call a poison control center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by a poison control center or doctor. Do not give anything by mouth to an unconscious person.

Inhalation: Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferable by mouth-to-mouth, if possible. Call a poison control center or doctor for treatment advice.

4.2 Most Important Symptoms and Effects, Acute and Delayed

Symptoms: Causes eye irritation.

4.3 Immediate Medical Attention and Special Treatment

Treatment: Treat symptomatically. Symptoms may be delayed.

FOR A MEDICAL EMERGENCY INVOLVING THIS PRODUCT CALL: 1-866-944-8565

Take container, label or product name with you when seeking medical attention.

NOTES TO PHYSICIAN: No specific antidote. Treatment of exposure should be directed at the control of symptoms and the clinical condition of the patient.

5. FIRE FIGHTING MEASURES**5.1 EXTINGUISHING MEDIA:**Suitable Extinguishing Media: Dry chemical, carbon dioxide (CO₂), alcohol foam, foam, water spray or fog. Do not use water jet as this will spread the fire.**5.2 SPECIAL HAZARDS ARISING FROM THE SUBSTANCE OR MIXTURE:**

Specific Hazards During Firefighting: During a fire, hazardous by-products can be released.

5.3 SPECIAL PROTECTIVE EQUIPMENT AND PRECAUTIONS FOR FIREFIGHTERS

Special Protective Equipment for Firefighters: Self-contained breathing apparatus and full protective gear should be worn in fighting large fires involving chemicals. Use water spray to keep fire exposed containers cool. Keep people away. Isolate fire and deny unnecessary entry.

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6. ACCIDENTAL RELEASE MEASURES**6.1 PERSONAL PRECAUTIONS, PROTECTIVE EQUIPMENT AND EMERGENCY PROCEDURES**

Personal Precautions:

Avoid inhalation of vapors and spray mist and contact with skin and eyes. Ensure adequate ventilation. Wear suitable protective clothing.

6.2 ENVIRONMENTAL PRECAUTIONS

Environmental Precautions:

Prevent further leakage or spillage if safe to do so. Do not contaminate water. Do not allow to enter drains, sewers, or watercourses.

6.3 METHODS AND MATERIALS FOR CONTAINMENT AND CLEAN-UP

Methods for Clean-Up:

Large Spills: Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible. Absorb in vermiculite, dry sand or earth and place into containers. After removal flush contaminated area thoroughly with water.

Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to

Remove residual contamination.

Never return spills to original containers for re-use.

7. HANDLING AND STORAGE**7.1 PRECAUTIONS FOR SAFE HANDLING:**

Advice on Safe Handling:

Avoid inhalation of mists, vapors / spray and contact with eyes, skin and clothing. Do not breathe mists or vapor. Wear personal protective equipment. Do not use in areas without adequate ventilation. Avoid prolonged exposure. Wash thoroughly after handling. Do not empty into drains. Handle and open container with care. Use care in handling/storage. Wash before eating, drinking and/or smoking.

7.2 CONDITIONS FOR SAFE STORAGE:

Requirements for Storage Areas and Containers:

Store in cool, dry place. Store in original container. Keep tightly closed. Do not reuse empty container. Do not contaminate water, food or feed by storage or disposal.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION**8.1 CONTROL PARAMETERS:****OCCUPATIONAL EXPOSURE LIMITS**

U.S. Workplace Exposure Level (ACGIH or AIHA) Guides

Components	Type	Value
1,2-propanediol	TWA	10 mg/m ³

Biological limit values**ACGIH Biological Exposure Indices**

Components	Value	Specimen
No listings		

8.2 EXPOSURE CONTROLS:**Engineering Measures**

Provide adequate general and local exhaust ventilation. Observe Occupational Exposure Limits and minimize the risk of inhalation of vapors and spray mists. Provide eyewash station and safety shower.

Individual Protection Measures:

Eye / Face Protection:

Goggles or shielded safety glasses are recommended.

Skin Protection:

Wear chemical-resistant gloves. Long-sleeved shirt, long pants, and socks.

Respiratory Protection:

In case of inadequate ventilation or risk of inhalation of mists or vapors, use suitable respiratory equipment such as MSHA/NIOSH TC-21C or NIOSH approved respirator with N, R, P or HE filter. Wear respiratory protection during operations where spraying or misting occurs. If respirators are used, a program should be in place to assure compliance with 29 CFR 1910.134, the OSHA Respiratory Protection standard. Wear air supplied respiratory protection if exposure concentrations are unknown.

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9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 APPEARANCE:	Liquid.
ODOR:	Mild.
ODOR THRESHOLD:	No data available.
COLOR:	Light green.
pH:	7.0 – 8.0 (1% solution)
MELTING POINT / FREEZING POINT:	No data available.
BOILING POINT:	No data available.
FLASH POINT:	>212°F (>100°C) / TCC
FLAMMABILITY (solid, gas):	No data available.
UPPER / LOWER FLAMMABILITY OR EXPLOSIVE LIMITS:	No data available.
VAPOR PRESSURE:	No data available.
SOLUBILITY:	Dispersible.
PARTITION CO-EFFICIENT, n-OCTANOL / WATER:	No data available.
AUTO-IGNITION TEMPERATURE:	No data available.
DECOMPOSITION TEMPERATURE:	No data available.
VISCOSITY, kinematic:	No data available.
SPECIFIC GRAVITY (Water = 1):	1.02 – 1.03 g/ml
BULK DENSITY:	8.51 – 8.59 lbs./gal. / 1.02 – 1.03 kg/L

Note: These physical data are typical values based on material tested but may vary from sample to sample.
Typical values should not be construed as a guaranteed analysis of any specific lot or as specification items.

10. STABILITY AND REACTIVITY**10.1 REACTIVITY**

Stable

10.2 CHEMICAL STABILITY

Stable under normal temperature conditions

10.3 POSSIBILITY OF HAZARDOUS REACTIONS

No reactions known under normal use conditions. Will not polymerize.

10.4 CONDITIONS TO AVOID

None known.

10.5 INCOMPATIBLE MATERIALS

Strong oxidizers, strong acids and bases at high temperatures.

10.6 HAZARDOUS DECOMPOSITION PRODUCTS

Oxides of carbon from burning.

11. TOXICOLOGICAL INFORMATION**11.1 LIKELY ROUTES OF EXPOSURE**

Eye contact.

LC₅₀ (rat): >2.33 mg/L (4 HR)**LD₅₀ Oral (rat):** >5,000 mg/kg**LD₅₀ Dermal (rabbit):** >2,000 mg/kg**Acute Toxicity Estimates:** No data available**Skin Irritation (rabbit):** Slightly irritating.**Eye Irritation (rabbit):** Serious eye irritation.**Specific Target Organ Toxicity:** Single exposure: No data available.**Aspiration:** No data available**Skin Sensitization (mouse):** Not a sensitizer**Carcinogenicity:** No data available**Germ Cell Mutagenicity:** No data available**Interactive Effects:** None known

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12. ECOLOGICAL INFORMATION**12.1 ECOTOXICITY**

The product is not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.

Ecotoxicological Data

	Species	Test Results
Product		
96-hour LC ₅₀	Poecilia reticulata	160.0 mg/L
24-hour EC ₅₀	Daphnia magna	99.1 mg/L

Drift or runoff may adversely affect non-target plants.

Do not apply directly to water.

Do not contaminate water when disposing of equipment wash water.

Do not apply when weather conditions favor drift from target area.

12.2 PERSISTENCE AND DEGRADABILITY

Biodegradability: No data available

12.3 BIOACCUMULATIVE POTENTIAL

Bioaccumulation: No data available.

12.4 MOBILITY IN SOIL

No data available.

12.5 OTHER ADVERSE EFFECTS

Assessment: No data available.

13. DISPOSAL CONSIDERATIONS**13.1 WASTE TREATMENT METHODS**

Wastes may be disposed of on site or at an approved waste disposal facility. Triple rinse (or equivalent), adding rinse water to spray tank. Offer container for recycling or dispose of in a sanitary landfill or by other procedures approved by appropriate authorities. Recycling decontaminated containers is the best option of container disposal. The Agricultural Container Recycling Council (ACRC) operates the national recycling program. To contact your state and local ACRC recycler visit the ACRC web page at <http://www.acrecycle.org/>. Do not contaminate water, food or feed by storage or disposal.

14. TRANSPORT INFORMATION**14.1 LAND TRANSPORT**

DOT Shipping Description: NOT REGULATED.

U.S. Surface Freight Classification: ADHESIVES, ADJUVANTS, SPREADERS OR STICKERS (NMFC 4610; CLASS 60)

15. REGULATORY INFORMATION**15.1 SAFETY, HEALTH AND ENVIRONMENTAL REGULATIONS****NFPA & HMIS Hazard Ratings:****NFPA**

1	Health	0	Least
0	Flammability	1	Slight
0	Instability	2	Moderate
		3	High
		4	Severe

HMIS

1	Health
0	Flammability
0	Reactivity
B	PPE

SARA Hazard Notification/Reporting**SARA Title III Hazard Category:**

Immediate Y
Delayed N

Fire N
Reactive N

Sudden Release of Pressure N

Reportable Quantity (RQ) under U.S. CERCLA: Not listed

SARA, Title III, Section 313: Not listed

RCRA Waste Code: Not listed

CA Proposition 65: Not applicable

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16. OTHER INFORMATION

SDS STATUS: All sections reviewed; change in format

PREPARED BY: Registrations and Regulatory Affairs

REVIEWED BY: Environmental Health and Safety

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CA REG. NO.: 34704-50041

WA REG. NO.: 34704-04008

Disclaimer and Limitation of Liability: This data sheet was developed from information on the constituent materials identified herein and does not relate to the use of such materials in combination with any other material or process. No warranty is expressed or implied with respect to the completeness or ongoing accuracy of the information contained in this data sheet, and LOVELAND PRODUCTS, INC. disclaims all liability for reliance on such information. This data sheet is not a guarantee of safety. Users are responsible for ensuring that they have all current information necessary to safely use the product described by this data sheet for their specific purpose.

CARRIER 038-A

AQUEOUS FLOWABLE CARRIER FOR GYPCHEK OR TM-BIOCONTROL-1 NPV

KEEP OUT OF REACH OF CHILDREN CAUTION

INGREDIENTS:

Proprietary materials, water.....100%

PRACTICAL TREATMENT:

Avoid contact with skin, eyes or clothing. In case of contact, immediately flush eyes or skin with plenty of water. Get medical attention if irritation persists. Inhalation may induce asthmatic attack in individuals sensitive to sulfites. If inhaled, remove from exposure.

PRINCIPAL USE:

CARRIER 038-A is an aqueous, flowable, concentrated suspension of EPA approved inert ingredients. It is specifically formulated to be used with GYPCHEK (EPA-27586-2) and TM-BIOCONTROL-1 (EPA-27586-1) to improve the deposit of, and provide protection to, the active ingredient of the GYPCHEK and TM-BIOCONTROL-1 NPV.

STORAGE AND DISPOSAL:

Do not contaminate water, food or feed by storage or disposal of waste.

Storage: Tightly reclude containers of unused CARRIER and store in upright position. Do not allow freezing.

Disposal: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility in accordance with federal and local regulations.

Container Disposal: Triple rinse (or equivalent). Then offer for recycling or reconditioning or puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities.

Manufactured For:

U.S. Department of Agriculture
Forest Service
180 Canfield Street
Morgantown, WV 26505

DIRECTIONS FOR USE:

Mixing: Make a GYPCHEK or TM-BIOCONTROL-1 NPV water slurry in a clean pail (see GYPCHEK or TM-BIOCONTROL-1 labels for recommended dose rates). Slowly add the GYPCHEK or TM-BIOCONTROL-1 water slurry to the mix tank. Agitate/recirculate while adding the GYPCHEK or TM-BIOCONTROL-1 to assure homogeneity of the final tank mix suspension.

Air Application: Use the recommended amount of GYPCHEK or TM-BIOCONTROL-1 (see GYPCHEK or TM-BIOCONTROL-1 label) in 0.5 - 1 gallon of CARRIER 038-A tank mix per acre.

WARRANTY NOTICE:

OMNOVA Solutions Inc. MAKES NO WARRANTY OF MERCHANT ABILITY, FITNESS FOR ANY PURPOSE, OR OTHERWISE, EXPRESS OR IMPLIED, concerning this product or its uses which extend beyond the use of the product under normal conditions in accord with the statements made on this label. In no case shall the seller be liable to consequential, special, or indirect damages resulting from the use or handling of this product. All such risks shall be assumed by the buyer.

Revision Date: 2009

**MATERIAL SAFETY DATA SHEET****1. Product and Company Identification**

Material name	CARRIER 038-A PL480
Version #	03
Revision date	03-02-2009
Chemical description	Aqueous Surfactant Mixture
CAS #	Mixture
SAP number	500918
Manufacturer information	OMNOVA Solutions Inc. 1455 J.A. Cochran By-Pass Chester, SC 29706 US Fax 803-377-2219 General 803-385-5181 CHEMTREC 800-424-9300 CHEMTREC (outside US) 703-527-3887

2. Hazards Identification

Emergency overview	Health injuries are not known or expected under normal use.
OSHA regulatory status	This product is considered not hazardous under 29 CFR 1910.1200 (Hazard Communication).
Potential health effects	
Routes of exposure	Not applicable.
Eyes	Health injuries are not known or expected under normal use.
Skin	Health injuries are not known or expected under normal use.
Inhalation	Health injuries are not known or expected under normal use.
Ingestion	Health injuries are not known or expected under normal use.

3. Composition / Information on Ingredients

The manufacturer lists no ingredients as hazardous according to OSHA 29 CFR 1910.1200.

4. First Aid Measures

First aid procedures	
Eye contact	Rinse with water. Get medical attention if irritation develops or persists.
Skin contact	Get medical attention if irritation develops or persists. Rinse skin with water/shower.
Inhalation	If breathing is difficult, remove to fresh air and keep at rest in a position comfortable for breathing. Call a physician if symptoms develop or persist.
Ingestion	Rinse mouth. If ingestion of a large amount does occur, call a poison control center immediately.
General advice	If you feel unwell, seek medical advice (show the label where possible).

5. Fire Fighting Measures

Flammable properties	Not flammable by OSHA criteria. Not combustible by OSHA criteria.
Extinguishing media	
Suitable extinguishing media	Water. Water fog. Foam. Dry chemical powder. Carbon dioxide (CO ₂).
Protection of firefighters	
Protective equipment and precautions for firefighters	Move containers from fire area if you can do it without risk. Use water spray to cool unopened containers. Cool containers with flooding quantities of water until well after fire is out.
Specific methods	In the event of fire, cool tanks with water spray. Use water spray to cool unopened containers.

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Version #: 03 Revision date: 03-02-2009 Print date: 03-02-2009

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6. Accidental Release Measures

Personal precautions	Keep unnecessary personnel away.
Environmental precautions	Prevent further leakage or spillage if safe to do so.
Methods for containment	Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area). Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible.
Methods for cleaning up	Do not allow the spilled product to enter public drainage system or open water courses. Large Spills: Dike far ahead of liquid spill for later disposal. Use a non-combustible material like vermiculite, sand or earth to soak up the product and place into a container for later disposal. Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean contaminated surface thoroughly. After removal flush contaminated area thoroughly with water. Never return spills in original containers for re-use.

7. Handling and Storage

Handling	Do not handle or store near an open flame, heat or other sources of ignition. Handle and open container with care.
Storage	Keep away from heat, sparks, and flame. Use care in handling/storage.

8. Exposure Controls / Personal Protection

Personal protective equipment	
Eye / face protection	Wear safety glasses; chemical goggles (if splashing is possible).
Skin protection	Wear suitable gloves.
Respiratory protection	No personal respiratory protective equipment normally required.
General hygiene considerations	Handle in accordance with good industrial hygiene and safety practice. Eye wash fountain and emergency showers are recommended.

9. Physical & Chemical Properties

Appearance	Not available.
Color	Brown.
Odor	Mild. soapy
Odor threshold	Not available.
Physical state	Liquid.
Form	Liquid.
pH	6
Melting point	Not available.
Freezing point	32 °F (0 °C) Approximate
Boiling point	212 °F (100 °C) Approximate
Flash point	>= 212 °F (>= 100 °C)
Evaporation rate	Not available.
Flammability	Not available.
Flammability limits in air, upper, % by volume	Not available.
Flammability limits in air, lower, % by volume	Not available.
Vapor pressure	Approximately as water
Vapor density	Approximately as water
Specific gravity	1.15
Relative density	Not available.
Solubility (water)	Miscible/Dispersible

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Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
VOC	7.4019 % estimated

10. Chemical Stability & Reactivity Information

Chemical stability	Stable at normal conditions.
Conditions to avoid	Heat, flames and sparks.
Incompatible materials	Alkaline metals. Water. Acids.
Hazardous decomposition products	No hazardous decomposition products are known.

11. Toxicological Information

Toxicological data

Product	Test Results
CARRIER 038-A BULK (Mixture)	Acute Oral LD50 Rabbit: 93223 mg/kg estimated Acute Oral LD50 Rat: 79893 mg/kg estimated

* Estimates for product may be based on additional component data not shown.

Chronic effects	Not available.
Carcinogenicity	This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.
Corrosivity	Not available.
Epidemiology	Not available.
Mutagenicity	Not available.
Neurological effects	Not available.
Reproductive effects	Not available.
Teratogenicity	Not available.
Further information	This product has no known adverse effect on human health.

12. Ecological Information

Ecotoxicological data

Product	Test Results
CARRIER 038-A BULK (Mixture)	EC50 Daphnia: 93192 mg/l 48.00 Hours estimated LC50 Fish: 24743 mg/l 96.00 Hours estimated

* Estimates for product may be based on additional component data not shown.

Ecotoxicity	This material is not expected to be harmful to aquatic life.
Environmental effects	Ecological injuries are not known or expected under normal use. An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Persistence and degradability	Not available.

13. Disposal Considerations

Disposal instructions	Do not allow this material to drain into sewers/water supplies. This product, in its present state, when discarded or disposed of, is not a hazardous waste according to Federal regulations (40 CFR 261.4 (b)(4)). Under RCRA, it is the responsibility of the user of the product to determine, at the time of disposal, whether the product meets RCRA criteria for hazardous waste. Dispose in accordance with all applicable regulations.
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14. Transport Information

DOT

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

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IMDG

Not regulated as dangerous goods.

15. Regulatory Information**US federal regulations**

This product is not known to be a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.
All components are on the U.S. EPA TSCA Inventory List.

CERCLA (Superfund) reportable quantity

None

Superfund Amendments and Reauthorization Act of 1986 (SARA)**Hazard categories**

Immediate Hazard - No
Delayed Hazard - No
Fire Hazard - No
Pressure Hazard - No
Reactivity Hazard - No

Section 302 extremely hazardous substance

No

Section 311 hazardous chemical

No

Inventory status**Country(s) or region****Inventory name****Compliant***

Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Chemicals Substances (EINECS)	No
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

16. Other Information**Further information**

HMIS® is a registered trade and service mark of the NPCA.

HMIS® ratings

Health: 0
Flammability: 1
Physical hazard: 0

NFPA ratings

Health: 0
Flammability: 1
Instability: 0

Disclaimer

The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

Issue date

03-02-2009

This data sheet contains changes from the previous version in section(s):

Hazards Identification: Potential environmental effects
Accidental Release Measures: Environmental precautions
Accidental Release Measures: Methods for cleaning up
Handling and Storage: Handling
Physical & Chemical Properties: Physical & Chemical Properties
Ecological Information: Ecotoxicity
Regulatory Information: State regulations

Material name: CARRIER 038-A PL480 - 1070

Version #: 03 Revision date: 03-02-2009 Print date: 03-02-2009

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Additional information about Gypchek, Carrier 038-A or Tactic® sticker is available on the Forest Service website, <http://www.fs.fed.us/foresthealth/pesticide/virusproducts.shtml>.

If you wish to speak to someone about Gypchek, Carrier 038-A or Tactic® sticker, or if you encounter problems while using these products, please contact:

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