Suffolk County Vector Control & Wetlands Management Long Term Plan & Environmental Impact Statement

DATE	STATION	COMPOUND	CONCENTRATION DETECTED (PART PER TRILLION)
6/18/1997	45	Atrazine	5
		Deethylatrazine	1
		Metolachlor	5
		Prometon	14
		Simazine	2
11/15/1999	45	Aldicarb sulfone	110
2/23/2000	45	Aldicarb sulfoxide	70
7/17/2000	340	Aldicarb sulfoxide	90
9/12/2000	45	Metolachlor	2
		Prometon	8
7/30/2001	45	Aldicarb sulfone	110
	85	Aldicarb sulfone	110
11/14/2001	45	Aldicarb sulfone	110
		Aldicarb sulfoxide	70
	85	Aldicarb sulfone	150
		Aldicarb sulfoxide	220
1/16/2002	45	Aldicarb sulfone	120
	85	Aldicarb sulfone	130

Task 3 Literature Review
Book 5 Part 2: Overview of Mosquito Control Pesticides

Prepared for:

Suffolk County Department of Public Works
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Abbreviations and Acronyms

Bt	Bacillus thuringiensis
Bti	Bacillus thuringiensis israelensis
Bs	Bacillus sphaericus
DDE	Dichlorodiphenyldichloroethane
DDT	Dichlorodiphenyltrichloroethane
ESA	Ethanesulfonic Acid
FFDCA	Federal Food, Drug, and Cosmetic Act
FIFRA	Federal Insecticide, Fungicide and Rodenticide Act
IGR	Insect growth regulator
IMM	Integrated Mosquito Management
IPM	Integrated Pest Management
MSDS	Material Safety Data Sheet
NYSDEC	New York State Department of Environmental Conservation
OA	Oxanilic Acid
OP	Organophosphate
PEHL	The Public and Health Laboratory
SCDHS	Suffolk County Department of Health Services
SCVC	Suffolk County Department of Public Work, Division of Vector Control
ULV	Ultra Low Volume
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey

Executive Summary

Mosquito-borne diseases are among the world's leading causes of illness and death today. The World Health Organization estimates that more than 300 million clinical cases each year are attributable to mosquito-borne illnesses. Despite great strides over the last 50 years, mosquito-borne illnesses continue to pose significant risks to parts of the population in the United States.

Humans have a history of controlling mosquitoes, and other creatures considered "pests" with substances known as pesticides. They are agents of biological or chemical origin that control the target organism by killing it or preventing it from engaging in behaviors deemed to be destructive. Ancient Romans killed insect pests by burning sulfur. In the 1600s, ants were controlled with mixtures of honey and arsenic. By the late nineteenth century, U.S. farmers were using copper acetoarsenite (Paris Green), calcium arsenate, nicotine sulfate, and sulfur to control insect pests in field crops.

A significant change in pesticide use began after World War II with the introduction of synthetic organic compounds, the most important of which was DDT (Dichlorodiphenyltrichloroethane). These new chemicals were inexpensive, effective, and have been widely applied. During the last 50 years chemical synthesis of pesticides has increased considerably. There are now more than 55 classes and 1,500 individual substances produced in more than 100,000 formulations of pesticides.

Pesticides utilized for mosquito control historically and presently include the following classes:

- *Organochlorines* (e.g.-DDT): Pesticides containing carbon, hydrogen, and chlorine. DDT was especially favored for its broad spectrum activity against pests of agriculture and human health. The US Environmental Protection Agency (USEPA) canceled all uses of DDT in 1973.
- *Organophosphates* (e.g.-Malathion): Pesticides containing phosphorus, they are all derived from one of the phosphoric acids. They have been used for mosquito control since the early 1950s.

- *Pyrethroids* (e.g.-Resmethrin, Sumithrin): Synthetic compounds that replicate the action of natural pyrethrum, which is derived from the flowers of the chrysanthemum plant.
- *Insect Growth Regulators* (e.g.-Methoprene): Chemicals that alter growth and development of the insect larvae, preventing it from reaching the adult stage.
- *Microbials* (e.g. - Bacillus thuringiensis israelensis [*Bti*]): Naturally occurring bacterium with specific toxicity to mosquito larvae. When ingested, they attack the gut lining of the larvae, causing starvation and death.
- *Synergists* (e.g.-Piperonyl Butoxide): Not in themselves considered toxic or insecticidal, synergists enhance the activity of pesticides by preventing the insects from metabolizing and expelling the chemicals prior to death occurring.

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) provides for Federal control of pesticide distribution, sale, and use. USEPA was given authority under FIFRA not only to study the consequences of pesticide usage but also to require users (farmers, utility companies, and others) to register when purchasing pesticides. Through later amendments to the law, users also must take exams in order to be certified as applicators of pesticides. In New York State, the certification process is administered by the New York State Department of Environmental Conservation (NYSDEC).

Every pesticide product must bear a label, which contains all of the information specified in FIFRA and the regulations 40 CFR 156.10, including:

1. Name, brand, and trademark.
2. Name and address of producer, registrant, or person produced for.
3. Net contents.
4. Product registration number.
5. Producing establishment number.
6. Ingredient statement.
7. Warning or precautionary statements.
8. Directions for use.

9. Use classification.

NYSDEC, in conjunction with Cornell University, summarizes the data for commercial application of all pesticides within New York State. In the most recent year for which reported data is available (2001) Suffolk County had the highest application of pesticides in the state, both on as gallons and pounds applied basis. It must be noted that the majority of pesticide applications in the county are associated with agricultural practices and are not related to mosquito control.

The Suffolk County Department of Public Works, Division of Vector Control, applies pesticide products to control mosquito populations in the county, as part of their Integrated Pest Management Program. Treatment of mosquitoes at the larval stage is preferred since the larvae are concentrated in a centralized location. Larvicide agents used by the Department include Vectobac® (Bti), Vectolex® (Bacillus sphaericus [Bs]), and Altosid®, (methoprene). If larval efforts fail to prevent a brood of mosquitoes, the county may elect to use adult control chemicals, which are applied using ground or aerial applications of Ultra Low Volume (ULV) aerosols. The primary adulticide products utilized by the county include Scourge® (Resmethrin), Anvil® (Sumithrin), and Fyfanon® (malathion). Resmethrin has been used since 1995 in both truck-mounted ULV foggers and, when necessary, in aerial applications. Sumithrin has been used since 1999 in truck-mounted foggers. Malathion has been in use for nearly twenty years.

Based on documented aquifer contamination by aldicarb in the early 1980s, and the importance of the underlying aquifers for water supply, the Suffolk County Department of Health Services (SCDHS) established a ground water monitoring program for pesticides and other chemicals of concern. The program, which concentrates on land areas where pesticides are routinely used (e.g. – agricultural lands, golf courses), has the capacity to analyze for 113 pesticides and pesticide degradate compounds. The county has also done pesticide monitoring on streams tributary to the Peconic Bay, as part of the Peconic Estuary Program.

1. Introduction

Pesticides are chemical substances intended to prevent, destroy, or repel undesirable organisms, or "pests". They include insecticides, fungicides, herbicides, and rodenticides. Pesticides may either be synthetic chemicals or naturally occurring substances, such as certain inorganic dusts, bacterial toxins, or plant derivatives. Pesticides have contributed to dramatic increases worldwide in crop yields and have helped to limit the spread of disease. They play an important part in the multi-faceted efforts undertaken to control disease.

This report is intended to serve as a brief introduction to the history of pesticide use, the types of pesticides utilized by mosquito control agencies in this country, the labeling requirements for commercial distribution, and those chemicals used specifically by the Suffolk County Department of Public Works, Division of Vector Control (SCVC).

Additional and more specific information on pesticide formulations, modes of action, and delivery systems can be found in Book 4, Overview of Mosquito Control. Information related to the impacts of pesticides on humans and the environment can be found in Books 6 and 7.

2. History of Pesticide Use in Mosquito Control

Pesticides are agents of chemical or biological origin that are utilized to control insects. Control may result from killing the insect or otherwise preventing it from engaging in behaviors that are deemed to be destructive. Pesticides may be natural or manmade and are applied to target pests in a myriad of formulations and delivery systems (sprays, baits, slow-release diffusion, etc.) (Ware and Whitacre, 2004).

Historians have traced the use of pesticides to the time of Homer around 1000 BC, but the earliest known records of pesticides pertain to the burning of "brimstone" (sulfur) as a fumigant (Harrison, 1978). In the United States, pyrethrum was the most important botanical insecticide in the market. Ground from the petals of several species of the chrysanthemum plant, it achieved prominence as "insect powder" before 1800, but was not widely used because of its expense. Pyrethrum flowers were picked entirely by hand and the large investment in land and labor made pyrethrum too costly for widespread use (Harrison, 1978).

In the nineteenth century, arsenic joined pyrethrum as a major active ingredient in insecticides, especially in agriculture. Although it's first such uses are obscure, an arsenic powder called Paris Green became popular in the United States in the 1860s to control the Colorado potato beetle. The insecticide was a great success and by 1896, the United States was using 2,000 tons of Paris Green annually (Harrison, 1978).

In the early twentieth century, attention was focused toward the mosquito when it was determined that it was the vector responsible for the transmission of malaria. Accepted means of killing mosquito larvae at that time were to dry up the pools in which they lived before they could complete metamorphosis into adult form, to suffocate them by laying down a film of oil that clogged their breathing tubes, or to poison the entire body of water in which they grew with chemical compounds such as carbolic acid, resin, and caustic soda, which were utilized in the Panama Canal zone in 1908 (Harrison, 1978).

In 1920 it was discovered that the *Anopheles* larvae (the mosquito species responsible for malaria transmission) would ingest everything of the right size that drifted into their mouths. Various substances were experimented with in order to develop the first chemical larvicide. The cheapest, most effective and easiest to handle was copper acetoarsenite (Paris Green), which had long been used against pests of food crops, mixed with water or still more effectively with fine dry dust (Russell, 2001).

At the beginning of World War II (1940), pesticide choices included several arsenicals, petroleum oils, nicotine, pyrethrum, rotenone, sulfur, hydrogen cyanide gas, and cryolite. These "first generation" pesticides were highly toxic compounds. Their use was largely abandoned because they were either too ineffective or too toxic. It was World War II that opened the modern era of chemical control with the introduction of a new concept of insect control, the "second generation" pesticides - synthetic organic compounds (Ware and Whitacre, 2004).

2.1. Organochlorines

The organochlorines are pesticides that contain carbon, hydrogen, and chlorine. They are also known by other names: *chlorinated hydrocarbons, chlorinated organics, chlorinated insecticides*, and *chlorinated synthetics* (Ware and Whitacre, 2004).

The first, and most important, organochlorine compound was developed in 1939 by a Swiss chemist named Paul Muller. He had crafted Neocide, to be used as a moth killer, out of a chemical that had been invented in Germany almost fifty years before. Once its effectiveness had been demonstrated, British and American factories began manufacturing it by the ton under a new name – dichlorodiphenyltrichloroethane, more commonly known by the initials DDT. In its early days, it was hailed as a miracle for a number of reasons (Russell, 2001):

- It was toxic to a wide range of insect pests (broad spectrum)
- It appeared to have low toxicity to mammals
- It was persistent in the environment
- It was not water soluble
- It was inexpensive and easy to apply

In 1944, Muller was awarded the Nobel Prize for its discovery. DDT was used for mosquito control in residential areas of the United States until the 1970s. More than 4 billion pounds of DDT have been used throughout the world, beginning in 1940. In the US, use ended in 1973 when USEPA banned it (Muir, 2002). DDT is still used for malaria control in several third world countries, although generally as a more targeted usage (inside homes, for example) than through broad applications throughout the environment.

The enthusiasm for pesticides began to temper with the publication in 1962 of Rachel Carson's book "Silent Spring," in which she issues grave warnings about pesticides and their impact on the environment. She argued that there were severe impacts on non-target creatures due to the pesticides' direct toxicity and their persistence in the environment. Her book focused on the chlorinated hydrocarbons, such as DDT (Delaplane, 1996).

2.2. Organophosphates

Organophosphates (OPs) is the term that includes all pesticides containing phosphorus. They have also historically been known as: *organic phosphates, phosphorus insecticides, nerve gas relatives,* and *phosphoric acid esters*. All organophosphates are derived from one of the phosphoric acids. Their insecticidal qualities were first observed in Germany during World War II in the study of extremely toxic OP nerve gases sarin, soman, and tabun. Initially, the discovery was made in search of substitutes for nicotine, which was heavily used as an insecticide but in short supply in Germany (Ware and Whitacre, 2004). Organophosphates were introduced to the market in 1946, and have been used for mosquito control since the early 1950s. Malathion, a general-use organophosphate, is one of the more widely used adulticides in the country, primarily because of its lower cost compared with other USEPA-approved adulticides (Muir, 2002).

2.3. Pyrethroids

Natural pyrethrum has not found wide use because of its cost and instability in sunlight. In recent decades, many synthetic pyrethrin-like materials have become available. Originally referred to as *synthetic pyrethroids*, they are now called simply pyrethroids (Ware and Whitacre, 2004). Some are stable in sunlight, but all are generally effective against mosquitoes at very low application rates (USEPA, 2002a).

The first pyrethroid (allethrin) was developed in 1949. Resmethrin, developed in 1967, and sumithrin, developed in 1973, are used extensively today for mosquito control (Ware and Whitacre, 2004).

2.4. Synergists

Synergists are not in themselves considered toxic or insecticidal, but are materials used with pesticides to enhance (synergize), the activity of the insecticides. The first was introduced in 1940 to increase the effectiveness of pyrethrum by slowing an insect's ability to metabolize the pesticide. Since then, many materials have been developed, but only a few are still marketed. Synergists are found in most all household, livestock and pet aerosols to enhance the action of the fast knockdown insecticides pyrethrum, allethrin, and resmethrin against flying insects (Ware and Whitacre, 2004). Piperonyl butoxide is the synergist most commonly used in mosquito control pesticides (NPTN, 2000a, b).

2.5. Insect Growth Regulators

Insect growth regulators (IGRs) are chemical compounds that alter growth and development in insects by interfering in the normal mechanisms of development, causing the insect to die before reaching the adult stage (Ware and Whitacre, 2004). Methoprene, registered for use in 1975, is the most common IGR used for mosquito control as a larvicide. In addition to posing low toxicity to mammals, there is little opportunity for human exposure, since the material is applied directly to ditches, ponds, marshes, or flooded areas that are not drinking water sources (FCCMC, 1998).

2.6. Microbials

Microbial insecticides obtain their name from microorganisms that are used to control certain insects. The insect disease-causing microorganisms are species specific, and generally pose minimal risk to other animals or plants. The insecticidal bacterium *Bacillus thuringiensis (Bt)* was discovered in the early 20th century. It is a soil inhabiting bacterium that, when ingested, leads to the slow degradation of the gut lining, and so leads to starvation. Over time, several *Bt* varieties have been discovered, each with its distinct toxicity characteristics to different insect species (Ware and Whitacre, 2004). *Bacillus thuringiensis* var. *israelensis*, with specific toxicity to mosquito larvae, was registered for use by USEPA in 1983. A similar acting larvicide, *Bacillus sphaericus (Bs)*, was registered for use in 1991 (USEPA, 2002b).

2.7. Integrated Pest Management

In the 1960s, researchers began developing a different approach to pest control called Integrated Pest Management (IPM). IPM aims to keep pests at insignificant levels through a focused, targeted, broad spectrum approach including the encouragement of beneficial predators or parasites that attack pests, and the timing of specific controls to coincide with the most susceptible period of the pest's life cycle. IPM assumes that certain low levels of pests are tolerable. It was not conceived of as a substitute for using pesticides. Rather, it is used to improve the effectiveness or reduce the overall use of pesticides (Delaplane, 1996). To differentiate the use of this technique solely for mosquito control purposes as opposed to agricultural or more general pest control reasons, many mosquito control agencies prefer to use the term Integrated Mosquito Management (IMM).

Mosquito control agencies generally incorporate the following elements to create their IMM programs:

- Surveillance for larval and adult mosquitoes
- Source reduction and water management practices
- Biological controls (mosquito fish)
- Chemical control

3. Pesticide Labeling Requirements

FIFRA provides for federal control of the distribution, sale and use of pesticides. All label language must be approved by USEPA prior to a pesticide being sold or distributed in the United States. The pesticide label is the primary document for conveying general and technical information from regulatory agencies and pesticide manufacturers to mosquito control agencies, the agricultural community, the commercial service industry, and the general public. It is the one source where scientific review, regulatory oversight, and public policy are interwoven to achieve a common objective: to clearly and precisely convey information on handling, storing, applying, and disposing of pesticides in a manner conducive to good health and environmental stewardship (Whitford et al., 2001).

Pesticides are developed by the manufacturer, registered with USEPA, and sold to the public with the assumption that users read, understand, and follow instructions found on the product label. Specific information on use, personal protective equipment, environmental precautions, and storage and disposal are found on the pesticide label. The purpose of the label is to provide clear directions to allow maximum product benefit while minimizing risks to human health and the environment. All research, testing, and regulatory processes ultimately are reflected through the language on the label (NYSDEC, 2003a).

Every pesticide label includes the statement, "It is a violation of federal law to use this product in a manner inconsistent with its labeling." This language obliges the purchaser or user of any pesticide to assume all legal responsibilities for the use of the product. Further, courts of law and regulators recognize the pesticide label is a binding contract that requires the person using the product to do as exactly as directed. Terms such as must, shall, do not, and shall not mean that the user is responsible for specific actions when applying or handling the given product. Any departure from such directions is, in the eyes of the law, an illegal use of the pesticide (NYC DEIS, 2001).

"Use" means more than just the application of the pesticide. Federal and state regulations define pesticide use to include handling, mixing, loading, storage, transportation, and disposal, as well as human and environmental exposure. This all-encompassing definition covers every activity that involves a pesticide—from purchase to container disposal. Many statements on the label result from rigorous scientific investigation and governmental regulatory decisions. Pesticide users should read, understand, and follow pesticide label directions to ensure effective pest control, personal safety, environmental protection and legal compliance (Whitford et al., 2001).

Every pesticide product must bear a label that contains the information specified in FIFRA and the regulations in 40 CFR 156.10. The contents of the label must clearly and prominently show the following (information presented here through Section 4.4 is taken from the federal regulations):

- Name, brand, and trademark under which the product is sold
- Name and address of the producer, registrant, or person for whom the product was produced
- Product Registration Number
- Producing Establishment Number – referring to the final establishment at which the product was produced or finished
- Net Contents, as set forth below:
    - The net weight or measure of content shall be exclusive of wrappers or other materials and shall be the average content unless explicitly stated as a minimum quantity.
    - If the pesticide is a liquid, the net content statement shall be in terms of liquid measure at 68 degrees Fahrenheit (°F) (20 degrees Celsius [°C]) and shall be expressed in conventional American units such as fluid ounces, pints, quarts, or gallons.
    - If the pesticide is a solid or semisolid, viscous or pressurized, or is a mixture of liquid and solid, the net content statement shall be in terms or weight expressed as pounds and ounces.

  - In all cases, net content shall be stated in terms of the largest suitable units, i.e. "1 pound 10 ounces" rather than "26 ounces."
  - In addition to the required units specified, the net content may be expressed in metric units.
  - Variation above minimum content or around an average is permissible only to the extent that it represents deviation unavoidable in good manufacturing practice. Variation below a stated minimum is not permitted. In no case shall the average content of the packages in a shipment fall below the stated average content.
- Warning or precautionary statements. Every pesticide product label must bear on the front panel the statement "Keep Out Of Reach Of Children." However, human hazard signals and precautionary statements will vary according to the product's toxicity to humans, as discussed under "Toxicity Categories."
- Ingredient Statement, which must contain the name and percentage by weight of each active ingredient, the total percentage by weight of all inert ingredients, and , if the pesticide contains arsenic in any form, a statement of the percentages of total and water-soluble arsenic calculated as elemental arsenic. Accepted common names are to be used followed by chemical name unless the common name is widely known. In cases where the pesticide formulation changes considerably over time (degradation), the following statement must be written on the label: "Not for sale or use after [date]." The product must meet all requirements on the label through that date. Inert ingredients may need to be listed if they pose a hazard to public health or the environment.
- Use Classification, indicating whether the product is for general use, restricted use, or both. If it is a restricted use product, specific directions must follow. Other information may be required if its use is restricted to certain applicators.
- Directions for use, which must be easily read and understandable by the average person who will use them. They may appear anywhere on the label providing they may be easily read. Directions may be omitted if:
  - The product is only to be used in manufacturing.

- It will not come into the hands of the public
- It has data sheets specifying products involved
- It is determined that directions are not necessary to prevent unreasonable adverse effects on humans and the environment
- It is only to be used by a physician
- It is a drug regulated under the Federal Food, Drug, and Cosmetic Act (FFDCA)
- It will only be used by formulators of pesticide

3.1. Safety Information

Child hazard warning. The front panel of every pesticide product label must bear the statement, "Keep Out Of Reach Of Children." USEPA may waive this requirement only in cases where the likelihood of contact with children is extremely remote, or when the product is approved for use on children.

A **signal word** must appear prominently on the front of the pesticide container, providing, in essence, a one-word summary of the product's potential toxicity to humans. The three signal words, in decreasing order of toxicity, are DANGER (highly toxic), WARNING (moderately toxic), and CAUTION (slightly toxic).

A signal word is assigned on the basis of laboratory tests conducted with that particular product. Data are compiled from animal studies on exposure through ingestion, inhalation, and dermal (skin and eye) absorption. The route of exposure which shows the highest human toxicity potential determines the signal word assigned to the label. For example, if laboratory test results indicate product XYZ to be moderately toxic if ingested, highly toxic if inhaled, and slightly toxic if absorbed through the skin or eyes, the signal word would be danger based on inhalation studies, and would be DANGER.

Hazards to humans and domestic animals. Precautionary statements indicating specific hazards, routes of exposure, and precautions to be taken to avoid human and animal injury are required on the label. For example: "Harmful if swallowed, inhaled, or absorbed through the skin." Precautionary warnings might include the language, "Do not breathe vapors or spray mist;" "Avoid contact with eyes, skin or clothing;" or "Handle concentrate in a ventilated area."

The **protective clothing and equipment statement** directs the applicator to reduce the potential for exposure by using protective clothing or equipment. Most pesticide labels contain very specific instructions concerning the type of clothing that must be worn during the handling and mixing processes.

Potential routes of exposure determine the types of protective clothing designated on the label. Generally, a long-sleeved shirt, long pants, and waterproof footwear are the minimum requirements. The label will state whether specific items such as respirators and chemical-resistant gloves, aprons, goggles, and boots are needed. Common label language includes "Wear full face shield, rubber gloves, apron, and waterproof footwear when pouring concentrate or when exposure to concentrate is possible," and "Eye protection and chemically resistant gloves and footwear, a long-sleeved shirt, and long-legged pants or coveralls are recommended."

The **Statement of practical treatment** (first aid) provides valuable information to persons at the scene of a pesticide poisoning. Some examples: "In case of contact with skin, wash immediately with plenty of soap and water;" "If swallowed, call a physician or poison control center immediately;" "Immediately wash eyes with water for at least 15 minutes and get medical attention;" "After first aid is given, take victim to clinic or hospital;" or, "If inhaled, remove victim to fresh air."

The statement of practical treatment informs physicians and emergency responders of appropriate medical procedures for poisoning victims. For example, the statement might indicate to a physician: "There is no specific antidote;" "If the product is ingested, induce emesis or stomach lavage;" or "The use of an aqueous slurry of activated charcoal may be considered." Products labeled DANGER also bear a toll-free telephone number that physicians may use for further treatment advice. Emergency telephone numbers are provided on the Material Safety Data Sheet (MSDS). The pesticide distributor or manufacturer should be contacted for the MSDS.

3.2. Environmental Information

Environmental hazard statements are required to state the nature of potential hazards and appropriate precautions to avoid accident, injury, or damage if the product presents risks to non-target organisms or the environment. Potential hazards are determined by a series of tests that evaluate a pesticide's toxicity to wildlife such as mammals, fish, birds, aquatic invertebrates, and pollinating insects. Statements might include label language such as, "This product is highly toxic to bees," or "This product is highly toxic to fish," or "…toxic to aquatic invertebrates." To reduce the risks, the label may direct measures such as, "Do not allow drift to contact nontarget plants," or "Do not apply directly to water or wetlands."

If the pesticide has the potential to harm an endangered or threatened species or its habitat, statements will indicate where not to apply the pesticide or refer the user to an endangered species bulletin for further information. For example, the label might read "Use of this product in a manner inconsistent with the Pesticide Use Bulletin for Protection of Endangered Species is a violation of federal law," "Restrictions for the protection of endangered species apply to this product," or "If restrictions apply to the area in which this product is to be used, you must obtain the Pesticide Use Bulletin for Protection of Endangered Species for that county."

Statements on environmental impact may indicate that the product "…may travel through soil and can enter ground water," or "…has been found in ground water." The label instructions will tell how to reduce the impact on the environment: "This product may not be mixed, loaded, or used within 50 feet of all wells, including abandoned wells, drainage wells, and sink holes," or "This product has been shown to leach under certain conditions. Do not apply to sand and loamy sand soils where the water table (ground water) is close to the surface."

3.3. Product Information

The **brand (trade) name** under which a pesticide product is sold always appears on the front panel and often is the most conspicuous part of the label.

The **name and address of the producer, registrant, or person for whom the product was produced** must be shown on the label. If the registrant's name appears on the label and the registrant is not the producer, it must be qualified by appropriate wording such as "Packed for…" "Distributed by…" or "Sold by…."

The **net weight or volume of the contents** of the formulated pesticide product is displayed prominently on the label or stamped on the container.

The product registration number appears on the label, preceded by the phrase "EPA Registration No." or "EPA Reg. No." The registration number identifies a specific pesticide product and signifies that federal registration requirements have been met. At a minimum, registration numbers consist of two sets of digits: e.g., 491-005. The first set of digits identifies the registrant. The second set represents the specific registration issued to the company by USEPA. Together, these numbers clearly identify the product.

The **establishment number** is preceded by the phrase "EPA Est." USEPA requires pesticide production sites to be registered with USEPA. A pesticide-producing establishment is assigned a USEPA establishment number that clearly identifies that location. All pesticides produced at that location must bear its USEPA establishment number on the label or container. Farm service centers that repackage bulk pesticides must be registered as pesticide-producing establishments and, as with all pesticide producers, must keep records of their pesticide production and file annual production reports.

The **ingredient statement** normally is found on the front panel of the label. It identifies the name and percentage of a pesticide product that affects the target pest. Chemical names often are complex; for example, *2-chloro-4-ethylamino-6-isopropylamino-s-triazine* is the active ingredient in the product *AAtrex*. To aid communication, USEPA-approved common names may be substituted for chemical names.

Inert ingredients allow active ingredients to be formulated into many different products. As part of the formulation, they determine a product's handling properties and influence toxicity, release rates, residual activity, persistence, and methods of application. Also, there are no pest controlling claims for inert ingredients and, because product formulations are confidential, the total percent by weight of inert ingredients usually is the only information about inert ingredients found on the label.

The **formulation** of the product often appears on the front panel of the label, either near the brand name or in the general information section. Pesticides may be formulated into many products; currently, in the US, some 450 active ingredients are formulated into 25,000 different products. Information about the type of product formulation—granular, liquid flowable, dry flowable, microencapsulated, emulsifiable concentrate, etc—provides insight about application equipment, handling properties, and performance characteristics.

General-use versus restricted-use classification. USEPA may classify a certain pesticide product for restricted use due to the complexity of the designated use, concerns about environmental safety, or potential human toxicities. A restricted-use product may be bought and used only by a certified applicator or persons under the direct supervision of a certified applicator. A restricted-use statement appears conspicuously at the top of the front panel of the label to make this classification obvious. All restricted-use pesticides are identified by the following language: "For retail sale to and use only by certified applicators or persons under their direct supervision, and only for those uses covered by the certified applicator's certification."

Pesticides that remain unclassified are referred to as general-use pesticides and may be purchased by the public. Most pesticides used by homeowners are general-use products. However, there is no positive statement on labels approving the chemical for homeowner use. Rather, it is the absence of the restricted use statement that allows for general use. Nothing that can be interpreted as a "general use statement" ever will appear on the product label.

The **physical and chemical hazard statements** identify a given pesticide's flammability or explosiveness. These statements show specific hazards and state conditions to be avoided. For example: "Extremely Flammable;" "Contents Under Pressure;" "Keep away from fire, sparks, and heated surfaces;" "Do not puncture or incinerate containers;" "Exposure to temperatures above 130º F cause bursting."

The **warranty** information is the manufacturer's assurance that the product conforms to the chemical description on the label and that it is fit for labeled purposes if used according to directions under normal conditions. The warranty does not extend to any use of the product contrary to label instructions, nor does it apply under abnormal conditions such as drought, tornadoes, hurricanes, or excessive rainfall.

3.4. Use Information

Misuse statements contain language such as, "It is a violation of federal law to use this product inconsistent with its labeling."

Storage and transportation statements may include the following: "Store at temperatures above 32º F;" "Do not contaminate feed, foodstuffs or drinking water;" "Do not store next to feed or food, or transport in or on vehicles containing foodstuffs or feed;" or "For help with any spill, leak fire or exposure involving this material, call Chem Trek (800-424-9300)." Directions for use often comprise the bulk of a pesticide label. They must be adequate to protect the public from fraud and personal injury and to prevent unreasonable adverse effects on the environment. The instructions must provide guidance to the user on the pests controlled, sites of application, compatibility with other pesticides, mixing or dilution rates, application rates, equipment needed for application, timing and frequency of applications, harvest intervals, and general information for successful results.

Directions for use may appear on any portion of the label. Because of the detail required for specific applications, use directions for common sites, pests, and applications may be grouped together under a general heading. Information specific to individual uses may be addressed under specific headings.

Container rinsing and disposal statements list proper procedures for handling pesticide containers and disposing of unused products. Federal, state, and local regulations often must be consulted to determine how to dispose of unused pesticide concentrates or diluted mixtures. Container disposal statements could read "Triple rinse (or equivalent);" "Do not reuse container;" "Offer for recycling or reconditioning;" "Puncture and dispose of in a sanitary landfill;"

"Disposal by other procedures allowed by state and local authorities;" "Improper disposal of excess pesticides, spray mixture, or rinsate is a violation of federal law;" "If these wastes cannot be disposed of by use according to label instructions, contact your state pesticide or environmental control agency, or the hazardous waste representative at the nearest EPA regional office for guidance." While numerous pesticide labels still state that properly rinsed containers may be burned, almost every state has clean air laws that prohibit such disposal.

4. Suffolk County Pesticide Applications

4.1. Non-Vector Control Pesticides

NYSDEC is the agency in New York State designated to regulate pesticides. The Division of Solid and Hazardous Materials regulates the application of pesticides in New York State and is responsible for compliance assistance and public outreach activities to ensure enforcement of State pesticide laws, which are composed of Article 33 and parts of Article 15 of the Environmental Conservation Law and Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York Parts 320-329.

In conjunction with Cornell University, NYSDEC summarizes the data for commercial application of all pesticides within the state. The most recent year for which the data has been published is 2001. For the 2001 report year, the total number of applicators, technicians and permittees reporting was:

- 19,365 Commercial Applicators and Technicians
- 351 Commercial Permittees (Sales)

(NYSDEC, 2003b).

These figures indicate that 95.8 percent of the 20,217 certified applicators and technicians, and 92 percent of the 382 commercial permittees reported for 2001. Despite direct mailings, discussions at Statewide workshops and meetings, and other attempts by NYSDEC to notify the regulated community of the reporting requirement, many are still unaware they are required to report, even if they make no applications during that year.

Table 4-1 presents a summary of the total commercial pesticide applications in New York State, listed by county for the year 2001. Suffolk County has the highest application of pesticides in the state on both a gallons and pounds applied basis.

Table 4-1 - Summary of Commercial Pesticide Applications by County for 2001

County	Amount **	
Albany	42802.25 gal.	739,979.07 lbs.
Allegheny	2,683.09 gal.	9,976.67 lbs.
Bronx	10,910.62 gal.	74,676.61 lbs.
Broome	8,223.27 gal.	184,848.21 lbs.
Cattaraugus	6,499.52 gal.	66,788.58 lbs.
Cayuga	30,366.04 gal.	53,170.43 lbs.
Chautauqua	10,136.29 gal.	151,888.96 lbs.
Chemung	4,378.21 gal.	105,518.58 lbs.
Chenango	5,854.61 gal.	112,603.74 lbs.
Clinton	26,639.43 gal.	56,454.75 lbs.
Columbia	9,468.95 gal.	40,836.99 lbs.
Cortland	45,792.90 gal.	35,894.96 lbs.
Delaware	8,089.21 gal.	19,613.15 lbs.
Dutchess	15,785.14 gal.	326,108.88 lbs.
Erie	116,022.97 gal.	888,175.74 lbs.
Essex	105,759.26 gal.	411,706.72 lbs.
Franklin	5,692.57 gal.	39,662.51 lbs.
Fulton	1,088.29 gal.	28,324.80 lbs.
Genesee	29,802.17 gal.	60,501.09 lbs.
Greene	25,470.85 gal.	392,079.75 lbs.
Hamilton	296.12 gal.	15,747.57 lbs.
Herkimer	24,072.77 gal.	156,422.76 lbs.
Jefferson	15,816.35 gal.	61,536.01 lbs.
Kings	24,524.11 gal.	181,916.42 lbs.
Lewis	8,035.46 gal.	4,777.82 lbs.
Livingston	13,186.36 gal.	28,602.61 lbs.
Madison	12,281.42 gal.	64,620.52 lbs.
Monroe	68,724.43 gal.	1,382,923.24 lbs.
Montgomery	4,600.98 gal.	47,698.49 lbs.
Nassau	178,470.34 gal.	1,469,187.25 lbs.
New York	93,733.06 gal.	488,797.89 lbs.
Niagara	50,302.55 gal.	218,857.93 lbs.
Oneida	10,218.62 gal.	143,312.15 lbs.
Onondaga	28,603.13 gal.	697,073.94 lbs.
Ontario	11,871.82 gal.	122,332.55 lbs.

County	Amount**	
Orange	11,194.45 gal.	358,942.90 lbs.
Orleans	8,073.78 gal.	22,446.49 lbs.
Oswego	65,680.93 gal.	89,110.25 lbs.
Ostego	9,084.07 gal.	28,699.69 lbs.
Putnam	4,150.85 gal.	79,823.05 lbs.
Queens	123,630.82 gal.	241,796.20 lbs.
Rensselaer	11,893.27 gal.	101,385.32 lbs.
Richmond	6,800.56 gal.	108,320.70 lbs.
Rockland	51,713.5 gal.	466,234.92 lbs.
Saratoga	108,337.00 gal.	448,694.12 lbs.
Schenectady	14,539.73 gal.	237,912.30 lbs.
Schoharie	3,123.99 gal.	7,328.60 lbs.
Schuyler	1,777.70 gal.	14,219.31 lbs.
Seneca	4,897.15 gal.	20,444.96 lbs.
St. Lawrence	31,898.22 gal.	81,102.40 lbs.
Steuben	7,627.01 gal.	84,957.62 lbs.
Suffolk	383,656.35 gal.	3,046,320.30 lbs.
Sullivan	4,275.57 gal.	75,647.76 lbs.
Tioga	2,648.99 gal.	33,556.12 lbs.
Tompkins	6,363.58 gal.	59,011.32 lbs.
Ulster	8,748.08 gal.	94,931.92 lbs.
Warren	9,783.14 gal.	145,379.39 lbs.
Washington	37,134.75 gal.	56,467.21 lbs.
Wayne	72,761.73 gal.	129,150.77 lbs.
Westchester	190,292.90 gal.	1,805,069.80 lbs.
Wyoming	16,421.62 gal.	45,816.04 lbs.
Yates	1,288.22 gal.	12,573.67 lbs.

**Note The quantity of pesticides commercially applied in a county is the sum of the gallons and pounds reported above. In other words, the gallons and pounds in the chart do not reflect two ways of speaking about a single volume of pesticides.

The above table does not include quantities which were reported where the county information was missing, invalid, or illegible.

4.2. Vector Control Pesticides

SCVC applies pesticide products, as necessary, to control mosquito populations in the county, as part of its IPM Program. If long-term methods for mosquito control, such as water management or biological control, cannot control breeding, the county focuses on the control of mosquito larvae. Treatment of the larval stage is preferred since the larvae are concentrated in a centralized location, and there are more treatment options available. Factors such as breeding location with respect to population centers, virus activity, larval instar stage and species present are all factors used in deciding on the proper treatment for larval control (Suffolk, 2004).

The bacterial pesticide Bti is highly specific to mosquito larvae and is an environmentally friendly product. The larvae ingest the Bti particles, which attack the gut lining of the stomach, resulting in the death of the mosquito (Ware and Whitacre, 2004). In 1995, the county began using Altosid (methoprene), an IGR, which prevents the mosquito from molting from the larval stage to adult. The county also utilizes Vectolex, a bacterial pesticide with live Bs as its active ingredient. Vectolex is a true biological control agent. It introduces a live bacterium into the mosquito breeding site, and this bacterium can recycle and maintain itself in the field. As a result, Vectolex can be effective against mosquito larvae for several weeks after application, if conditions are favorable. Vectolex provides a form of cost-effective, long-term control in areas that continually hold water and breed mosquitoes, such as drainage ditches and catch basins (Suffolk, 2004).

If larval control efforts based on surveillance data fail to stop a brood of mosquitoes, the county may elect to utilize adult control, which is accomplished using ground or aerial applications of Ultra-Low-Volume (ULV) aerosols, with materials that rapidly degrade in the environment. By applying adulticides using ULV techniques, and during times of peak mosquito activity (early morning and late evening), adult mosquitoes can be controlled and adverse effects to other insect species can be minimized. The environmental impacts of mosquito control chemicals are discussed in detail elsewhere in this literature search (see Book 7 and Book 8).

The program relies primarily on the mosquito adulticides Scourge (Resmethrin), Anvil (Sumithrin), both of which are synthetic pyrethroids, and Fyfanon (Malathion), which is an organophosphate. Scourge has been used by Vector Control since 1995, in both the truck mounted ULV foggers and when necessary, in the aerial application program. Malathion has been used by Suffolk County Vector Control for nearly twenty years and continues to prove effective in controlling adult mosquitoes. Anvil has been used since 1999 in truck mounted foggers and through "hand-held" (cart) applications. The application of adult control pesticides is not the preferred course of action and is used only when sufficient public requests are received, the trap monitoring program reveals extreme numbers of human biting mosquitoes, or there is a threat of a mosquito-borne disease to a community (Suffolk, 2004).

Tables 4-2 to 4-7 reflect the pesticides used by Suffolk County since 1998 based on the acreage of application for each product.

Table 4-2 - Suffolk County Vector Control 2003 Pesticide Usage

Pesticide	Active Ingredient	Air/Ground Application	2003 Acreage	2002 Acreage	Change
Larvicides					
Altosid 5%	Methoprene	Ground	688	688	0
Altosid 20%	Methoprene	Aerial	23296	23520	-224
Altosid pellets	Methoprene	Ground	26	73	-47
Altosid XRG	Methoprene	Ground	0	4	-4
Vectobac 12 AS	Bti	Air/Ground	6420	15508	-9088
Bti briquets	Bti	Ground	1	1	-1
Vectobac CG	Bti	Ground	60	8	52
Vectolex CG	*B. sphaericus*	Ground	892	612	280
Altosid XR briquets	Methoprene	Ground	46	39	7
Vectolex WSP	*B. sphaericus*	Ground	0	27	-27
Larvicide total			31428	40415	-8987
Duplex Vect 12AS	methoprene+Bti		4700	7900	-3200
Corrected acreage			26728	32515	-5787
Adulticides					
Fyfanon	malathion	Ground	213	0	213
Scourge	resmethrin	Ground/Air	30933	22827	8107
Suspend SC	deltamethrin	Ground	0	21	-21
Anvil 10+10	sumithrin	Ground	3733	6400	-2667
Mosquito Barrier	garlic	Ground	55	45	10
Flit 10 EC	permethrin	Ground	0	0	0
Adulticide acreage			34880	29248	5632

Table 4-3 - Suffolk County Vector Control 2002 Pesticide Usage

Pesticide	Active Ingredient	Air/Ground Application	2002 Acreage	2001 Acreage	Change
Larvicides					
Altosid 5%	Methoprene	Ground	688	1360	-672
Altosid 20%	Methoprene	Aerial	23520	32096	-8576
Altosid pellets	Methoprene	Ground	73	113	-40
Altosid XRG	Methoprene	Ground	4	1	3
Vectobac 12 AS	Bti	Air/Ground	15508	11440	4068
Bti briquets	Bti	Ground	1	6	-5
Vectobac CG	Bti	Ground	8	0	8
Vectolex CG	*B. sphaericus*	Ground	612	868	-256
Altosid XR briquets	Methoprene	Ground	39	50	-11
Vectolex WSP	*B. sphaericus*	Ground	27	0	27
Larvicide total			40415	45884	-5469
Duplex Vect 12AS	methoprene+Bti		7900	10158	-2258
Corrected acreage			32515	35726	-3211
Adulticides					
Fyfanon	malathion	Ground	0	256	-256
Scourge	resmethrin	Ground/Air	22827	14993	7834
Suspend SC	deltamethrin	Ground	21	0	21
Anvil 10+10	sumithrin	Ground	6400	3200	3200
Mosquito Barrier	garlic	Ground	45	0	45
Flit 10 EC	permethrin	Ground	0	200	-200
Adulticide acreage			29248	18589	10659

Table 4-4 - Suffolk County Vector Control 2001 Pesticide Usage

Pesticide	Active Ingredient	Air/Ground Application	2001 Acreage	2000 Acreage	Change
Larvicides					
Altosid 5%	Methoprene	Ground	1360	2192	-832
Altosid 20%	Methoprene	Aerial	32096	24960	7136
Altosid pellets	Methoprene	Ground	113	123	-10
Altosid XRG	Methoprene	Ground	1	336	-335
Vectobac 12 AS	Bti	Air/Ground	11440	3900	7540
Bti briquets	Bti	Ground	6	3	3
Vectobac CG	Bti	Ground	0	0	0
Vectolex CG	*B. sphaericus*	Ground	868	446	422
Altosid XR briquets	Methoprene	Ground	50	35	15
Larvicide total			45884	31961	13923
Duplex Vect 12AS	methoprene+Bti		10158	0	10158
Corrected acreage			35726	31961	3765
Adulticides					
Fyfanon	malathion	Ground	256	213	43
Scourge	resmethrin	Ground/Air	14933	49707	-34774
Anvil 10+10	sumithrin	Ground	3200	18560	-15360
Flit 10 EC	permethrin	Ground	200	0	200
Adulticide acreage			18589	68480	-49891

Table 4-5 - Suffolk County Vector Control 2000 Pesticide Usage

Pesticide	Active Ingredient	Air/Ground Application	2000 Acreage	1999 Acreage	Change
Larvicides					
Altosid 5%	Methoprene	Ground	2192	513	1679
Altosid 20%	Methoprene	Aerial	24960	21647	3313
Altosid pellets	Methoprene	Ground	123	2	121
Altosid XRG	Methoprene	Ground	336	32	304
Vectobac 12 AS	Bti	Air/Ground	3900	2391	1509
Bti briquets	Bti	Ground	3	0	3
Vectobac CG	Bti	Ground	0	1779	-1779
Vectolex CG	*B. sphaericus*	Ground	446	15	431
Altosid XR briquets	Methoprene	Ground	35	0	35
Larvicide acreage			31961	26379	5582
Adulticides					
Fyfanon	malathion	Ground	256	8380	-8124
Scourge	resmethrin	Ground/Air	14993	33717	-18724
Anvil 10+10	sumithrin	Ground	3200	12510	-9310
Flit 10 EC	permethrin	Ground	200	33	167
Adulticide acreage			68480	54640	13840

Table 4-6 - Suffolk County Vector Control 1999 Pesticide Usage

Pesticide	Active Ingredient	Air/Ground Application	1999 Acreage	1998 Acreage	Change
Larvicides					
Altosid 5%	Methoprene	Ground	513	1240	-727
Altosid 20%	Methoprene	Aerial	21647	23488	-1841
Altosid pellets	Methoprene	Ground	2	304	-302
Altosid XRG	Methoprene	Ground	32	628	-596
Vectobac 12 AS	Bti	Air/Ground	2391	972	1419
Bti briquets	Bti	Ground	0	0	0
Vectobac CG	Bti	Ground	1779	1790	-11
Vectolex CG	*B. sphaericus*	Ground	15	37	-22
Altosid XR briquets	Methoprene	Ground	0	0	0
Larvicide acreage			26379	28459	-2080
Adulticides					
Fyfanon	malathion	Ground	8380	7168	1212
Scourge	resmethrin	Ground/Air	33717	23467	10250
Anvil 10+10	sumithrin	Ground	12510	0	12510
Flit 10 EC	permethrin	Ground	33	416	-383
Adulticide acreage			54640	31051	23589

Table 4-7 - Suffolk County Vector Control 1998 Pesticide Usage

Pesticide	Active Ingredient	Air/Ground Application	1998 Acreage	1997 Acreage	Change
Larvicides					
Altosid 5%	Methoprene	Ground	1240	800	440
Altosid 20%	Methoprene	Aerial	23488	24256	-768
Altosid pellets	Methoprene	Ground	304	422	-118
Altosid XRG	Methoprene	Ground	628	0	628
Vectobac 12 AS	Bti	Air/Ground	972	588	384
Bti briquets	Bti	Ground	0	0	0
Vectobac CG	Bti	Ground	1790	2625	-835
Vectolex CG	*B. sphaericus*	Ground	37	13	24
Altosid XR briquets	Methoprene	Ground	0	0	0
Larvicide acreage			28459	28704	-245
Adulticides					
Fyfanon	malathion	Ground	7168	3563	3605
Scourge	resmethrin	Ground/Air	23467	16640	6827
Anvil 10+10	sumithrin	Ground	0	0	0
Flit 10 EC	permethrin	Ground	416	288	128
Adulticide acreage			31051	20491	10560

4.3. Suffolk County Monitoring Data

Because of the importance of the groundwater aquifer for water supply, and in response to documented contamination of the aquifer by aldicarb in the early 1980s (Soren and Steltz, 1984), the Suffolk County Department of Health Services (SCDHS) established a ground-water monitoring program for pesticides and other chemicals of concern (Phillips et al., 1999). The SCDHS program has demonstrated the presence in local groundwater of older, persistent residues from pesticides like aldicarb, which are no longer used on Long Island. More recent monitoring by the SCDHS has shown that the herbicides metolachlor and simazine can also be detected in the shallow groundwater of Suffolk County (Baier and Trent, 1998). Metolachlor has been used on potato crops, and simazine has been used for weed control at utility substations.

The Public and Environmental Health Laboratory (PEHL) of the SCDHS has the ability to analyse water samples for 113 pesticides and pesticide degradate compounds. The program's research and monitoring efforts concentrate on land uses where pesticides are routinely used. Areas investigated include golf courses, vineyards, agricultural and residential use areas. The three most frequently detected pesticides are:

1) metolachlor and its OA and ESA metabolites;

2) the aldicarb metabolites B aldicarb sulfoxide and aldicarb sulfone; and,

3) alachlor and its OA and ESA metabolites.

All three active ingredients have been removed from sale in Suffolk County. However, because of their persistence and mobility, these chemical compounds can be expected to continue appearing in groundwater for years to come, and will migrate with groundwater to areas far from their points of application. Alachlor and metolachlor were widely used for two or more decades prior to the development and implementation of the PEHL analytical method utilized to detect their respective OA and ESA metabolites (Trent and Paulsen, 2002).

In 1998, a joint study was conducted by NYSDEC, the US Geological Survey (USGS), and SCDHS to sample wells in Suffolk County (including water supply wells) with known or suspected pesticide residues. The primary purpose of this study was to supplement the SCDHS pesticide monitoring program. Because all of the samples taken were from raw, untreated water from the aquifer, they were not representative of the chemical characteristics of drinking water. The pesticide residues monitored in the study included chemicals not routinely monitored by SCDHS. For example, samples were analyzed for the herbicide tebuthiuron, which is commonly used in association with simazine, and the metolachlor metabolites metolachlor ethanesulfonic acid (metolachlor ESA), metolachlor oxanilic acid (metolachlor OA), and the simazine metabolite deisopropylatrazine. Other pesticides monitored in the study included many of the most commonly used pesticides in the country.

Water samples were collected from 50 wells in areas of known or suspected pesticide use in Suffolk County. Of the 60 pesticide residues monitored, 25 were detected. The seven pesticide residues detected at the highest frequency and highest concentrations were the herbicides atrazine, metolachlor, simazine, tebuthiuron; the metolachlor degredates metolachlor ESA and metolachlor OA; and the simazine degredate deisopropylatrazine. The insecticide residues dieldrin, p, p'- DDE (dichlorodiphenyldichloroethane), and carbofuran were detected in more than 20 percent of the samples collected, and concentrations of insecticide residues generally were below 50 µg/l (Phillips, 1999).

Except for dieldrin and simazine, concentrations of the pesticide residues detected in the samples were below established State and Federal standards. The metolachlor ESA, and metolachlor OA) detections ranged from 1 to 30 µg/l (Phillips, 1999). Concentrations of metolachlor and its metabolites were generally highest in samples from agricultural areas, where metolachlor has been applied in the past. In contrast, concentrations of simazine, deisopropylatrazine (a simazine metabolite), and tebuthiuron were highest in residential and mixed land use areas, particularly in areas near utility rights-of-way. This pattern is consistent with previous detections of simazine residues. Since the purpose of the study was to test for pesticides in groundwater in relation to known or suspected pesticide use, the results are not representative of general groundwater quality in Suffolk County (Phillips, 1999).

Suffolk County also conducts pesticide monitoring on streams that are tributary to the Peconic Bay, as part of the Peconic Estuary Program. Table 4-8 shows the positive detections for pesticides for 2003 in the streams tributary to the Peconic.

Similarly, the County collected data for the two rivers draining the eastern portion of the County as part of environmental assessments of them, conducted in 2002 and 2003. The samples were collected largely by SCDHS and USGS, although some were collected by Brookhaven National Laboratory or other organizations. SCDHS sampling in thee rivers began in 1993, and the data analyzed in the reports included samples taken in 2001 for the Carmans River and 20022 for the Peconic River. Detection limits used by the involved laboratories were at or around the mid-part per trillion range, although some were much lower (Cashin Associates, 2002, 2004).

For the Carmans River, 58 samples were analyzed for organic compounds other than volatile organic compounds. These were almost entirely pesticides, although a few of the compounds were other, non-pesticide semi-volatile compounds. Only two pesticide compounds were detected, in a total of five samples. The detections were:

- metolachlor metabolite (CGA 354743)

  May 14, 2001, at 150 ng/l

  July 24, 2001, at 260 ng/l

- aldicarb metabolite

  October 29, 2001, at 70 ng/l

  November 9, 2001, at two different stations, one at 100 ng/l, and one at 170 ng/l

(Cashin Associates, 2002)

Sampling in the Peconic River involved, in total, testing for 154 discrete compounds including metabolites and breakdown products of pesticides. A total of seven compounds have been detected, all since 1997. Table 4-9 shows the distribution of the detections. Aldicarb breakdown products are two of the compounds, and atrazine and a metabolite are two others, meaning only five distinct pesticides have been detected. They are:

- Aldicarb – its breakdown products were detected in nine of 73 samples.
- Atrazine – detected in one of 32 samples.
- Metalochlor – detected in one of 31 samples.
- Prometon – detected in two of 32 samples.
- Simazine – detected in one of 27 samples.

With the exception of the aldicarb products (detected in 12% of samples), detections of any pesticide compounds were extremely infrequent (Cashin Associates, 2004).

It must be noted that the pesticides discovered in the sampling programs referenced above are in very large part contributed by agricultural practices within the County and are not related to the use of vector control chemicals used for reducing mosquito populations. No vector control chemical has been detected in groundwater or as part of routine environmental sampling within the County. Certain testing conducted with the express purpose of sampling the impacts of vector control pesticide applications have been able to detect some of these chemicals in the environment. These data will be reported on separately.

Table 4-8 - Positive Detections for Pesticides (ppb) – 2003 - Streams Tributary to the Peconic

Date	Station	StationName	Positive Detections									
01/07/03	200004	Crescent Duck Farm	Aldicarb sulfone	0.16	Aldicarb sulfoxide	0.17						
01/07/03	200004	Crescent Duck Farm	Alachlor ESA	0.13	Metachlor ESA	0.58	Metachlor OA	0.45				
04/09/03	200004	Crescent Duck Farm	Aldicarb sulfone	0.24	Aldicarb sulfoxide	0.17						
04/09/03	200004	Crescent Duck Farm	Metachlor ESA	0.62	Metachlor OA	0.49						
12/30/03	200004	Crescent Duck Farm	Aldicarb sulfone	0.14	Aldicarb sulfoxide	0.11						
12/30/03	200004	Crescent Duck Farm	Metachlor ESA	0.56	Metachlor OA	0.59						
01/08/03	200010	Peconic River	Aldicarb sulfone	0.11	Aldicarb sulfoxide	0.12						
01/07/03	200041	Meetinghouse Creek	Aldicarb sulfone	1.30	Aldicarb sulfoxide	0.88						
01/07/03	200041	Meetinghouse Creek	DEET	0.06	Ibuprofen	0.17						
04/09/03	200041	Meetinghouse Creek	Aldicarb sulfone	0.52	Aldicarb sulfoxide	0.34						
04/09/03	200041	Meetinghouse Creek	Chrysene	0.19	DEET	0.10	Fluoranthene	0.46	Phenanthrene	0.25	Pyrene	0.25
12/30/03	200041	Meetinghouse Creek	Aldicarb sulfone	0.77	Aldicarb sulfoxide	0.76						
12/30/03	200041	Meetinghouse Creek	Ibuprofen	0.24								
04/09/03	200044	Peconic River	Aldicarb sulfoxide	0.12								
04/09/03	200044	Peconic River	Caffeine	0.34	Gemfibrozil	0.52						
01/07/03	200110	Sawmill Creek	Metachlor ESA	0.18	Metachlor OA	0.13						
01/07/03	200110	Sawmill Creek	Metolachlor	0.11								
04/09/03	200110	Sawmill Creek	Metachlor ESA	0.32								
04/09/03	200110	Sawmill Creek	Fluoranthene	0.16	Metolachlor	0.09	Phenanthrene	0.09	Pyrene	0.08		
12/30/03	200110	Sawmill Creek	Metachlor ESA	0.28								
01/07/03	200120	Terry Creek	Aldicarb sulfone	0.26	Aldicarb sulfoxide	0.21						
01/07/03	200120	Terry Creek	Metachlor ESA	0.41	Metachlor OA	0.24						
04/09/03	200120	Terry Creek	Aldicarb sulfone	0.20	Aldicarb sulfoxide	0.19						
04/09/03	200120	Terry Creek	Metachlor ESA	0.38	Metachlor OA	0.16						
12/30/03	200120	Terry Creek	Aldicarb sulfone	0.20	Aldicarb sulfoxide	0.19						
12/30/03	200120	Terry Creek	Metachlor ESA	0.39	Metachlor OA	0.26						
01/07/03	200130	Reeves Creek	Aldicarb sulfone	0.14	Aldicarb sulfoxide	0.20						
01/07/03	200130	Reeves Creek	Metachlor ESA	2.21	Metachlor OA	2.02						
01/07/03	200130	Reeves Creek	Metalaxyl	0.25	Metolachlor	0.12						
04/09/03	200130	Reeves Creek	Metachlor ESA	2.13	Metachlor OA	1.89						
04/09/03	200130	Reeves Creek	Metalaxyl	0.19	Metolachlor	0.09	Terbacil	0.07				
12/30/03	200130	Reeves Creek	Aldicarb sulfone	0.23	Aldicarb sulfoxide	0.30						
12/30/03	200130	Reeves Creek	Alachlor ESA	0.09	Alachlor OA	0.12	Metachlor ESA	3.15	Metachlor OA	2.57		
12/30/03	200130	Reeves Creek	Dinoseb	0.09	Metalaxyl	0.33	Metolachlor	0.25				
01/14/03	200140	East Creek, S Jamesport	Aldicarb sulfone	0.13	Aldicarb sulfoxide	0.14						
01/14/03	200140	East Creek, S Jamesport	Alachlor OA	0.24	Metachlor ESA	2.95	Metachlor OA	2.53				

Date	Station	StationName	Positive Detections									
01/14/03	200140	East Creek, S Jamesport	Metalaxyl	0.30								
04/09/03	200140	East Creek, S Jamesport	Alachlor OA	0.28	Metachlor ESA	3.26	Metachlor OA	1.74				
04/09/03	200140	East Creek, S Jamesport	Metalaxyl	0.33								
01/14/03	200150	West Drain, S Jamesport	Aldicarb sulfone	0.35	Aldicarb sulfoxide	0.41						
01/14/03	200150	West Drain, S Jamesport	DEET	0.07	Dinoseb	0.18	Metalaxyl	0.06				
04/09/03	200150	West Drain, S Jamesport	Aldicarb sulfone	0.53	Aldicarb sulfoxide	0.40						
04/09/03	200150	West Drain, S Jamesport	DEET	0.06	Dinoseb	0.51	Ibuprofen	0.35	Metalaxyl	0.12		
01/14/03	200160	Brushes Creek	Aldicarb sulfone	0.18								
01/14/03	200160	Brushes Creek	Alachlor ESA	3.12	Alachlor OA	1.09	Metachlor ESA	0.5	Metachlor OA	0.47		
01/14/03	200160	Brushes Creek	Alachlor	0.14								
01/14/03	200160	Brushes Creek	Metalaxyl	0.13								
04/09/03	200160	Brushes Creek	Alachlor ESA	2.41	Alachlor OA	0.67	Imidacloprid	0.27	Metachlor ESA	0.67	Metachlor OA	0.35
04/09/03	200160	Brushes Creek	Dichlorbenil	0.17	Metalaxyl	1.89						
01/13/03	200180	Hall's Creek	Alachlor ESA	0.95	Metachlor ESA	3.34	Metachlor OA	2.02				
01/13/03	200180	Hall's Creek	Dinoseb	0.23	Metalaxyl	0.16	Metolachlor	0.24				
04/23/03	200180	Hall's Creek	Alachlor ESA	1.75	Metachlor ESA	2.32	Metachlor OA	0.87				
04/23/03	200180	Hall's Creek	Atrazine	0.06	Dinoseb	6.39	Metalaxyl	0.1	Metolachlor	0.74		
01/13/03	200190	Downs Creek	Metachlor ESA	2.12	Metachlor OA	1.92						
01/13/03	200190	Downs Creek	Metalaxyl	0.08								
04/23/03	200190	Downs Creek	Aldicarb sulfone	0.58	Aldicarb sulfoxide	0.39						
04/23/03	200190	Downs Creek	Metachlor ESA	2.13	Metachlor OA	1.41						
01/13/03	200200	West Creek	Alachlor ESA	0.38	Metachlor ESA	0.40						
01/13/03	200210	East Creek, Cutchogue	Aldicarb sulfone	0.15	Aldicarb sulfoxide	0.10						
01/13/03	200210	East Creek, Cutchogue	Metachlor ESA		Metachlor ESA	0.25						
01/13/03	200210	East Creek, Cutchogue	Kelthane	0.45								
04/23/03	200210	East Creek, Cutchogue	Aldicarb sulfone	1.00	Aldicarb sulfoxide	1.10						
04/23/03	200210	East Creek, Cutchogue	Alachlor ESA	1.56	Metachlor ESA	0.62	Metachlor OA	0.38				
01/14/03	200230	Pipes Creek	Metachlor ESA	0.38								
01/14/03	200230	Pipes Creek	Simazine	0.10	Tebuthiuron	0.13						
04/24/03	200230	Pipes Creek	Metachlor ESA	0.30								
04/24/03	200230	Pipes Creek	DEET	0.05	Tebuthiuron	0.09						
01/14/03	200260	Narrow River South	Alachlor OA	0.40	Metachlor ESA	3.11	Metachlor OA	1.92				
01/14/03	200260	Narrow River South	Metalaxyl	0.08								
04/24/03	200260	Narrow River South	Alachlor ESA	0.75	Metachlor ESA	3.20	Metachlor OA	1.45				
04/24/03	200260	Narrow River South	Metalaxyl	0.10								
12/18/03	200260	Narrow River South	Alachlor ESA	0.21	Metachlor ESA	1.28	Metachlor OA	0.70				
12/18/03	200260	Narrow River South	Metalaxyl	0.06								

Table 4-9. Pesticides Detected in the Peconic River Surface Waters

Date	Station	Compound	Concentration Detected (part per trillion)
6/18/97	45	Atrazine	5
		Deethyl atrazine	1
		Metalochlor	5
		Prometon	14
		Simazine	2
11/15/99	45	Aldicarb sulfone	110
2/23/00	45	Aldicarb sulfoxide	70
7/17/00	340	Aldicarb sulfoxide	90
9/12/00	45	Metalochlor	2
		Prometon	8
7/30/01	45	Aldicarb sulfone	110
	85	Aldicarb sulfone	110
11/14/01	45	Aldicarb sulfone	110
		Aldicarb sulfoxide	70
	85	Aldicarb sulfone	150
		Aldicarb sulfoxide	220
1/16/02	45	Aldicarb sulfone	120
	85	Aldicarb sulfone	130

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