CHAPTER 3.A

FRAMEWORK OF THE ANALYSIS

A. INTRODUCTION

The impact issues of concern for the *Mosquito-Borne Disease Control Program* are those associated with application of adulticides to control adult mosquitoes that may pose a human health risk. The potential for such impacts to occur would depend on which adulticide is applied, where it is applied, how it is applied, the meteorological conditions under which it is applied, and what exposure scenarios for individuals and biota (other living organisms in an area) are created by the application. Once these parameters are defined and projected, it is then possible to develop methodologies for assessing the risk and consequences of exposure to adulticides. This chapter outlines the overall procedures and rationale of the impact assessment, and "sets up" the technical analyses that will be based on the assumptions arrived at through the examination of the key factors affecting the analyses. Figure 3.A-1 gives an overview of the framework of analysis as it relates to the various impact analyses. While not shown in Figure 3.A-1, extensive literature research was also performed as part of the overall technical assessments.

B. EXAMINATION OF ADULTICIDES

PRODUCT CLASSIFICATION AND INGREDIENTS

There are typically two primary constituents found in adulticide products: the "active" ingredient, and "inert" ingredients. Since the "active" ingredient in an adulticide product is the chemical component in the adulticide that is intended to target and eradicate the adult mosquito, it is of primary significance for the public health and natural resources impact assessments. The potential adverse effects of these active ingredients on the public health and natural resources are extensively analyzed. "Inert" ingredients, defined as any ingredient in the product that is not intended to affect a target pest (an ingredient with no pesticidal effect), are generally added as solvents and/or to aid in the dispersion of the product. As discussed in Chapter 2, "Pesticides," information about the specific inert ingredients found in the adulticides was not disclosed by all of the manufacturers to New York City Department of Health (NYCDOH) for the purposes of this environmental impact statement (EIS). Because the level of information on the inert ingredients that is reported in the product Material Safety Data Sheets (MSDSs) and manufacturer's product labels is limited and because the manufacturers consider the identity and percentages of inert ingredients to be confidential business information, the technical analyses have addressed the potential adverse impacts related to inert ingredients qualitatively. The analyses include a discussion of the types of chemicals typically used as inerts, the estimated amounts of such inerts applied to the environment, and the known relative toxicities of such classes of compounds. A discussion on the active and inert ingredients found in the two classes of adulticides (pyrethroids and organophosphates) registered for community-scale use in New York State is provided below. It should be noted that the analyses in this EIS evaluate the

potential impacts from all products registered with New York State that would likely be used on a community-scale basis, and consider each of these products to be equally effective in reducing mosquito populations.

Active Ingredients

Under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), an active ingredient is defined as one that prevents, destroys, repels or mitigates a pest, or is a plant regulator, defoliant, desiccant or nitrogen stabilizer. As described earlier in Chapter 2, "Pesticide Regulations and Usage," the 17 adulticides registered for use in New York State that would likely be used on community-scale basis, belong to either the pyrethroid class or the organophosphate class. Within these 17 adulticides, 4 active ingredients common to the pyrethroid class, and 2 active ingredients common to the organophosphate are found, and are described below.

Synergist

Although piperonyl butoxide (PBO) may be considered an active ingredient on its own, it is typically added to pyrethroid formulations to function as a chemical synergist. A synergist is a chemical that enhances the effectiveness of another chemical. Pyrethroids can be metabolized (detoxified) by enzymes in the insect. Synergists such as PBO may be added to the pyrethroid in order to slow down or prevent the metabolism of pyrethroids, thereby enabling a smaller amount of pyrethroids to have the same effectiveness. Therefore, a pyrethroid product may contain larger amounts of PBO than the active ingredient. For purposes of this EIS, PBO was subjected to the quantified technical analyses, and was treated as equivalent to an active ingredient.

Inert or Other Ingredients

As discussed in Chapter 2, "Pesticide Regulations and Usage," inerts are simply defined as ingredients that are not active as pesticide, and are generally added as a solvent and/or to aid in the dispersion of the product. The Federal and State laws do not require individual inert ingredients to be identified by name and percentage on the product label. However, the total percentage of all inert ingredients must be declared. As mentioned above, for the purposes of the EIS, the technical analyses will address the potential impact issues related to inerts qualitatively, as specific information about the inerts was not disclosed by the manufacturers to NYCDOH.

Additional Carriers /Additives

Some of the products may require or allow dilution depending on the application method used. Additives can include a number of substances such as water, light mineral oil, petroleum distillate, or soybean oil. Adulticide products applied as ultra low volume (ULV) formulations (i.e., using the least amount of product with still proven effectiveness to cover a large area) do not require additional carriers or additives. The analyses in this EIS are based on adulticides applied as ULV, since the *Adult Mosquito Control Programs* currently only considers the use of ULV products. The impacts resulting from non-ULV applications are discussed in the alternative analysis chapters (Chapters 3.U and 4.U). Under the proposed *Mosquito-Borne Disease Control Program*, the NYCDOH would not add carriers or additives to the ULV product unless required by the label. Thermal fogging, another method of application that requires the addition of carriers or additives, is also not considered under the Proposed Action.

NYS REGISTERED ADULTICIDE PRODUCTS TO BE ANALYZED

As described in Chapter 2, "Pesticide Regulations and Usage," there are 17 adulticides (11 pyrethroid and 6 organophosphate products) registered in New York State that can be used for community-scale use. This EIS will consider the potential impacts of only the products that are registered at this time, with their current formulations. Changes in product formulations are likely over time, and the NYCDOH may evaluate new formulations in the future. The 17 adulticides registered for use in New York State that would likely be used for application on a community-based scale in this EIS fall into 2 major categories: organophosphates and pyrethroids. Although all 17 adulticides could potentially be used by NYCDOH as part of the Proposed Action, 5 products, each containing one of the active ingredients of concern, were chosen for presentation of detailed technical analysis to assess potential adverse impacts from application. These products, which are indicative of the products that are most likely to be used by NYCDOH as part of the Proposed Action contain a combination of the highest content of active ingredient and/or PBO, and the least amount of inerts, The exception to this was the choice of Fyfanon ULV (which contains a slightly lower percentage of the active ingredient malathion–see Chapter 2, "Pesticide Regulations and Usage," Table 2-10), as this was the product used by the City in 1999. These products are:

- Fyfanon ULV Ultra Low Volume Concentrate Insecticide (active ingredient: malathion)
- Dibrom Concentrate Insecticide (active ingredient: naled)
- Permethrin 57% OS (active ingredient: permethrin)
- Scourge Insecticide with SBP-1382/piperonyl Butoxide 18%+54% MF Formula II (active ingredients: resmethrin/PBO)
- Anvil 10+10 (active ingredients: sumithrin/PBO)

As mentioned above, for the purposes of the EIS, the synergist PBO will be considered as equivalent to an active ingredient. Therefore, within the five products listed above, further references to the six "active ingredients" refer to malathion, naled, permethrin, resmethrin, sumithrin and PBO.

Current manufacturer product labels were obtained from New York State Department of Environmental Conservation (NYSDEC) for all the above-mentioned adulticides registered in New York State that can be used for community-scale use. Beyond identifying the ingredients in each product, the labels provide information on how the adulticide is to be used and limitations on how the products may be applied. A discussion of the composition, recommended application procedures and limitations provided in the labels for the six active ingredients selected for detailed technical analysis is outlined below.

Chemical Composition

The chemical compositions of the adulticides selected for analysis are presented in Table 3.A-1 below. See Appendix 3.A for the chemical composition of all synthetic adulticides registered for community-scale use in New York State.

Application Techniques and Recommended Application Amounts

In addition to the constituency of these adulticides, it is important to understand the mechanisms by which such adulticides could be applied.

The primary mechanisms for application of adulticides would be via backpack, truck, all-terrain vehicle (ATV) or aerial methods. Backpack applications would potentially be applied in locations

Table 3.A-1
Chemical Composition of Adulticides Selected for Analysis

Adulticide	Ingredient	Percentage
Organophosphates		
Fyfanon ULV Concentrate Insecticide	Malathion	95.0
	Inerts	5.0
Dibrom Concentrate Insecticide	Naled	87.4
	Inerts	12.6
Pyrethroids		
Permethrin 57% OS	Permethrin	57.0
	Inerts (Aromatic Solvents)	43.0
Scourge Insecticide with SBP-1382/Piperonyl Butoxide 18%+54% MF Formula II	Resmethrin	18.0
	Piperonyl Butoxide	54.0
	Inerts (Petroleum Distillates)	28.0
Anvil 10+10	Sumithrin	10.0
	Piperonyl Butoxide	10.0
	Inerts (Petroleum Distillates)	80.0

where physical space dimensions limit the means of application. Applications by trucks may occur when a larger scale of application would be required and/or where physical limitations to aerial application are present. Aerial applications (by either helicopter or fixed-wing aircraft) may be required when a large region is in need of adulticide application, or where access limitations for at-grade vehicular applications are present.

Also provided on the product label is the application amount per unit area that is recommended for the various application methods to be used. The product labels for the adulticide formulations being analyzed provide a maximum-allowable application rate for the active ingredient in the product. Where application rates for the product as a whole were given on the label, the application rate for the active ingredient was calculated. The application amount depends on the required concentration of the adulticide and the vehicle/foot speed of the application. For example, as the concentration of the adulticide decreases, the application amount also decreases, and as the vehicle/foot speed increases by a certain factor, the application rates also increases by that same factor.

Table 3.A-2 presents the recommended active ingredient application amounts per unit area for ground and aerial applications, for the six active ingredients selected for detailed technical analysis. Application amounts for all synthetic adulticides registered for community-scale application in New York State can be found in Appendix 3.A.

To illustrate the relative amount of adulticides that can be applied over an acre, a comparison using the maximum-allowable application rate of the product Fyfanon ULV Concentrate Insecticide (an organophosphate product which contains the active ingredient malathion—see Table 3.A-2 above) is provided. For ground application, according to the registration label, Fyfanon ULV Concentrate Insecticide is to be applied at a rate of 2 to 4 fluid ounces per acre. This is equivalent to ¼-½ cup, or 1/16-1/8 quarts per acre (an acre is approximately an area 210 feet x 210 feet). Figure 3.A-2 presents the example given above for ground application, illustrating the amount of adulticide that could be applied over an acre of land.

Physical and Chemical Properties

Table 3.A-3 presents information on several chemical and physical characteristics of the active ingredients contained in the adulticides selected for detailed technical analysis. The table presents information on specific gravity (density), half-life in soil and water, solubility, soil mobility, boiling point, and melting point.

Table 3.A-2
Adulticide Active Ingredient Application Amounts

Adulticide	Active Ingredient (% in product)	Application Rate (lbs/acre)	
		Ground	Aerial
Organophosphates			
Fyfanon ULV Concentrate Insecticide	Malathion (95)	0.0542 non-thermal truck	0.2280
Dibrom Concentrate Insecticide	Naled (87.4)	0.0175	0.1044
Pyrethroids			
Permethrin 57% OS	Permethrin (57)	0.0210 non-thermal truck	0.0234
Scourge Insecticide with SBP-1382/ Piperonyl Butoxide 18% + 54% MF Formula II	Resmethrin (18)	0.0070 non-thermal truck	0.0070
	Piperonyl Butoxide (54)	0.0210 non-thermal truck	0.0210
Anvil 10+10	Sumithrin (10)	0.0036 non-thermal and thermal truck/ backpack	0.0036
	Piperonyl Butoxide (10)	0.0036 non-thermal and thermal truck/ backpack	0.0036

Source: NYS Registration Labels

Other Label Limitations

In addition to the method of application and the recommended amount of adulticide to be applied per acre, the manufacturer's product labels provide information about other limitations on how the products may be applied. These include either general or specific recommendations about droplet size distributions, and recommended meteorological conditions for application. Recommended ranges of droplet sizes are generally given in terms of mass median diameter (MMD) or volume median diameter (VMD). The MMD is the diameter which divides the spray such that half of the mass has droplets of diameters less than the MMD, and half the mass has droplets of diameters greater than the MMD. Table 3.A-4 summarizes information from the product labels on recommended droplet size during application.

C. DRIFT/DEPOSITION MODELING OF ADULTICIDES

SELECTION OF MODELS

In selecting the appropriate mathematic model to best simulate the discharge of adulticides into the environment, several factors were considered. These include:

Table 3.A-4
Recommended Droplet Size on Product Labels

Adulticide (Active Ingredient)	Droplet Size (?m)	
	Ground	Aerial
Organophosphates		
Fyfanon ULV Concentrate Insecticide (Malathion)	MMD not to exceed 17 w/ no more than 3 percent exceeding 32	MMD=50-60 w/ no more than 10 percent exceeding 100
Dibrom Concentrate Insecticide (Naled)	11-20, MMD not to exceed 15, no droplet to exceed 50	30-80 w/ no more than 5 percent exceeding 80
Pyrethroids		
Permethrin 57% OS	MMD=10-20 (non-thermal truck)	MMD=50 or less, no more than 2.5 percent exceeding 100
Scourge Insecticide with SBP-1382/ Piperonyl Butoxide 18% + 54% MF Formula II (Resmethrin, PBO)	MMD=18-50 (backpack) MMD=8-20 (truck)	N/A
Anvil 10+10 (Sumithrin, PBO)	Majority of particles 5-25	MMD not to exceed 50 w/ no more than 2.5 percent exceeding 100

N/A – No additional information/restrictions reported.
Source: New York State Registration Labels

- The ability to simulate releases of adultcides from source types that best represent aerial or ground applications.
- The ability to simulate ambient air concentrations as well as deposition levels of adulticides after release from a source.
- The ability to simulate drift/deposition in rural and urban environments.

Based on the requirements listed above, two models were identified for possible inclusion into the modeling efforts: the U.S. Environmental Protection Agency - Spray Drift Task Force AgDRIFT® model and USEPA's Industrial Source Complex Short Term -ISCST3 model (ISCST3). The AgDRIFT® and ISCST3 models have two different approaches for simulating the release of adulticides and computing the fate of the products. Provided below is a general discussion of the models, including their development and methods for simulating airborne releases of adulticide.

AgDRIFT®

The generally accepted models for the prediction of atmospheric transport of pesticide sprays are a group of models known as AGDISP (Agricultural DISPersal) and FSCBG (U.S. Forest Service Cramer-Barry-Grimm). Each of these models uses the same Lagrangian approach to track the spray particles from the spray boom to the ground. The FSCBG model includes a Gaussian plume model to evaluate the dispersion of the particles at extreme downwind distances from 1 to 5 miles. Because of their importance to the forest service and other members of the agricultural community, both AGDISP and FSCBG have undergone extensive field trials and evaluations.

In April of 1990 the Spray Drift Task Force, (SDTF) a consortium of 39 chemical manufacturing companies, was formed to develop a database of spray drift trials to support pesticide registrations. In

1994 with support from the SDTF, USEPA, and U.S. Department of Agriculture (USDA) a Cooperative Research and Development Agreement was established to evaluate spray drift models. The resultant product of this ongoing effort is the AgDRIFT® (Agricultural DRIFT) model. AgDRIFT® also includes a sub-model called "DropKick," which can be used to estimate the drop size distribution of the spray at the nozzle tip, and an improved evaporation algorithm.

ISCST3

While the AgDRIFT® model was specifically developed to address the potential drift from pesticide applications, there are other dispersion models that USEPA has developed and recommended for use in the simulation of potential environmental impacts of airborne releases. Based on the models recommended for various uses in the *USEPA's Guidelines on Air Quality Modeling* and the recommendations in the *New York City Environmental Quality Review (CEQR) Technical Manual*, the ISCST3 dispersion model was included as a possible model to be evaluated in this study.

The USEPA's ISCST3 model, which is described in the *User's Guide for the Industrial Source Complex (ISC3) Dispersion Models (EPA-450/B-95-003a)*, has the ability to calculate airborne and deposition pollutant concentrations from one or more points (e.g., exhaust stack), area, or volume sources based on hourly meteorological data. The model is based on Gaussian dispersion algorithms. The model has the capability of calculating pollutant concentrations at locations where the plume from the exhaust stack is affected by the aerodynamic wakes and eddies (downwash) produced by nearby structures. However, for its application in this study, direct impacts from airborne releases were of primary concern; therefore, the downwash options were not selected.

ISCST3 has the ability to calculate airborne concentrations (at ground and elevated height locations) and deposition levels (at ground locations).

Sensitivity Analysis

A series of sensitivity runs were performed with both AgDRIFT® and ISCST3 to determine the model input parameters that have: (1) a significant effect on the resultant predicted airborne concentrations and deposition levels (e.g., wind speed, droplet size distribution, height of release; and (2) relatively no effect on the model predictions (e.g., humidity, temperature). The sensitivity runs were also performed to provide a comparison of the magnitude of the predicted results from both models.

Initial runs were based on a single path, one-time application of a "generic" adulticide product. The results of the sensitivity studies identified the key input variables for both models to be wind speed, release height and droplet size. The results indicated that, in general, the predicted levels of adulticides were higher, and therefore more conservative using the ISC3ST model than when the AgDRIFT® model was used. A full presentation of the results for the sensitivity analysis is found in Appendix 3.A.

Based on the sensitivity analysis, the results from the ISCST3 model were selected to provide reasonably conservative estimates of adulticide airborne concentrations and deposition values for the risk assessment analyses included in the DEIS. The ISCST3 model inputs used for the site-specific analyses are outlined below.

SOURCE PARAMETERS

Source Type

The ISCST3 model has the ability to simulate releases from different types of sources that include point, area, and volume sources. The release of adulticides was simulated as a continuous source, releasing the adulticides for a period of 1 hour at the label-recommended application rate for each product. The source was simulated as a series of volume sources, as these sources best represent the types of releases that may occur from either ground or aerial applications. Each square volume source was simulated at an initial width of approximately 20 ft. Fifty-one volume sources were modeled, for a total length of 1,020 ft.

Source Release Height

The simulation modeling was performed using a range of release heights to represent both ground and aerial adulticide applications. The aerial release height variable for a particular application can be affected by the local terrain, buildings, power lines, and other obstructions. Therefore, simulations were performed at two different release heights, 100 feet and 200 feet above ground, to cover the range of reasonable heights that may be employed for aerial applications. Simulations of ground applications (i.e., using a truck) were performed at a release height of 12 feet above ground.

Droplet Size Distribution

Adult mosquito control utilizes very small droplets to form a mist or cloud. As this cloud moves or disperses through the atmosphere, these very small droplets collide with the mosquitoes. The process used to produce these fine droplets produces a distribution of different size droplets rather than a single size. As mentioned above, these drop size distributions are most often classified by MMD or VMD. The MMD or VMD is the diameter, which divides the spray such that half of the mass or volume has droplets of diameters smaller than the MMD or VMD, and half of the mass or volume has droplets of diameters greater than the MMD or VMD.

If the MMD or VMD is too large the drops settle rapidly and do not form the desired cloud. If the drops are too small they will not settle, they will disperse at the release point and possibly not reach the intended target. As outlined above, the label recommended droplet sizes for the various products being analyzed in the EIS, fall within the range of 5?m to 80?m for truck and aerial applications. Initial sensitivity runs were performed using three different VMDs: 20?m, 40?m, and 55?m, all well within the recommended droplet size distributions for the products being analyzed. The results indicated that although airborne concentrations were not significantly affected by varying the VMD, deposition levels were more sensitive to VMD with the maximum calculated deposition values for a VMD of 55?m. Therefore, all simulations for the risk assessment analyses were performed using a VMD of 55?m.

RECEPTOR LOCATIONS

For airborne concentration and deposition level estimates, receptors (i.e., location of potential public access) were evaluated at distances away from the source at: 25 - 600 ft (at 25-foot intervals), 750 ft, 1,000 ft and 2,000 ft. Airborne concentrations were estimated at pedestrian-level receptors (6 ft above grade), as well as receptors at 12 ft, 15 ft, 25 ft, 50 ft, 75 ft, and 100 ft above grade. Deposition levels were estimated at ground level receptors (0 ft above grade) as well on surfaces at 12 ft above grade.

METEOROLOGICAL DATA

Historical Meteorological Data Examination

In order to provide some insight on the likely types of meteorological conditions that may be encountered during spraying periods, an examination of the meteorological data recorded at La Guardia airport for the years 1991 through 1995 was performed. Assuming adulticide spraying would only occur from May through October in any given year, and since many of the labels for the New York State registered adulticide products recommend applying these products at/after sunset and at/before sunrise, an examination of the meteorological data for the time periods from sunset to sunrise for the May-October time frame was performed. For these time periods, the recorded wind speeds and computed stabilities were examined. The results of the meteorological data examination indicate that for the time periods of concern, there were more occurrences of wind speeds less than 10 mph than there were for wind speeds greater than 10 mph. The relative frequencies of unstable (1, 2, 3), neutral (4) and stable (5, 6, 7) atmospheric conditions by month for the 1991-1995 period were also examined. The results indicated that on average, over half the time neutral conditions occur, and stable conditions were encountered less than half the time. Rarely were unstable conditions calculated.

Meteorological Data Set Used in Site-Specific Analysis

The ISCST3 model was developed to incorporate meteorological data from airports/meteorological stations, so that computations could be performed for multiple hourly averaging times (such as 1-hour, 8-hour, 24-hour and annual concentrations). However, in order to simulate the release of adulticides resulting in worst-case airborne concentrations and deposition values, certain parameters within the meteorological data set used in the analysis were set to fixed values. As described above, during likely spraying times during the years 1991-1995, more than half the time wind speeds were historically less than 10 mph. Also, on average, atmospheric stabilities conditions were neutral and less frequently stable. Based on these results, and to cover the various likely meteorological conditions, the site-specific adulticide application simulations were performed using a meteorological data set with fixed wind speeds of 2 mph, 5 mph, and 10 mph, and fixed atmospheric stabilities of 4 (neutral), and 5 (stable). In the mathematical simulations with ISCST3, the wind direction was varied at 90? (directly perpendicular to the truck or aircraft path, 175? (near parallel winds blowing along the direction the truck or aircraft are traveling), and 135? (midpoint between near parallel and perpendicular winds).

MODEL CONTROL OPTIONS

Deposition modeling includes simulations of the plume (i.e., the pollutant release) to “tilt” towards the surface (if the plume is elevated) as it travels downwind, and a deposition velocity is used to calculate the flux of matter deposited at the surface. The ISCST3 model includes a dry depletion option which accounts for the mass of particles deposited on the surface from gravitational settling, and the material is removed from the plume as it is deposited on the surface, thereby conserving mass. This model control option was employed in the adulticide application simulations.

Airborne concentrations and deposition levels from adulticide applications were modeled using urban dispersion coefficients.

MODELING RESULTS

Based on the procedures described above, the ISCST3 model was employed to estimate conservatively the maximum predicted concentrations and deposition levels of the adulticide products

being analyzed. The modeling was based on the assumption that the area to be treated was within the 300 ft swath adjacent to the source of application. The results indicated much higher deposition levels at the various receptors when simulated at truck-level source heights (12 feet above grade) as opposed to aerial level source heights. Therefore, to provide conservative estimates of likely spraying activities in New York City, the ground application results of the modeling were used as inputs to the public health, and natural resources risk analyses.

Table 3.A-5 presents the results of the maximum predicted airborne concentrations from ground applications of the active ingredients for each of the five products being analyzed. The modeling runs that produced the highest predicted concentrations among the three wind speeds analyzed (2 mph, 5 mph, and 10 mph) and the two stability classes analyzed (4 and 5) were used as inputs to the public health and natural resources risk assessments. The results represent a "peak" maximum concentration value at the receptor distance 25 feet from the source.

Table 3.A-5
Active Ingredient Concentration Modeling Results

Adulticide	Active Ingredient	1-hour Average Concentration (µg/m3)* Peak Value at 25 ft Receptor Distance	
		Maximum Value	@ 6ft Receptor Height
Organophosphates			
Fyfanon ULV Concentrate Insecticide	Malathion (95%)	57.1	48.0
Dibrom Concentrate Insecticide	Naled (87.4%)	18.4	15.5
Pyrethroids			
Permethrin 57% OS	Permethrin (57%)	22.1	18.6
Scourge Insecticide with SBP-1382/ Piperonyl Butoxide 18% + 54% MF Formula II	Resmethrin (18%)	7.38	6.21
	Piperonyl Butoxide (54%)	22.1	18.6
Anvil 10+10	Sumithrin (10%)	3.80	3.19
	Piperonyl Butoxide (10%)	3.80	3.19

* Micrograms of active ingredient per cubic meter of air.
Source: ISCST3 modeling runs with maximum allowable label application rates

The results are given for the concentration estimated at pedestrian level receptors (6 ft above grade) and the maximum from all other modeled receptor heights.

Table 3.A-6 presents the results of the maximum predicted deposition levels from ground applications of the active ingredients for each of the five products being analyzed. It should be noted that although the results for naled for ground application (more conservative than for aerial application) are used as inputs to the technical analyses, ground application of naled is not considered for the Proposed Action. The modeling runs that produced the highest predicted deposition levels among the three wind speeds analyzed (2 mph, 5 mph, and 10 mph) and the two stability classes analyzed (4 and 5) were used as inputs to the public health and natural resources risk assessments. The model assumes

Table 3.A-6
Active Ingredient Level Modeling Results

Adulticide	Active Ingredient	Average Deposition Level (mg/m^2)			
		Average Within 300 ft		Peak Value at 25 ft Receptor Distance	
		Ground Level	Surface at 12 ft Height	Ground Level	Surface at 12 ft Height
Organophosphates					
Fyfanon ULV Concentrate Insecticide	Malathion (95%)	5.01	6.91	25.0	36.1
Dibrom Concentrate Insecticide	Naled (87.4%)	1.62	2.23	8.09	11.7
Pyrethroids					
Permethrin 57% OS	Permethrin (57%)	1.94	2.68	9.71	14.0
Scourge Insecticide with SBP-1382/ Piperonyl Butoxide 18% + 54% MF Formula II	Resmethrin (18%)	0.65	0.89	3.24	4.67
	Piperonyl Butoxide (54%)	1.94	2.68	9.71	14.0
Anvil 10+10	Sumithrin (10%)	0.33	0.46	1.67	2.40
	Piperonyl Butoxide (10%)	0.33	0.46	1.67	2.40

* Milligrams of active ingredient per square meter of surface.

that the first pass of a spray truck or helicopter occurs adjacent to a 300-foot swath treatment area, and all subsequent passes occur parallel to, and upwind from the first pass, at intervals of 300 feet. The results represent a "peak" maximum deposition value at the 25 ft receptor distance from the first pass of the source and an average deposition value within the 300 ft swath adjacent to the first pass of the source (which incorporates multiple passes of the truck every 300 ft upwind of the first pass).

The results are given for the deposition levels estimated at ground level receptors (0 ft above grade) and surfaces at receptors located 12 ft above grade.

As shown in Table 3.A-5, 1-hour active ingredient concentration levels for the organophosphate products range from approximately 18 µg/m^3 (i.e., micrograms of active ingredient per cubic meter of air, where a microgram is one one-millionth of a gram and there are 454 grams per pound) to 57 µg/m^3 for any modeled receptor height 25 feet away from the spray source, and from 16 µg/m^3 to 48 µg/m^3 for receptors at pedestrian height. In general, because of the higher maximum allowable application rate for malathion, the ISCST3 model predictions result in higher concentration levels for malathion than those predicted for naled.

For the pyrethroid products, the active ingredient concentration results range from 4 µg/m^3 to 22 µg/m^3 at any modeled receptor height, and from 3 µg/m^3 to 18 µg/m^3 at pedestrian height. The upper-end predicted concentrations are associated with the application of Permethrin 57% OS. Permethrin 57% OS, which does not contain a synergist, has a much higher maximum allowable application rate than the other pyrethroid products being analyzed. Therefore, the resultant concentration levels for permethrin in this Permethrin 57% OS are higher than the levels for the other pyrethroids.

As shown in Table 3.A-6, average active ingredient deposition levels within 300 feet of the source for the organophosphate products range from approximately 2 mg/m^2 (i.e., milligrams of active ingredient per square meter of soil) to 5 mg/m^2 at ground level receptors, and from 2 mg/m^2 to 7

mg/m^2 for receptors located 12 feet above ground. Peak deposition levels at a distance 25 ft from the spray source range from 8 mg/m^2 to 25 mg/m^2 on ground level to 12 mg/m^2 36 mg/m^2 for surfaces at 12 feet high. Again, because of the higher maximum allowable application rate for malathion, the predicted deposition levels are higher for malathion than those for naled.

For the pyrethroid products, the average deposition levels within 300 feet of the source range from 0.3 mg/m^2 to 2 mg/m^2 at ground level receptors and from 0.5 mg/m^2 to 3 mg/m^2 for receptors located 12 feet above ground. At a distance 25 feet from the spray source, peak deposition levels range from approximately 2 mg/m^2 to 10 mg/m^2 for ground level receptors, and from 2 mg/m^2 to 14 mg/m^2 for receptors 12 feet above ground. As described for the concentration results above, the pyrethroid product with the highest maximum allowable application rate is Permethrin 57% OS; therefore, the deposition results for permethrin in Permethrin 57% OS are predicted to be higher than the other pyrethroid products being analyzed.

The results of the analysis also showed that from multi-pass ground application, most of the larger size droplets in the adulticide application would be deposited within the first 300 feet from the source. While the finer droplet sizes can be transported by the prevailing wind and drift beyond the 300-foot application area, the maximum airborne concentrations were determined for locations immediately adjacent to the point of application from trucks. Therefore, the potential airborne and deposition levels of adulticides at further downwind distances were computed to be significantly lower than those included in the technical impact assessment analyses.

As discussed in Chapter 2, "Pesticide Regulations and Usage," the issues relating to potential impacts from inerts in the adulticide products is dealt with qualitatively within the technical analyses in this EIS. However, to gain a better understanding of the relative amounts of the ingredients within an adulticide product that may be applied in a treatment area, estimates of the total amounts of inerts (in terms of concentration and deposition levels following an application) can be calculated for comparison with the values for the active ingredients. As discussed in Chapter 2, "Pesticide Regulations and Usage," inerts can make up a relatively large percentage of pyrethroid products. Biomist 1.5+7.5 ULV, which contains 1.5 percent of the active ingredient permethrin, and 91 percent inerts, contains the maximum amount of applied inerts in any of the pyrethroid products. This amount is approximately 118 times greater than the application rate of the active ingredient sumithrin (found in Anvil 2+2 and Anvil 10+10). The minimum amount of applied inerts in any of the pyrethroid products is found in Scourge 18+54, and has an application rate approximately three times the application rate of the active ingredient sumithrin. Based on the summary of results in Table 3.A-5, the maximum predicted one-hour concentrations of inerts would range from 9.58 to 447.81 $\mu g/m^3$. Maximum predicted deposition values for inerts would range from 5.0 to 283.44 mg/m^2, based on the results from Table 3.A-6.

D. ENVIRONMENT TYPES

It is not possible to predict exactly where in the City in a given year it may be necessary to apply adulticides to control mosquito-borne pathogens in the future. In large measure, these sites will be determined by the location of the disease outbreaks in humans, mammals, birds, and mosquitoes, and the likely habitat for mosquitoes. However, it is possible that at one time or another most land uses in the City and all of its natural areas could be affected by spraying. Therefore, six typical environments within the City have been identified for analysis, with emphasis on those that may be particularly vulnerable to the application of adulticides. These environment types are outlined below, and include a short synopsis of potential pathways by which either humans or wildlife could be affected by the Proposed Action.

RESIDENTIAL ENVIRONMENT

The predominant developed land use in the City is residential. Areas considered in this EIS include high-, medium- and low-density areas, which relate to greater and lesser concentrations of people and contain different building forms (e.g., high-rise, mid-rise, low-rise). Single-family homes and row houses with gardens and yards create exposure pathways both for mosquitoes and for contact with sprayed adulticides. In addition, dust in this lower-density housing might contain a higher percentage of outside soil than in high-rise apartments, because soil is more likely to be tracked into lower density housing with attached yards. A high-rise apartment building may offer more protection from exposure, but an area where all the buildings are tall may limit applications to truck spraying. In addition to direct exposures to adulticides during or immediately after spraying, indirect pathways of exposure exist in all types of housing through open windows and doors and deposition of material on window ledges, roofs, open stairs, yards, and other surfaces. For residential scenarios, potential adulticide exposures to resident children and adults will be evaluated in the public health impact analysis. Potentially complete exposure pathways that may be considered in the public health impact analysis for this type of use would include inhalation of airborne adulticides, dermal contact with adulticides from direct deposition or dermal transfer from other surfaces, incidental ingestion of adulticide residues from hand-to-mouth behavior, and ingestion of contaminated produce or drinking water.

PARKS AND PUBLICLY ACCESSIBLE OPEN SPACES

Open areas, particularly where there are conditions that support mosquito activity and where people congregate, are environments likely to expose the public to infected mosquitoes and to direct or indirect contact with adulticides. These areas are located throughout the City and range from small "vest-pocket" parks and play areas to very large parks, with substantial facilities and large numbers of users. The potential limitations of the spraying of adulticides in State/Federal parks versus locally owned facilities will be discussed in the EIS. Facilities such as schools and parks will be identified in each of the representative areas. For this analysis, two types of open space need to be considered: paved playgrounds, where deposited material could be washed off in a rainfall and be discharged into the City's run-off sewer system; and dirt or grassy play areas, where the deposited materials could persist in the environment for a much longer time. Six representative receptor groups for the public health impact analysis will be considered in this category: young children (6 years or younger), older children (7 to 12 years), adolescents (13 to 18 years), adults (older than 18 years), community gardeners, and the homeless. In addition to direct dermal contact exposure to adulticides in drift during or immediately after spraying, potentially complete indirect exposure pathways will include inhalation of adulticides in dust (e.g., dust resuspended while playing on a dirt field), incidental ingestion of adulticides deposited on soil while playing or deposited in swimming areas, direct ingestion of adulticides deposited on skin (i.e., child hand-to-mouth behavior), and dermal contact with adulticides in soil, surfaces, plants, or in surface water (e.g., children playing in wading pools). In addition, exposure could occur when contaminated soil is tracked, by both people and pets, into their homes. This would depend primarily on the proximity of the home to the open space and the type of housing. Dust in single-family homes might contain a higher percentage of outside soil than in a high-rise apartment because soil is more likely to be tracked into lower density housing with attached yards.

NATURAL RESOURCES

As defined by the *City Environmental Quality Review (CEQR) Technical Manual*, a natural resource is a plant or animal species and any area "capable of providing habitat for plant and animal species or capable of functioning to support environmental systems and maintaining the City's environmental

balance." Included in these resources are the City's upland habitats, wetlands, and fresh and marine water bodies. Many of these habitats are found in the City's parks or nature preserves, but some flourish on land that is not publicly accessible. Throughout the City, these habitats support a wide variety of mammals, migratory and non-migratory birds, amphibians, reptiles, fishes, insects and other invertebrates, and other marine organisms. Species of special concern because of their local rarity or status as threatened or endangered also reside in or use the City's natural habitats. Natural resource areas often contain breeding grounds for mosquitoes and other arthropods and are therefore likely targets for application of adulticides. It is necessary to understand how these habitats function to assess the exposure and risk of harm to flora and fauna of the City's natural resource system. Assessing exposure of natural resources should acknowledge the influence of season, which affects the abundance and diversity of biota and their sensitive life stages.

In order to assess the potential effects of adulticide application on the City's natural resources, the various types of habitats within the representative areas must be described with respect to the plant and animal community and important physical and chemical characteristics specific to each habitat type. Habitats to be evaluated should include uplands (woodlands and fields), beaches/dunes, tidal and non-tidal wetlands, and estuarine and freshwater surface water bodies. The EIS will evaluate the potential impacts to the plant and animal resources of the habitats in the representative areas, including fish, birds, mammals, insects and other invertebrates, amphibians and reptiles, and threatened or endangered species. The evaluation will consider seasonal use of these habitats by animals and the life stages present during the mosquito season.

COMMUNITY FACILITIES AND INSTITUTIONAL USES

This category includes schools, day-care centers, hospitals, and nursing homes. The risk of both disease and impacts from adulticides would be greater to certain segments of the population (e.g., the elderly, the very young, people with respiratory disorders, and hospitalized patients) who use these facilities.

For patients in hospitals, accidental inhalation of adulticides in drift during or immediately following application will be considered as a potentially complete exposure pathway. This assumes an environment with open windows and ventilation that allows uncontrolled airborne and deposition exposure (although hospitals in the selected areas for adulticide applications may have filtered HVAC systems, in which case no complete exposure pathway exists). For residents in nursing homes, potentially complete exposure pathways are similar to those under the residential scenario. Thus, the effects of adulticide application on this sensitive segment of the population will be included under the residential scenario.

For children (younger than 6 years old) in daycare centers, potentially complete exposure pathways (e.g., dermal exposure) would be similar to those for child residents; thus, the effects of adulticide application on this segment of the population will be included under the residential scenario. In addition to direct exposures to adulticides in drift during or immediately after spraying, potentially complete exposure pathways at school will include inhalation of airborne pesticides, dermal contact due to direct or indirect deposition, incidental ingestion of adulticides in soil hand-to-mouth behavior, dermal contact with adulticides in soil, ingestion via contaminated water and inhalation of adulticides in dust.

COMMERCIAL USES

The commercial areas of the City include such uses as offices, stores and shopping centers, local retail establishments, and wholesale markets. For most segments of the population, these land uses

would be at significantly lower risk than the residential, open space, or natural resources areas discussed above because children are not likely to play or be present in these areas for a significant portion of their daily activity and few wildlife species are found here. The human health risk in these areas is therefore mainly considered for the adult population. Potential health impacts to this sub-category of receptors may be evaluated qualitatively because the primary and potentially complete exposure pathways will be addressed through the more conservative residential exposure scenario. Potentially complete exposure pathways that will be considered in the public health risk assessment include inhalation of adulticides in dust and accidental dermal contact and inhalation of adulticides in drift during or immediately following application.

A sub-category of potential concern includes wholesale food markets with open air stalls or restaurants with open air dining where deposition of adulticide particles could contaminate tables and food and therefore affect consumers.

INDUSTRIAL USES

For the purposes of this EIS, this environment type includes a range of industries and utilities, as well as transportation uses, such as railroads and highways. The population at risk is primarily the adult worker. The worker population is generally less dense in an industrial area than in a denser commercial area; nonetheless, small factories with open windows and facilities where employees work out of doors (e.g., yards) could offer pathways for exposure to mosquitoes and to adulticides. In addition to direct exposures to adulticides in drift during or immediately after spraying, potentially complete exposure pathways for the adult worker will include the incidental ingestion of adulticides deposited on soil, inhalation of adulticides in dust, and dermal contact with adulticides in soil, surface-water, or surfaces (including equipment, supplies, vegetation).

E. REPRESENTATIVE AREAS FOR EIS ANALYSIS

With the range of environment types in mind, and since it would be impossible to gauge the impacts of adulticide spraying on every neighborhood in New York City, seven representative geographic areas of the City have been selected for site-specific study. These areas are representative for projecting potential Citywide impacts from the proposed *Mosquito-Borne Disease Control Plan*. As shown on Table 3.A-7 and further discussed below, these include areas with a variety of land uses, and areas with a variety of natural environments. Areas with vulnerable populations and threatened or endangered wildlife species have also been considered. Seven areas were selected as representative of environment types throughout the City (see Figure 3.A-3). As shown in Table 3.A-7, the representative areas include the full range of environment types to be found in New York City, some likely mosquito breeding grounds, and locations of vulnerable human populations and animal species. The following is a short discussion of each representative area and the various New York City environment types they intended to represent. A more detailed discussion of these areas can be found in Chapter 3.B, "Land Use, Community Facilities, Public Policy, and Zoning."

COLLEGE POINT

College Point was selected to represent likely mosquito breeding grounds with nearby residential areas and sensitive environmental systems (Figure 3.A-4). It contains wetlands, parks, active coastal recreational uses, and low- to moderate-density housing, as well as a number of nursing homes. Located in northern Queens along the East River, College Point is representative of similar communities in Northeast Queens such as Whitestone, Bayside, and parts of Flushing.

JAMAICA BAY AND ENVIRONS/PAERDEGAT BASIN AREA

Representing many similar residential neighborhoods in Brooklyn and Queens, Paerdegat Basin is a mid-density, auto-dependent community with a range of schools, mid-sized neighborhood parks, and access to the waterfront (Figures 3.A-5 and 3.A-6). Low- to mid-scale, attached and semi-attached housing with rear decks or yards represents communities throughout the City's outer boroughs. With one of the City's largest combined sewer outfalls which discharges into Paerdegat Basin, the area offers the opportunity to examine the potential impact of adulticide application from runoff after rain events. Proximity of the Paerdegat Basin study area to Jamaica Bay allows analysis of adulticide application's potential impacts on large wetlands areas and migratory seabirds.

EDGEMERE/FAR ROCKAWAY

This area presents a mix of single-family homes and high-rise public housing and contains a large hospital and a number of day care facilities (Figure 3.A-7). Much of the area is underdeveloped, with large swaths of vacant, unused, overgrown land. This area contains a high proportion of young children and a high level of street activity. With portions fronting on the Atlantic Ocean and Jamaica Bay (tidal wetlands), this environment is similar to other areas along the Brooklyn and Queens south shore.

HUNTS POINT/SOUNDVIEW

Hunts Point/Soundview combines a heavily industrialized area with a residential neighborhood (Figure 3.A-8). Hunts Point/Soundview is similar to other neighborhoods in the South Bronx, Upper Manhattan, and Central Brooklyn, with mid-rise apartment buildings housing predominantly low-income residents in close proximity to industrial uses. With markets that supply food to all parts of the City, this area offers the opportunity to examine impacts of spraying on the food supply.

JEROME PARK/VAN CORTLANDT PARK SOUTH

Jerome Park/Van Cortlandt Park South is centered around a reservoir used for the public water supply. The area also contains large institutional and park uses. Van Cortlandt Park represents other large, wooded parks such as Fort Tryon Park, Pelham Bay Park, Forest Park, and Prospect Park (Figure 3.A-9). With mid-rise apartment buildings sited on steeper topography, this area is similar to neighborhoods in Northern Manhattan and the Bronx. With large schools such as Lehman College and Bronx High School of Science, the area provides an opportunity to examine adulticide spraying impacts at campus-type settings.

MANHATTAN'S UPPER EAST SIDE

Manhattan's Upper East Side, including a large section of Central Park, is one of the most densely populated neighborhoods in the City (Figure3.A-10). Like many residential areas of Manhattan, tall apartment buildings line all the avenues, with row houses down mid-blocks. There are some balconies but otherwise little outdoor residential activity facing the streets. However, the avenue sidewalks are busy with pedestrian traffic and outdoor dining establishments, and vendors sell fruit and vegetables on the street. Public transit is the primary means of transportation. The area also contains a preponderance of public and private schools that serve the neighborhood's children. The inclusion of Central Park in the study area provides the opportunity to examine the impact of adulticide spraying on nesting birds, and on other relatively natural environments and recreational uses in an urban setting.

Table 3.A-7
Representative Areas and Environment Types

Environment Types	College Point	Jamaica Bay/ Paerdegat Basin	Edgemere/ Far Rockaway	Soundview/ Hunts Point	Jerome Park/Van Cortlandt Park South	Man. Upper East Side	Lemon Creek/ Wolfe's Pond
Residential							
Low-rise	X	X	X	X	X		X
Mid-rise	X	X	X	X	X	X	
High-rise			X	X	X	X	
Parks/Open Areas							
Public open space	X	X	X	X	X	X	X
Paved open areas	X	X	X	X	X	X	
Unpaved open areas (including residential front and rear yards)	X	X	X	X	X		X
Marinas/Waterfront Recreation (i.e., beach, boating)	X	X	X	X			X
Natural Resources							
Upland forest		X			X	X	X
Upland field	X	X	X		X	X	X
Tidal wetland	X	X	X	X			X
Freshwater wetland	X	X				X	X
Water Supply		X	X		X		
Sensitive water bodies (including estuaries, rivers, basins)	X	X	X	X		X	X
Community Facilities/ Institutional Uses							
Schools	X	X	X	X	X	X	X
Hospitals			X				X
Elder care centers	X	X	X		X	X	
Commercial							
Retail	X	X	X	X	X	X	X
Outdoor Dining	X	X			X	X	
Open markets				X		X	
Large Vacant Parcels		X	X	X			
Industrial/Transportation							
Municipal facilities (including transfer stations, WPCP, depots)	X	X		X	X		
Manufacturing/warehouse	X	X		X			
Rail/Transit system			X	X	X	X	X
Major Arterials/Highways	X	X		X	X	X	X

Source: Allee King Rosen & Fleming, Inc., October 2000.

LEMON CREEK/WOLFE'S POND PARK

This area of Staten Island represents the least densely developed portions of the City, with a street pattern, density, and type of use similar to many of the more suburban areas within the City's borders (Figure 3.A-11). With single-family homes containing driveways, front and rear yards, and outdoor pools, Lemon Creek/Wolfe's Pond is like many neighborhoods in Staten Island, Riverdale, the Bronx,

and portions of Eastern Queens such as Forest Hills, Kew Gardens and Douglaston. The area also contains hospitals, large parks and undeveloped natural areas, freshwater and tidal wetlands, and ocean beaches.

F. EXPOSURE SCENARIOS

An exposure scenario describes the way by which a person or biota can potentially be exposed to adulticides as a result of spraying. Exposure scenarios are defined by the potential "populations" (public health) and "receptors" (natural resources) that may be exposed–and the "pathways" by which they may be exposed. Exposure pathways are the routes by which a population or receptor may come in contact with an adulticide and depend on how the adulticide is applied (e.g., ground or aerial spraying), when it is applied (e.g., sunset, middle of night, before sunrise), and what medium (e.g., water, air) may be affected. The public health and natural resources technical analyses focus on the risk resulting from exposure to adulticides in airborne and surface concentrations. The various populations and receptors, and exposure pathways included in the analyses for public health and natural resources are outlined below.

PUBLIC HEALTH

The various human populations that can potentially be exposed to adulticiding activities are identified below. To account for the variability in human populations (i.e., differences in age, or levels of activity) resulting in the potential variability in exposures to the adulticides, the identified human populations were further broken down into specific age ranges and population subgroups. The following human populations and age groups address these issues:

Human Populations

Residents:

- Young Child (0-6 years)
- Older Child, Adolescent and Adult (7 years and older)

Workers:

- Commercial/Industrial
- Public Works (i.e., street sweepers, park employees, sanitation department)

Sensitive Groups:

- Hospitalized/In Nursing Homes
- Homeless
- Suffering from Asthma, Multiple Chemical Sensitivity, Autism and Learning Disabilities

School Populations:

- Older Child (7-12 years)
- Adolescent (13-18 years)
- Staff and Teachers (older than 18 years)

Park Visitors:

- Young Child (0-6 years)
- Older child (7-12 years)

- Adolescent (13-18 years)
- Adult (older than 18 years)
- Community Gardener (older than 18 years)

Exposures to developing fetuses, pregnant women, the elderly and those with chronic illnesses are also accounted for within the populations listed above, and will be discussed in further detail in Chapter 3.C, "Public Health." Exposures for people in subways would be less than those projected for residents and workers.

Exposure Pathways

If adulticides are used to kill adult mosquitoes, people might be exposed to these adulticides' active ingredients in a variety of ways. Potential risks to public health may include exposure via inhalation, dermal contact, and ingestion. These could occur from direct exposure following adulticide application, and indirect exposure to adulticides in soil, food, or water. During spraying, adulticides in the air could be inhaled; they could also settle and leave a residue on people's skin and clothing. Such residues also may settle on non-targeted outdoor surfaces (such as lawns, gardens and swimming areas) and on surfaces within homes, which airborne insecticides could enter through open windows or ventilation systems. Therefore, the "exposure pathways" through which human exposure might occur include not only inhalation of airborne adulticides and skin contact with adulticide residue during spraying, but also accidental ingestion (eating) of adulticide residues because of hand-to-mouth behaviors; ingestion of contaminated produce and drinking water, and exposure due to participation in outdoor aquatic activities.

General Exposure Scenarios Related to Public Health

During spraying application, adulticide formulations will be dispersed in the air, and may settle and leave a residue directly on an individual's skin, due to dispersion and spray drift. Adulticide residues may also settle on non-targeted outdoor surfaces (such as lawns, gardens and swimming areas) and surfaces within homes (through open windows or ventilation systems). There is also the potential for insecticides to enter public water supply systems. For the above populations, at least one of the following scenarios for each pathway will be considered in the public health analysis.

Inhalation

Listed below and illustrated in Figure 3.A-12 are the various exposure scenarios related to inhalation of adulticides through direct and indirect exposure.

- Spray drift while spraying.
- Re-suspended outdoor soil/dust.
- Vaporized from domestic water supplies while showering/bathing if water is contaminated.

Dermal (Skin) Contact

Listed below and illustrated in Figure 3.A-13 are the various exposure scenarios related to dermal contact through direct and indirect exposure.

- Drift while spraying.
- Contaminated soil.
- Swimming/wading.
- Showering/bathing.

- Via contaminated surfaces.
- Contaminated laundry.

Ingestion

Listed below and illustrated in Figure 3.A-14 are the various exposure scenarios related to ingestion through direct and indirect exposure.

- Incidental, from deposition on skin/hands while spraying.
- Incidental, via dermal transfer from contaminated surfaces to hands.
- Contaminated soil.
- Incidental, from water while swimming/wading.
- Drinking water.
- Fruits and vegetables.
- Fish and shellfish.

NATURAL RESOURCES

The various types of wildlife that can be potentially exposed to adulticiding activities are identified below. In this study, these species are called receptors.

Receptors

Terrestrial (Land) Receptors

- Mammals
- Birds
- Insects
- Sensitive Plants

Aquatic Receptors

- Fish
- Crustaceans (Daphnids)
- Aquatic Insect Larvae
- Mollusks
- Algae
- Amphibians

Exposure Pathways

Exposure to terrestrial and aquatic receptors can occur through direct exposure from the primary source (drift and deposition of the adulticide spray) or indirect exposure through secondary sources. Exposure from secondary sources can occur via the terrestrial-based food chain, the aquatic-based food chain or from runoff from precipitation events that follow an application.

General Exposure Scenarios Related to Natural Resources

The primary source of exposure to terrestrial systems is direct contact to the spray. Mammals, birds, insects and other non-target organisms may experience direct exposure through inhalation of the

spray drift or through direct bodily contact with the adulticide from deposition, which may then be ingested during grooming or preening. The drift from application can also transport adulticides to ponds, streams, and wetlands, where aquatic organisms may potentially be exposed through direct contact with the water. Figure 3.A-15 illustrates the various exposure scenarios related to the direct exposure of adulticides to terrestrial and aquatic receptors.

Secondary sources of adulticide exposure include those that occur through the terrestrial and aquatic-based food chains. For example, spray that falls on grasses, seeds and insects may be consumed by birds and mammals. Fish-eating birds and mammals are also potentially exposed through the aquatic-based food chain from either fish that have been exposed through direct exposure to the spray or through runoff from precipitation (i.e., rainfall that washes away deposited adulticides to water bodies) events that may follow an adulticide application. The various scenarios related to exposure through secondary sources are illustrated in Figure 3.A-16.

EXPOSURE SCENARIOS WITHIN THE REPRESENTATIVE AREAS

Considering the potential areas for adulticide applications, vulnerable human and natural resource populations, and the environment types, the exposure scenarios within these representative areas are discussed below. Nearly all of the areas include residential and commercial uses. Where there are exposure scenarios particular to the respective representative area, they are noted for each of the areas discussed below.

College Point

This area is surrounded by Flushing Bay to the south and west, the East River to the north, the Whitestone Expressway to the east, and the Whitestone Bridge to the northeast.

Based on information reported by the U.S. Census, the residential population of this representative area was 22,367 in 1990 and 25,598 in 2000 (a 14 percent increase).

Public Health

The central part of this area is primarily residential, with various industrial, commercial, and institutional uses to the south and east, and waterfront open space uses found along Flushing Bay and the East River. Most of the residential development, which includes attached and detached houses, is composed of 2- and 3-story single-family and multi-family houses with front and rear yards and driveways. The Riverview Condominium Complex in the northwestern portion of the study area is composed of townhouses and villas. A townhouse complex is currently under construction near an existing low-rise apartment complex in the north central portion of the study area. Large, single-family homes are located in Malba, in the northeastern portion of the area.

The industrial uses in the study area are concentrated in the College Point Industrial Park and on the waterfront west of College Point Boulevard. These areas contain a mixture of light and heavy manufacturing, warehouse and distribution facilities, utilities, auto-related uses, and mixed commercial and industrial operations. Some of the major industrial uses in the area are Con Edison, Queens Surface Corporation, a New York City Department of Sanitation (NYCDOS) Marine Transfer Station, and the New York City Department of Environmental Protection (NYCDEP) Tallman Island Water Pollution Control Plant. Industrial uses on portions adjacent to the former Flushing Airport area include a post office facility and a New York Times printing and distribution facility.

The major publicly accessible open spaces in the area are Frank Golden Park, Powell's Cove Park and the open space area at the Riverview Condominium complex. There is a publicly accessible fishing pier located in Malba and a ramp at the Ariel Tennis and Rowing Club. The College Point Yacht Club

is located in the northwestern portion of the study area. The major commercial areas are located along 20th Avenue. There is a fruit and vegetable market near 15th Avenue. Major retailers occupy the block bounded by 20th and 14th Avenues, 131st Street and the Whitestone Expressway service road. The block also contains office buildings. The study area contains several institutional uses including P.S. 29, P.S. 129 and several churches along 14th Avenue.

Exposure Scenarios Particular to the Representative Area:

Exposure through direct and indirect contact to the human population groups associated with these environments:

- Range of residential conditions
- Schools
- Nursing Home
- Paved and Unpaved Parks

Natural Resources

Natural resources in College Point include Powell's Cove on the East River and a variety of tidal wetlands throughout the area. The former Flushing Airport was built on a wetland in 1927; since its closing in 1984, the site has slowly transformed back into a substantial open water and wetland area.

Exposure Scenarios Particular to the Representative Area:

Exposure to biota through primary and secondary sources in these environments:

- Former Flushing Airport Wetland Area
- Powell's Cove Park Area

Jamaica Bay and Environs/Paerdegat Basin Area

Within this very large area, Paerdegat Basin in southeast Brooklyn was selected for its inclusion of several specific environments. The area is roughly bounded by Jamaica Bay and the Belt Parkway to the east and south, Ralph Avenue to the west, and East 85th Street to the north. Most of the waters in the basin are significantly influenced by tidal activities from Jamaica Bay and the discharge from a large CSO at its head. While NYCDEP is in the process of designing a large holding tank to minimize such discharges in the future at this location, the completion of the construction of a CSO holding tank is still many years into the future.

Based on information reported by the U.S. Census, residential population of this representative area was 35,317 in 1990 and 44,125 in 2000 (a 25 percent increase).

Public Health

Four residential communities surround Paerdegat Basin: Georgetown and Bergen Beach to the southeast of the basin, and Paerdegat Basin and a portion of Canarsie to the northeast of the basin. The area is predominantly residential, with 2- to 3-story, semi-detached and attached houses along most side streets and portions of surrounding arterials. Few houses have front yards, but rear yards or decks are a consistent feature. Neighborhood retail corridors are located on two major streets: Ralph Avenue (west of the Basin) and Flatlands Avenue (north of the Basin). There are very few restaurants in the Paerdegat area, and none with outdoor seating. Similarly, few of the bodegas, delis, and markets sell fruit or other foods in the open air. As the Belt Parkway runs through the area, it skirts Jamaica Bay and passes over the mouth of the basin.

Four public schools are located in various parts of the study area and often have City playgrounds, basketball courts, and handball courts nearby. In addition to these playgrounds, the study area contains three major parks along the Bay: Canarsie Beach Park, bordering the basin to the northeast (which contains Canarsie Pier); McGuire Park, bordering the eastern mouth of the basin; and Bergen Beach, south of the mouth of the basin.

Exposure Scenarios Particular to the Representative Area:

Exposure through direct and indirect contact to the human population groups associated with these environments:

- Parks
- Beaches
- Schools

Natural Resources

The study area's three parks, along with the portion of the basin near its mouth, encompass much of the area's natural landscape. Near the combined sewer outfall (CSO), industrial land uses are predominant, while closer to the bay, the basin's shores are lined with open land, including play areas and marinas near the outlet to Jamaica Bay.

Exposure Scenarios Particular to the Representative Area:

Exposure to biota through primary and secondary sources in these environments:

- Natural areas/parks bordering Jamaica Bay
- CSO at head of Paerdegat Basin

Edgemere/Far Rockaway

This area, located on the Rockaway peninsula at the southeastern end of Jamaica Bay in Queens runs from the Grass Hassock Channel section of Jamaica Bay to Rockaway Beach and the Atlantic Ocean. Edgemere is a small, diverse residential neighborhood. Based on information reported by the U.S. Census, the residential population of this representative area was 14,813 in 1990 and 12,022 in 2000 (a 19 percent decrease).

Public Health

In addition to its four clusters of 9- to 20-story apartment buildings (three of them public housing projects), the other predominant housing type in Edgemere is 1-story, single-family houses on small lots. These houses, which appear to have at one point been part of uniform blocks, are now interspersed with vacant lots. The blocks adjacent to the Boardwalk and Rockaway Beach were also formerly lined with houses but are now completely vacant and covered with low-lying vegetation, beach grasses, and sand; and the streets themselves are dirt paths. The A subway line runs through the area on elevated tracks north of the beach.

The small amount of commercial activity in the area is limited to portions of Beach Channel Drive, as is the majority of the street activity in the area. The neighborhood's only public school and hospital are also on Beach Channel Drive, next to and across the street from the Edgemere Houses.

Exposure Scenarios Particular to the Representative Area:

Exposure through direct and indirect contact to the human population groups associated with these four environments:

- Hospitals
- High Density Residential Buildings
- Parks
- Beaches

Natural Resources

Edgemere contains several environment types of interest, including recreational ocean beach areas (which contains breeding grounds for the piping plover, an endangered species), vacant land, high-rise and low-density housing, a hospital, and a large community park on the bay.

In addition to the vacant land in the area, Edgemere Park (a.k.a. Rockaway Community Park) which juts into Jamaica Bay, and Rockaway Beach on the Atlantic Ocean, comprise Edgemere's natural land areas.

Exposure Scenarios Particular to the Representative Area:

Exposure to biota through primary and secondary sources in these environments:

- Open areas bordering Rockaway Beach/Atlantic Ocean
- Piping Plover endangered species areas
- Grass Hassock Channel

Hunts Point/Soundview Exposure Pathway

A wide range of uses characterizes this representative area south of the Bruckner Expressway in the South Bronx. Roughly centered on the Bronx River as it flows to the East River in New York Harbor, the study area comprises Hunts Point on the west and Soundview on the east shore of the river.

Based on information reported by the U.S. Census, the 1990 residential population of the Hunts Point portion of the representative area was 8,557 residents and that of Soundview was 19,523 in 1990. By 2000, the total population of Hunt's Point/Soundview had risen to 31,043, an 11 percent increase.

Public Health

The most significant land use in Hunts Point is the Hunts Point Food Distribution Center and Hunts Point Cooperative Market, which together occupy a huge swath of riverfront land along the eastern side of the peninsula. These facilities handle the majority of wholesale meat and produce serving the City. One small market with produce displayed in front of the store is located at Hunts Point Avenue and Bruckner Boulevard. Industrial and vacant land covers approximately three-quarters of the Hunts Point area, most of it food-supply and automotive-related. In addition, two large municipal facilities, the New York City Department of Correction Maritime Correctional Facility III and the NYCDEP Hunts Point Water Pollution Control Plant, are located on the southern tip of the study area along the East River.

The northern quarter of the study area contains a residential neighborhood of brick mid-rise housing interspersed with ground floor retail, low-rise commercial uses, and more auto-related and industrial uses. A ring of institutional, open space, and light and heavy industrial uses surround the blocks of residential buildings. Residences on the fringe of the industrial area tend to be mid-rise apartment blocks or 2- to 3-story row houses, with accessory off-street parking lots and several small community gardens. Several open spaces, including Drake Park, the P.S. 48 Playground, and Julio Carballo Fields, represent the only greenspace in Hunts Point.

On the east side of the Bronx River, land uses in Soundview contrast greatly with those of Hunts Point. The neighborhood is primarily composed of residential development and accessory service uses (commercial and institutional), and a large public open space, Soundview Park. Four public housing projects are located here—three high-rise projects (Soundview Park Homes, Lafayette Morrison Houses, and Soundview Houses) and one low-rise, clustered development (Classon Point Gardens Houses). Toward the study area boundary at Soundview Avenue, the housing stock includes row houses, low-rise apartment blocks, and single-family detached homes with driveways and gardens toward the southern end. Recreational uses such as ball fields, playgrounds and a boat launch enhance various areas of Soundview Park. Soundview contains a concentration of commercial uses along Bruckner Boulevard, including a bowling alley and a large grocery store. The commercial uses continue south along Soundview Avenue, especially at Story Avenue, where a small strip mall with neighborhood services and a meat market are located.

Exposure Scenarios Particular to the Representative Area:

Exposure through direct and indirect contact to the human population groups associated with these environments:

- Hunts Point Food Market/Cooperative Market
- Soundview Park

Natural Resources

The Bronx River is the primary concern with respect to natural resource in the study area.

Exposure Scenarios Particular to the Representative Area:

Exposure to biota through primary and secondary sources in this environment:

- The Bronx River

Jerome Park/Van Cortlandt Park South Exposure Pathway

One of the focal points of this representative area is Jerome Park in the Bronx, which contains a large reservoir that is part of the City's Croton water supply system. The study area is composed of parcels in the Van Cortlandt Village, Kingsbridge, and Kingsbridge Heights neighborhoods. In addition, the area includes the southern end of Van Cortlandt Park, which contains various types of natural resources.

Based on information reported by the U.S. Census, the residential population of this representative area was 35,217 in 1990 and 38,759 in 2000, a 10 percent increase.

Public Health

The Jerome Park Reservoir, through which passes approximately 10 percent of New York City's daily water supply, is surrounded by residential and accessory uses to the north, west, and south, and institutional and industrial uses to the east. The residential housing stock in the north and east is primarily composed of mid-rise apartment blocks sprinkled with single- and multi-family detached houses. Winding streets connect the residential uses to area parks and service nodes, which contain small grocery stores and other local commercial uses. The south contains a more regular street grid with housing stock that is similar to yet more dense than that of the northern area. On the eastern side of the area, a string of school complexes (DeWitt Clinton High School, Bronx High School of Science, Lehman College, and Walton School) occupies four superblocks. At the eastern boundary are the New York City Transit (NYCT) rail yards and three residential high-rises.

Several open spaces located near the reservoir have been included for study as part of the representative area. The southern parcel of Van Cortlandt Park—including Moshulu Golf Course, a driving range, playground areas, the parade ground, and the Van Cortlandt Mansion and Museum—is located on the northern border of the study area. Within the residential areas near the reservoir, there are numerous neighborhood parks such as Ft. Independence Park and Fort Four Playground. In addition, the western boundary of the study area is parallel to the Major Deegan Expressway, and publicly accessible open spaces occupy parts of the right-of-way.

Exposure Scenarios Particular to the Representative Area:

Exposure through direct and indirect contact to the human population groups associated with these environments:

- Multiple schools
- Van Cortlandt Park/Moshulu Golf Course
- Health care institutions
- Jerome Park Reservoir

Natural Resources

In addition to the Jerome Park Reservoir, Van Cortlandt Park is a forested area with a lake near the Major Deegan Expressway that offers a unique habitat for study.

Exposure Scenarios Particular to the Representative Area:

Exposure to biota through primary and secondary sources in this environment:

- Van Cortlandt Park forested area and lake

Manhattan's Upper East Side

The Upper East Side study area is bounded by Central Park to the northwest, 96th Street to the northeast, the East River to the east, and 84th Street to the southwest. The study area within the park extends south to the 72nd Street Transverse.

Based on information reported by the U.S. Census, the population of this representative area was 73,011 residents in 1990 and 76,741 in 2000, a 5 percent increase.

Public Health

This representative area includes predominantly high-density residential blocks, with styles ranging from mid-rise row houses to high-rise apartment towers. While front yards are almost non-existent, most older row-houses on mid-blocks have small rear yards and gardens. The Lexington Avenue subway runs through the area, making stops at 86th Street and 96th Street.

The study area includes a heavily traveled portion of Museum Mile along Fifth Avenue; destination retail corridors on Madison Avenue and on 86th Street; local retail on Lexington Avenue, Third Avenue, and Second Avenue; and many restaurants and bars, especially along Second Avenue. There are a number of small outdoor produce stands along First, Third, and Lexington Avenues. In addition to Central Park, another important park is Carl Shurz Park located along the East River, containing paved walkways, a dog run, riverfront esplanade, children's playground, and basketball courts. Asphalt Green, at 92nd Street, is a large and active recreational area with a large outdoor turf field and indoor athletic and swimming facilities. A number of public and private schools dot the area.

Exposure Scenarios Particular to the Representative Area:

Exposure through direct and indirect contact to the human population groups associated with these environments:

- High-density residential setting
- Central Park and Carl Schurz Park
- Lexington Avenue Subway Line

Natural Resources

This area also includes the portion of Central Park that contains a birding area known as the Ramble, as well as the Shakespeare Garden, Great Lawn, Metropolitan Museum of Art, Central Park Reservoir and surrounding running track, and a number of other wooded and open areas. It is also located on the major flyway used by migratory birds during the spring and fall.

Exposure Scenarios Particular to the Representative Area:

Exposure to biota through primary and secondary sources in these environments:

- Central Park and the Ramble birding area
- Central Park Reservoir
- Turtle Pond

Lemon Creek/Wolfe's Pond Park

This area in southern Staten Island was selected primarily because of its substantial natural areas and its suburban land uses. It is bounded by Amboy Road to the north, Huguenot Avenue to the east, the Atlantic Ocean to the south, and Sharrott Avenue to the west.

Based on information reported by the U.S. Census, the residential population of this representative area was 3,382 in 1990 and 4,977 in 2000, a 47 percent increase.

Public Health

The area is predominantly residential, containing single-family and two-family detached and attached houses. Most of the houses are two to three stories on medium- to large-sized lots, with front and rear yards and driveways. In addition, many of the homes have pools, balconies and outdoor furniture. The Captain's Quarters townhouse complex is located in the southwest portion of the study area.

The area has several public schools with accessory play fields, including Tottenville High School, I.S. 7, and P.S. 3. Other institutional facilities include Staten Island Hospital, a pre-school, several churches and a summer camp. The Staten Island Rapid Transit line runs along the northern portion of the study area. The few commercial uses in the study area are storefronts along Seguine Avenue and Amboy Road. The area has two large public parks—Wolfe's Pond Park and Lemon Creek Park. These parks provide shoreline access as well as recreational facilities and passive sitting and eating areas.

Exposure Scenarios Particular to the Representative Area:

Exposure through direct and indirect contact to the human population groups associated with these environments:

- Low-density residential with outdoor patios and pools
- Lemon-Creek Marina recreational area

- Staten Island University Hospital

Natural Resources

The Lemon Creek watershed contains delineated freshwater and tidal wetlands in one of the largest assemblages of wetlands on Staten Island. The creek has three freshwater feeding tributaries that add to the habitat value of the diversity of the tidal wetlands by providing freshwater and saline habitats. The watershed is also designated by New York State Department of State (NYSDOS) as a Significant Coastal Fish and Wildlife Habitat. Wildlife species in the area include mallards, egrets, green heron, blue heron, muskrat, and fiddler crabs. There is a purple martin colony in Lemon Creek Park, the only significant such colony in the City.

The study area has both tidal and nontidal wetlands, upland fields, and forest. Additional tidal and nontidal wetlands are found in a wetlands protection area under the jurisdiction of NYSDEC.

Exposure Scenarios Particular to the Representative Area:

Exposure to biota through primary and secondary sources in these environments:

- Lemon Creek watershed
- Wolfe's Pond Park
- NYSDEC Wetlands Preserve

Worker exposure

There would also be exposure pathways for the trained applicators who apply the insecticides. These would be addressed by compliance with the Occupational Safety and Hazard Act (OSHA) regulations. All contractors involved in the *Mosquito-Borne Disease Control Program* will be responsible for proper transportation, storage, and disposal of potentially hazardous materials and for proper reporting and cleanup of any spills. City workers involved in the *Mosquito-Borne Disease Control Programs,* such as police officers escorting the spraying trucks, would follow procedures recommended by NYCDOH to minimize potential exposure to adulticides and to ensure compliance with applicable OSHA and New York State Public Employees Safety and Health (PESH) regulations and standards. These procedures include training of workers in the potential hazards of adulticides, use of appropriate personal protective equipment, and work practices designed to prevent exposure.

REGIONAL ISSUES

The representative areas address the potential impacts associated with adulticiding applications on the various types of uses/activities/pathways throughout New York City. However, there is also the need to identify the potential cumulative impact on the City's water supply and regional loading from storm water runoff on potential natural resources from the application of adulticides.

Cumulative Drift

As shown in the results of the drift/deposition modeling, for ground applications that are 300 feet between applications, most of the larger size droplets in the adulticide application would be deposited within the first 300 feet from the source. While the finer droplet sizes can be transported by the prevailing wind and drift beyond the 300-foot application area, maximum predicted airborne concentrations and deposition levels of adult components at much greater distances would be significantly lower than those utilized in the technical impact analyses. Therefore, the potential impact of cumulative drift (from either NYCDOH-sponsored actions or from a combination of NYCDOH actions within City boundaries and concurrent adulticiding actions undertaken outside the City

boundaries by non New York City agencies) should be lower than the airborne concentrations and deposition levels employed in the technical analyses for this study.

Water Supply

The City of New York receives the bulk of its water supply from upstate reservoirs. The New York City surface (reservoir) water supply system provides approximately 1.4 billion gallons per day of drinking water to 8 million City residents, plus visitors, commuters and approximately one million people living in Westchester, Putnam, Orange, and Ulster counties. Approximately 80 percent of the surface water supply (approximately 90 percent) is supplied by the Catskill and Delaware reservoir systems, located in Delaware, Green, Schoharie, Sullivan and Ulster counties, west of the Hudson River. The Croton System, the City's original upstate supply, provides about 10 percent of the City's daily water from 12 reservoirs and 3 controlled lakes in Putnam, Westchester, and Dutchess counties. The Croton System supplies the Jerome Park Reservoir in the Bronx and the Catskill/Delaware System supplies water to the Hillview Reservoir (in Westchester County). Both are uncovered reservoirs. The Jerome Park Reservoir is included in this EIS in one of the representative areas.

New York City also has a Groundwater System in southeastern Queens, and over 350,000 residents of southeastern Queens receive groundwater or a blend of groundwater and surface water. The Magothy and Glacier aquifers, which are the sources for the Groundwater System, are located beneath southern Queens, and application of adulticides in this region could potentially affect the quality of groundwater supplies. In addition, the raw groundwater supplies may contain volatile organic compounds (VOCs), which have been entrained (drawn) into the water supply by spills or discharges of industrial products, including oil-based products that contain VOCs. Air-stripper facilities operate at several wells to remove VOCs found in those sources. Air strippers operate by blowing ambient air through aerators where water flows. Since the air strippers blow a large volume of ambient air as the primary means to displace VOCs from the groundwater supply, the potential for airborne adulticides to become entrained in the air strippers exists, and an analysis of the potential introduction of adulticides into the water supply through the air strippers was assessed.

In order to address a concern about the potential cumulative impact on the City's water supply from adulticide applications, the potential cumulative impacts on the surface-water supply (should Westchester and Putnam count perform similar concurrent adulticiding operations at the time such actions are undertaken in New York City) were assessed. A detailed explanation of the methodology and results of these analyses are presented in Section 3.E, "Water Supply."

Combined Sewer Outfalls (CSOs)

Another additional regional concern will be the potential cumulative loading of adulticides into the aquatic environment if it rains after an application, and the runoff is discharged into the waterways surrounding the City.

Jamaica Bay and its immediate environs are of particular interest for this EIS, because the bay itself is an important natural estuary. The bay is designated by NYSDEC as a Critical Environmental Area (the only one in New York City) and by NYSDOS as a Significant Coastal Fish and Wildlife Habitat. On the federal level, a portion of it is a National Wildlife Refuge within the Gateway National Recreation Area. It is also the receiving water for runoff after rain events from an enormous drainage area in Brooklyn and Queens. The runoff primarily arrives via CSOs, but also travels to the bay directly.

Therefore, in the analysis of potential regional impacts from runoff, estimates of the water discharges to Jamaica Bay were developed. Projections of the potential worst-case loading of adulticide to the

CSOs were determined based on the label application limits and the drainage coverage areas in order to determine the total loading to this larger study area. These projections of cumulative runoff were then used to estimate the regional impact on Jamaica Bay and its natural resources, and are considered to be representative of worst-case regional impacts from runoff.

G. SUMMARY OF ANALYSIS ASSUMPTIONS

Several assumptions were used in the modeling to yield conservative estimates of the adulticide concentrations and deposition levels resulting from adulticiding activities.

Based on a sensitivity analysis key input variables for both the AgDRIFT and ISCST3 models were identified. These inputs variables were wind speed, release height and droplet size. The results of the modeling for both these models were compared while varying these key input variables. The results indicated that the maximum predicted airborne concentration and deposition levels of adulticides were greater from the ISCST3 model, and therefore this model was selected for estimating the potential adulticide concentration and deposition levels within the representative areas following application. These conservative estimates were used as part of the inputs to the technical analyses.

The label-recommended droplet sizes for the various products analyzed in the EIS fall within the range of 5?m to 80?m for truck and aerial applications. Initial sensitivity runs were performed using three different VMDs: 20?m, 40?m, and 55?m, all well within the recommended droplet size distributions for the products being analyzed. The results indicated that although maximum predicted airborne concentrations were not significantly affected by varying the VMD, deposition levels were more sensitive to VMD with the maximum calculated deposition values for a VMD of 55?m. Therefore, as a conservative assumption, all simulations for the technical analyses were performed assuming a VMD of 55?m.

To cover the various likely meteorological conditions, the site-specific adulticide application simulations were performed using a meteorological data set with fixed wind speeds of 2 mph, 5 mph, and 10 mph, and fixed atmospheric stabilities of 4 (neutral) and 5 (stable). The wind direction was varied at 90 (directly perpendicular to the truck or aircraft path, 175 (near parallel winds blowing along the direction the truck or aircraft are traveling) and 135 (midpoint between near parallel and perpendicular winds). The results from the modeling runs that yielded the highest predicted concentrations among the combination of three wind speeds and two stability classes analyzed, were used as part of the inputs to the technical analyses.

Receptors were modeled at varying distances away from the sources. For airborne concentration levels, receptors were placed at pedestrian-level heights, as well as various other heights above grade. For deposition levels, receptors were placed at ground level, as well as surfaces at 12 ft above grade. Since the results indicated much higher concentration and deposition levels at the various receptors when simulated at truck-level source heights (12 ft above ground) as opposed to aerial level source heights, ground application results were used as inputs to the technical analyses. With respect to maximum predicted airborne concentrations, the analyses showed the highest 1-hour average concentration at a distance of 25 feet away from a truck application of adulticides. The concentration levels used in the technical analyses were conservatively based on the maximum value at this distance away from the source, at both a pedestrian level height as well as at any height above grade. The deposition levels which were used in some of the acute impact analyses were also conservatively based on the maximum value at a distance 25 feet away from a truck application of adulticides. Maximum calculated average deposition values within a 300 ft swath away from a truck application of adulticides were also used in some of the technical impact analyses. These simulations also

incorporated the potential cumulative effect of multiple passes of a truck every 300 ft upstream of the first pass.

Another key assumption used in the technical analyses was the potential frequency of adulticide application in an area. Based on the knowledge gained from 1999 and 2000 outbreaks, and to provide a reasonable worst-case estimate of the number of times a given area might be sprayed in one spray season to control the spread of disease, the following potential maximum application schedule of adulticides within the same representative area was assumed:

Day 1 – Day 4 – Day 14 – Day 17 – Day 27 – Day 30 – Day 40 – Day 43 – Day 53 – Day 56.

In other words, the technical analyses assumed that after the first application in an area, a follow-up application would occur 3 nights later. With the potential re-emergence of adult mosquitoes and based on surveillance data, in order to project worst-case conditions, another spraying event may be required 10 nights later (i.e., Day 14). This event may again be followed up by an application 3 days later. The initial analyses assumed that this schedule would continue for a total of 10 applications within a period of two months for this program. Assuming adulticide spraying, if necessary, would only occur from May through October in any given year, the above spray schedule assumes the same area could be sprayed with 10 applications in a 2-month period during these months. If a lesser number of applications were assumed for the analyses, the predicted longer-term impacts would be significantly less than those projected in the technical analyses.

Other detailed analysis assumptions used for each technical analysis can be found in their respective chapters. ☞

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