COOPERATIVE EXTENSION

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MEMORANDUM

TO : Aldicarb Steering Committee
LIRPB 208 Technical Advisory Committee
NYSDEC 208 Groundwater Technical Subcommittee

FROM : Ann Lemley, College of Human Ecology, Cornell University A.L.

SUBJECT: Aldicarb Videotape

DATE : December 2, 1980

This is the latest version of the script for a proposed videotape dealing with the aldicarb situation on Long Island. It has undergone several revisions; we have incorporated a number of suggestions which have been made and appreciate your continuing efforts and assistance. We welcome any further changes you may wish to suggest. Work has begun and is continuing on the video portion of the project. Some video sequences must await the planting season next spring; we expect that the tape will be finished shortly thereafter. Please feel free to comment.

Attachment

Aldicarb film - Carol Doolittle
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VIDEO	SCRIPT
Shore pictures on Long Island	Long Island - surrounded by water, but yet faced with a limited supply of that precious resource which must continually be protected from contamination.
Child or person turning on water	Each day millions of people turn the tap, expecting that the water will be potable, free from any contaminant which might cause ill effects.
Factory, farm, tractor	This is a story of competition for resources - by individuals, agriculture, industry. Each has its priorities, its requirements to survive, and all must be concerned with protecting the unique water resource on Long Island.
Dense group of people (shopping center)	The competition is made keener by a population of three million people living on the eastern half of an island 120 miles long and 20 miles wide.
Map of Long Island	There are four counties on the whole island: Kings, Queens, Nassau, and Suffolk.
City-type buildings	Kings and Queens counties are part of New York City, and obtain their water from upstate New York.
Typical suburban residential area	Population has shifted out from New York City over the years so that Nassau County has gradually been transformed from a rural area with significant agriculture to one which is largely suburban.
Housing development and farm	Suffolk County, not as accessible for commuting to New York City, still retains substantial open lands, and vegetable and fruit farming remain an important part of the Suffolk County economy.

VIDEO	SCRIPT
Industry	Light industry of various types is spread throughout Nassau and Suffolk.
Irrigation on Farm	Agricultural and industrial activities must compete for use of, and can inadvertently contaminate water, the irreplaceable resource.
Upstate stream or waterfall	Throughout the eastern United States, water has traditionally been an abundant and inexpensive resource. Only recently has demand in certain localities begun to outstrip local supplies of suitable water.
Geological maps	On Long Island, the water supply is isolated in a unique geologic way. The island itself is a large detached segment of the Atlantic coastal plain. Beneath the island is impermeable bedrock, the uppermost surface of which ranges in altitude from about sea level at the northwest corner to about 2000 feet below sea level in the southeastern part of Suffolk County. Above the bedrock is a wedge-shaped mass of unconsolidated sedimentary deposits that attain a maximum thickness of about 2000 feet. These deposits constitute the groundwater reservoir of Long Island and can be divided into six major units which differ in their geologic age, composition, and hydrologic properties. Four of these are important water-bearing strata or aquifers: the glacial deposits, Jamaica gravel, Magothy formation, and the Lloyd sands.
Well (if possible) Water Tower	All of the public and private water supplies in Nassau and Suffolk Counties depend on wells which tap the water in

VIDEO	SCRIPT
	these aquifers. There are no dependable surface supplies--no lakes or streams to serve as alternatives.
Rain seeping into soil	The groundwater in the aquifers derives from precipitation, rain and snow, which seeps deep into the soil. The route which this moisture takes depends on the texture of the soil; for example, sand and gravel make good water aquifers and clay and silt make good dividers.
Recharge basin	Recharge basins - depressions in the ground - have been placed strategically throughout the Island to catch fresh water and enable the groundwater supply to be replenished before this rainwater can run off into the sea.
Graphics	The water table, or top of the aquifer, is quite near the surface in many areas. A lowering of the water table, whether as a result of dry weather or because of large withdrawals for any number of reasons, may lead to a natural inflow of salt water into an aquifer. Such water is neither potable nor suitable for irrigation. The groundwater, trapped in soil, does not flow like the water in rivers and streams. If it is contaminated by pollutants from the surface, the pollutants cannot be easily washed away. There is a tendency to assume that water from wells is the cleanest water available. This purity cannot be taken for granted. Pollutants on the surface can soak into the ground and be carried into the aquifer. Some pollutants will not reach the aquifer, being degraded by chemical or biological action, or by adsorption on the soil.

VIDEO	SCRIPT
Change in soil horizons, dark to sand	In the root zone of plants, where oxygen is very plentiful, the largest percentage of degradation occurs. Relatively little degradation occurs at lower soil levels where oxygen is scarce. If pollutants get that far, groundwater will become polluted and will remain so until it is naturally flushed. Under Long Island this process would take decades and possibly centuries.
Pumps Wells Towers	All of the fresh water taken from the groundwater under Long Island is pumped from wells. Even public and municipal water supplies bring water from one or more wells spread over the area which they serve. Water is pumped from private, domestic wells directly into individual homes; public supplies often pump water into towers which provide water by gravity to an area of several square miles.
Old well covered with growth	Long Island has always depended on its groundwater for a supply of fresh and potable ater. Only recently has the quality of that water been threatened.
Southwest sewer district	The economic consequences of insufficient fresh and potable water supplies will ultimately result in significant alterations in the way Long Islanders are accustomed to living. Costs of eliminating pollution by sewering or of purifying polluted water will certainly increase, and these costs will inevitably fall directly or indirectly on consumers.
Liquid wastes (?) Washing dishes Fertilizer (?)	The implications of allowing the groundwater on Long Island to become polluted cannot be taken lightly, and, in fact, are likely to be more pronounced and longer lasting than

VIDEO	SCRIPT
	elsewhere because of demographic, economic, geographic, and gelogic reasons. Since the early 1970's Long Islanders have become aware of the pollution of their water by detergents, nitrates, heavy metals, and organic chemicals. A reasonable quantity of high quality water was threatened.
Newspaper Articles	When aldicarb, a toxic organic chemical used as a pesticide, was first discovered in the groundwater of Suffolk County in August, 1979, reaction was swift and extensive.
Newspaper Articles	Government agencies at every level became involved, either directly or indirectly. Sale and use of the pesticide (which had been marketed on Long Island for four years) were banned.
Collecting Samples	An extensive sampling program was begun by the Suffolk County Department of Health Services.
Dr. Zaki's maps	During the following year, eight thousand wells, including a number of community water supplies, were tested for aldicarb. The sampling was restricted to areas near potato fields because Long Island groundwater has little lateral flow, and the pesticide was used on potato fields. It was a logical assumption that the extent of contamination was fairly localized.
Narrator on camera	But how did this undesirable contamination come about? What is aldicarb? Why was it used? How did it get into the groundwater? And most important, how can a similar problem be prevented in the future?

VIDEO	SCRIPT
Picture of beetle and nematode	Aldicarb was thought to be an ideal pesticide for combatting infestation of the Colorado potato beetle and the golden nematode in the potato fields. The history of its development highlights an attempt to find an environmentally safe yet effective pesticide.
Scientist in lab	During the 1960's, scientists in industry worked to develop pesticides which would be effective against a variety of insects, but which would degrade naturally in the soil to harmless derivatives. The experiments with DDT, its persistence in the environment, and the many problems which arose from that were convincing arguments that equally effective but more environmentally suitable pesticides were needed.
Graphic of carbamates	Many chemicals were synthesized and studied. In particular, a class of chemicals called carbamates received much attention. The carbamates act as inhibitors of enzymes, a property which makes them good pesticides, but which also makes them toxic to humans.
Lock and Key Graphics	Enzymes are chemicals in the body which enable important processes to occur rapidly by providing sites of the right shape and condition to accommodate other chemicals, something like a puzzle. Pesticides which act as enzyme inhibitors also fit into this special site on the enzyme, and by doing so, the usual process is effectively blocked. Other chemicals can no longer fit in and react.

VIDEO	SCRIPT
Graphics of nerve synapse	Aldicarb, one of the pesticides developed, effectively blocks the enzyme cholinesterase, which is important to the chemical processes of the central nervous system of insects and of other animals including humans. The process which normally takes place is the transport of a nerve impulse across a synapse, or nerve ending. When there is cholinesterase depression, blockage of this enzyme, the impulse transport is prevented. Dizziness and nausea are signs of this condition, and if enough inhibitor is present, death can result. Aldicarb is an effective enzyme inhibitor in very small doses. Whereas we know the short-term, acute effects of this chemical, we do not know the long-term, chronic effects of low levels of exposure.
Slide of application of Temik	One of the agricultural advantages of aldicarb was that very small quantities made it effective. It also has another attractive quality. Ordinarily, it quickly decomposes in the environment into harmless derivatives. This decomposition occurs either as a result of microbial action or chemically, in non-acidic water. It seemed ideally suited for use on the potato fields. It required application but once a year, and whatever pesticide was not taken up by the plant would presumably decompose in the top soil layers.
Farming operations	But why use a very toxic pesticide to grow potatoes? The answer is a philosophical one. We live in a society dependent on high technology where one person provides food for sixty-four other people. Without the application of science to agricultural production, our society would be quite

VIDEO	SCRIPT
	different. Potato farming in Suffolk County is a typical agricultural operation.
Field of potatoes	The crop must be healthy and abundant in order to pay the high cost of production.
Farm equipment	Potato farming is capital intensive. The price of a new harvester alone exceeds $75,000. Pests which harm productivity must be controlled efficiently and effectively.
Chewed up plants	The Colorado potato beetle has been particularly destructive on Suffolk County potato farms. After aldicarb was first used in 1975, the crop yield increased 30% over the previous year.
Closeup of nematode bulletin	In addition, aldicarb has proven effective against the golden nematode, a microscopic, wormlike pest which was quarantined and largely confined to Long Island.
Slides or actual spring pictures	During its four years of use, aldicarb proved so effective and superior a pesticide as to achieve virtually exclusive use by Long Island potato farmers. When potatoes are planted in March or early April, the potato seed pieces are placed in rows at 7 inch intervals. A small amount of aldicarb is placed in the soil between the seed pieces. The pesticide is taken up by the plant from the soil and insects die when they eat the plant foliage. By the time the potatoes are harvested, there is not enough pesticide left to harm anyone eating them.

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Narrator	The application rate and timing as well as the choice of insect control method and chemical, are management decisions. At the moment, there is no comparably effective alternative to aldicarb that makes economic sense.
Aldicarb container	The application rate of 26 lbs/acre of the active ingredient, aldicarb, was effective and assumed to be safe. Similar amounts are used in many other parts of the country.
Soil falling through hands	But the places in Suffolk County where aldicarb was found in the groundwater are characterized by sandy, gravelly, very acid soils and by a shallow water table.
Graphics	After application, some of the chemical apparently dissolves in rain water and infiltrates more deeply into the soil and is eventually leached to the water table before it can decompose. Aldicarb has been found in water that is anywhere from 5 to 80 feet below the surface. It has been carried downward through the soil, and could also still be stored in the soil, not yet having reached the aquifer.
Narrator	The chemical which was supposed to decompose in soil rich in microflora, was percolated down through sandy, sterile soil, and has remained stable and undecomposed in the acidic groundwater present in the aquifer.
Teaspoon vs. a swimming pool	Although aldicarb was applied only once during the growing season, and in very small amounts, enough leached into the groundwater to contaminate it. The New York State Department of Health has set an advisory guideline of 7 parts

VIDEO	SCRIPT
	per billion of aldicarb in water as the maximum safe concentration for drinking water. Over one thousand of the wells tested in eastern Suffolk County, including two public water supplies were shown to have aldicarb present in excess of this level.
	The people using this water were advised to discontinue drinking it and had to use bottled water for an interim period.
GAC Filter and Greeport water filter	Eventually, large activated carbon filters were installed in their homes in order to remove the contaminant from the water. The lifetime of each filter depends on how much water flows through it, and this can be calculated for each household. These filters are expensive and inconvenient, but represent an immediate short-term solution to a serious problem.
Lab shot	Research on alternative and complementary methods of treating water contaminated with aldicarb is being conducted at Federal and university laboratories.
Narrator pointing to graphics of: 1) treatment 2) alternate supplies 3) eliminate pollutant	But what of long-term solutions for contamination by pesticides or other chemicals? There are several general approaches which could be followed. Water supplies could be <u>treated</u> so as to eliminate or at least neutralize whatever contamination is present. Another approach is to locate <u>alternate</u> water supplies. Using bottled water in the home, or piping in water from an adjacent water supply may be feasible, but these would be extremely costly. Finally, eliminating or at

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	least reducing to acceptable levels the amount of pollutant that enters the groundwater by a variety of means may be possible. Each of these approaches is under investigation in connection with the aldicarb problem.
Lab Shot	First, groundwater contaminated with aldicarb can be treated chemically or physically to make it potable. Chemical treatment is complicated and costly, and is feasible only at water treatment plants.
Private well	On Long Island, all private and even public water supplies consist of many individual wells with no large treatment site, so this approach is not attractive in most affected areas.
Charcoal filter	Removal of aldicarb by adsorption on an activated charcoal filter is expensive and requires regular monitoring.
Home	The possibility of removing aldicarb and other potential pollutants using such filters in private homes is impractical.
Filter	In addition, these filters can be ideal places for bacteria to grow since they retain organic compounds upon which bacteria feed.
Bottled water being carried into house	An individual homeowner could seek an alternate water supply. Bottled water for drinking and cooking is an expensive and inconvenient, but possible alternative. But it is not a desireable alternative.

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Greenport	Homes could be connected to public water supplies. It is feasible to provide certain treatments in central facilities that are impractical in individual homes, and this may be the direction in the future. Large treatment plants would have to be built, and water would become correspondingly more costly.
Narrator	A third major approach to contamination of water is controlling the source of the pollutant. It may be possible to manage the use of these chemicals so that the amounts reaching the water table are reduced to safe levels. Determining the optimal management practices requires time, research effort, and money, but the approach holds the greatest potential for a satisfactory long-term solution to contamination of groundwater on Long Island and elsewhere by agricultural products.
Potato fields with soil testing	A set of management practices which would result in a lower concentration of aldicarb in groundwater, adequate insect protection, and acceptable pesticide uptake by the vegetable is under investigation. Both experimental and mathematical methods form the basis of the approach. The experimental program is underway in potato fields and in chemical laboratories. A special permit was secured from the U. S. Environmental Protection Agency to allow researchers to test the effectiveness of aldicarb application procedures in selected sites. Adjacent strips of a single potato field receive different aldicarb treatments. The objective of these procedures is to prolong the period

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	that the pesticide remains in the root zone where plant uptake and natural degradation occur, and thus to reduce the residual amount of pesticide that percolates to deeper soil layers and to the groundwater.
Graphics: plant and calendar clock	In one treatment, the total amount of pesticide applied was reduced. In another treatment, the application was delayed until later in the spring rainy season. A third treatment consisted of two reduced applications separated by about 3 weeks; the total amount applied equaled the usual single application. Control experiments with no aldicarb application and with normal aldicarb application (which in previous years had resulted in groundwater contamination) were conducted for comparison purposes.
Soil analysis in field. Digging, Mixing, Packaging, Freezing.	The effectiveness of the treatments is evaluated by analyzing soil samples for aldicarb and by counting the insect population. Soil from a given depth is carefully mixed on a mixing table as soon as it is taken from the ground. This process homogenizes the sample so that chemical analysis can be performed on any part of that sample. After mixing, a sample is packaged and labeled; it is then frozen to eliminate further chemical or biological degradation and sent to the laboratory for chemical analysis. Successive samples, which are taken at critical points during the growing season, are taken from different locations within the treatment area so as to obtain the most accurate information concerning movement of aldicarb downward through the soil.

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Plant sampling	Analyses of plant tissue for aldicarb are performed concurrently and soil is analyzed for other chemical components as well.
Computer printout with narrator	The data are evaluated in order to answer such questions as: How far downward does aldicarb penetrate in the course of a year? Does aldicarb move in discrete pulses in direct relation to rainfall? Should there be concern that the presently unaffected deeper wells in other parts of the island will become contaminated in the next few years as aldicarb already in the soil reaches new depths?
Maps and overlays	Concurrently, a mathematical investigation has been initiated. A model attempts to account for the fate of all the aldicarb which is applied. By tracking the progress of a chemical (in this case aldicarb), its assimilation by plants, storage in soil, decomposition, or transport to groundwater, and by integrating this information with knowledge of plant behavior, soil properties, water movement, and physical and chemical processes, one can calculate and predict the fate of various substances in the soil. The mathematical results should support and be consistent with the results observed in the experimental study. If this is so, the mathematical model becomes a very powerful tool. In the future, one can confidently substitute the mathematical analysis for the field work. Results of proposed alternative management practices can be predicted in minutes and for a few dollars, whereas actual field experiments might require as much as a year or more and thousands of

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dollars.

The mathematical analysis which is currently being applied to aldicarb on Long Island has been successfully applied to other groundwater pollution problems in New York State. It has predicted the rate at which groundwater resources are recharged and the concentrations of nitrogen that may be expected in it. This information has been used in deciding the need for sewering specific areas -- decisions involving millions of dollars.

1) Household chemicals

2) Drums of chemicals with poison signs

The problem of groundwater pollution on Long Island, as demonstrated by the pesticide aldicarb, is a very complicated and far-reaching one which does not lend itself to quick solutions. Current questions of contamination from other organic chemicals raise many of the same issues that were brought to the public's attention by the aldicarb problem. There are tradeoffs among health, the economy, lifestyles, aesthetics, and the environment which must be faced and resolved. Should all water be treated? Should all water be publicly supplied? How can potential pollutants be controlled? Research techniques can help provide some of the long-range answers. But other questions must be resolved by recognizing problems and priorities. Rational people must cooperate to protect this precious resource - water - which is necessary for life itself.

(May need a more powerful ending)