VIII. Pesticidia

● **Pesticidia**

As a child growing up among bird-lovers in the 40s and 50s, running for fun in the DDT fog behind the mosquito abatement trucks, chlordane for lice, bugspray on dinner, I could have been a poster child for *Silent Spring*. In my preteen years (back before *birdwatchers* became *birders* or *Marsh Hawks Northern Harriers*), I was enchanted by birds, learning to identify them, to recognize and imitate their songs. The Cardinal (before he was the Northern Cardinal), who stayed with us all winter, brilliant against the snow, was my totem, and I listened attentively to hear if he was telling us whether rain was coming or not. More than merely appalled, I was repulsed by the whole extermination mentality behind the whole idea of pesticides, when I finally looked into it in my 30s.

Thanks in large measure to Rachel Carson, DDT, originally developed for military purposes—as were many commercial toxics—was banned (in 1971 in the US, worldwide—with exceptions, like use against malaria—in 2001 via the *Stockholm Convention on Persistent Organic Pollutants*), setting a precedent for future actions against other pesticides (including the defoliant 2,4,5-T, the next biggest fight after DDT—still a major battle even after Agent Orange had been banned in Vietnam).

The DDT ban also pretty much set in concrete the inter-agency dispute between USDA (along with USDI-BLM) and the EPA—EPA having been created in 1970 by NEPA, the *National Environmental Policy Act*, largely to ban DDT and otherwise bring the public lands agencies over from chemical-dependent commodity production and marketing to environmental protection of natural resources—a task made all the harder in that all the lands agencies' policies were locked into high-chemical maximum production agribusiness goals of the Green Revolution.

After joining the struggle to ban the chemicals in Agent Orange and other phenoxy herbicides, inspired and informed by anti-herbicide groups like Hoedads and CATS (Citizens Against Toxic Sprays), I became progressively more involved in other pesticide issues not only in forestry (e.g., broadcast sprayings for spruce budworm) but in food-crop agriculture and occupational health hazards to farmers and farmworkers.

My involvement and understanding was deepened by working directly with activists in a number of local, regional, national and international pesticide reform groups. Among those paramount in my memory are Jay Feldman, Norma Grier and Monica Moore, founding directors, respectively, of NCAMP (the National Coalition Against Misuse of Pesticides), NCAP (the Northwest Coalition for Alternatives to Pesticides) and PANNA (the Pesticide Action Network North America), who gave me practical education in pesticide politics and grassroots effectiveness. Among other notable achievements, each of these pioneers took the essential step of having on their staff trained scientists dedicated to translating abstruse scientific and technical data into information usable personally and politically useful to the grassroots. Later, it was my pleasure to serve on the NCAMP Board of Directors (1988-89) and the PANNA Steering Committee (1990-94).

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Pesticide reform was one of the most effective efforts in the toxics-reduction movement, carrying the legacy of Rachel Carson and in the forefront of the global effort to institute principles of environmental sustainability set out in the 1987 *Brundtland Report* and *Agenda 21* of 1992.

Though the 1972 amendments to FIFRA (the *Federal Fungicide, Insecticide and Rodenticide*

Act of 1947), in moving regulation of pesticides from USDA to EPA added a considerable measure of environmental and public health protection to what had been essentially a commercial products registration and facilitation law, the amendments still fell far short of what was considered an adequate environmental protection measure (leaving, for instance, great leeway in agency interpretation of terms like "reasonable risk," and leading the general public and farmers to the misconception, encouraged by pesticide dealers, that EPA registration was a kind of proof that a pesticide was "safe"). Activist demands led to some improvements in 1978 amendments, but some changes (principally due to resistance of the USDA, USDI and chemical industry lobbyists) also weakened the law from an environmental standpoint.

For instance, EPA had allowed pesticides that had been registered before 1972 to remain in use even though they lacked sufficient health and safety data to meet the 1972 standards; but denied registration to new pesticides that consisted of the same substances. The 1978 amendments allowed EPA to give the same "conditional" registration to such new products. Activists argued that such "conditional" registrations gave further proof that registration in no way indicated pesticide safety. They also pointed out that many substances hidden in the "inert ingredients" category EPA allowed on labels, though not technically "active ingredients" as EPA defined the term, were in fact themselves hazardous, thereby again giving the lie to the belief that registration was proof of safety.

Continuing activist efforts led to further FIFRA reform, again with mixed results. The *Food Quality Protection Act* of 1986, for instance, while improving testing and disclosure requirements, replaced the *Food, Drug and Cosmetic Act* gold standard prohibition against cancer-causing substances in food (the so-called "Delaney clause") with a variable risk assessment standard which, in effect, condoned marketing of food even if it contains residues of carcinogenic pesticides.

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While the Environmental Impact Statement (EIS) requirements of the *National Environmental Policy Act* (NEPA, 1970) opened all federal agency policies and practices to public scrutiny, NFMA and FLPMA (the *National Forest Management Act* and *Federal Lands Policy and Management Act* of 1974 and 1976, respectively), were specifically intended to make USDA agencies like the Forest Service and the Animal and Plant Health Inspection Service (APHIS) and USDI agencies like the BLM (Bureau of Land Management) begin to implement ecosystem-sensitive procedures. In fact, it took a number of citizen suits under NEPA in the 80s and 90s over broadcast spraying of herbicides and insecticides on public lands to get the resource agencies to begin to take NEPA, NFMA and FLPMA seriously.

BLM was most recalcitrant, but USDA wasn't exactly easy. Besides the herbicide spraying of forests and rangelands to kill competing vegetation, the spraying of thousands of acres with insecticides to "control" spruce budworm and pine beetle outbreaks, and heavy pro-chemical propaganda issued to farmers, USDA under auspices of APHIS was also spraying tens of thousands of acres of rangeland for grasshoppers and Mormon crickets and thousands of people in towns and cities for Mediterranean Fruit Fly (Medfly). The helicopter broadcast spraying of insecticides on hundreds of blocks and on tens of thousands of people in urban and suburban environments (not once, but repeatedly), primarily to protect citrus crops—it was hard to avoid images of the Holocaust and rice paddies, images made even more poignant in the widespread slaughter of coyotes, wolves and other wild animals through trapping, poisoning, and gunning down from helicopters by personnel of the APHIS sub-agency ADC (Animal Damage Control), largely in support of private businesses (e.g., livestock ranching) that do business on public lands.

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The more I learned about pesticides, the better I came to understand (thanks to people like Peter Montague of the Environmental Research Foundation and Pat Costner at Greenpeace) the pervasive and pernicious effects on the environment and its inhabitants of the nearly-ubiquitous molecules released by chlorine chemistry industries. Pesticides like DDT, 2,4-D and 2,4,5-T; unavoidable by-products like dioxin; solvents like Carbon Tetrachloride, TCE and TCA; PVC and other plastics; CFC in refrigerators—chlorine in the water and waterpipes, chlorine in the food, chlorine in the soap, chlorine in tankcars on railroads crisscrossing the country . . . .

As with other toxics struggles, one of the main problems was how to get people to understand the mechanisms by which the chemicals act. New lab reports and epidemiological studies were showing that conventional notions of dose-response were inadequate to address some of these compounds, which could cause genetic damage (cancer, mutation, birth defects, developmental disorders, etc.) in doses as low as could be measured, and that not only dose but time of exposure (including stage of life and lifestyle of the person exposed), duration of exposure, route(s) of exposure, exposure to other chemicals at the same time, and many other complicating factors had to to be taken into consideration in determining toxicity and effect. *Dose determines the poison* was suddenly an out-of-date maxim. Nonetheless, the case for replacing chemical control with more rational methods couldn't make much headway unless alternatives could be offered. Enter Integrated Pest Management (IPM), stage left.

IPM, with the intent to reduce exposure of non-target organisms, human and non-human, and to reduce development of resistant pests to pesticides, called for reduced use of chemical pesticides, and use instead of a systems approach employing a combination of methods, including strategic timing based on pest life cycles, multi-cropping, natural predators, etc.

One major change IPM required was a change of mindset, semantics and vocabulary, a change from martial metaphors and objectives like *control* and *elimination* (evident in brand names like *Combat*, *Assault*, etc.), to ecologically-aware terms like *management* and *acceptable levels*. (*Elimination* is the only reasonable goal for many man-made toxics—e.g., Persistent Organic Pollutants like dioxin, PCBs and DDT—but it can be highly impractical goal, economically and ecologically, when applied to organisms that exist in inter-linked food chains and intricate webs of life.)

Although IPM use by the resource agencies had been mandated in the final years of the Carter administration, and IPM methodology had been successfully applied on millions of acres of forest-, range- and crop-lands, the Carter rules and directives were systematically repealed in the first months of the Reagan administration, effectively erased from Forest Service and BLM operations manuals. As a result, citizen suits claiming violation of NEPA brought USDA and BLM into court repeatedly in the 80s and 90s. The agencies lost many of those suits (including, most effectively, suits brought by the self-taught plaintiff-activist Paul Merrell), and for a time (until the agencies learned how to construct EISs that satisfied the letter of court rulings) broadcast spraying of the public lands was stopped.

As part of the settlement of one of those suits, a 1984 action brought by activist Sam Hitt against the Southwestern Region (Region 3) of the USFS for broadcast spraying of the insecticide carbaryl against infestations of spruce budworm, I was for two years part of a committee charged with bringing IPM into official practice by the Region, which had a long history of adherence to chemical management and apparently deliberate avoidance of IPM.

During that time, IPM was also being widely accepted into other sectors besides forest, range

and field-agriculture. For instance, my involvement with USDA-APHIS budworm, grasshopper and Medfly spray programs, put me in touch with Bill Curry while he was still an EPA employee who had been instrumental in getting the IPM concept adopted in Carter's EPA and successfully applied in some USDA-APHIS programs (in particular, the rangeland grasshopper program). After leaving EPA (as many Carter-era employees did under the cuts and priorities required by Reagan's Office of Management and Budget), he had become a private consultant on IPM and I was able to get a grant for ATI to contract with him to help institute an IPM program in the Bisbee, Arizona, school district. A few years later, ATI was instrumental in getting the City of Bisbee to ban use of herbicides on City properties and to establish an IPM program for vegetation management. Although after a time most aspects of the schools program were quietly discontinued, the City program has withstood many attempts at repeal and to date continues in effect.

But, of course, the pesticide issue remains. DDT and 2,4,5-T and a few others have been banned in whole or part, and others likely will be, but other biocides always take their place; then those are used until they're found unacceptable (due, e.g., to toxicity or increasing pest resistance), then those are banned until etc etc. Despite headway on some fronts (e.g., the 2016 passage of a TSCA reform bill), the US regulatory framework that allows chemicals in general and pesticides in particular to be used without adequate prior testing remains in force. And the weird notion of toxic chemicals being considered "innocent until proved guilty" continues to hold sway, with people exposed as a matter of course, and millions of dollars invested by the pesticide industry to make sure that such "proof" is nearly impossible to establish in the regulatory arena and the courts.

Spray

They started spraying at night under emergency orders
from the Governor to catch the wind and moisture
just right with funding from the President to kill
they said a Worm which would if not stopped destroy
the multi-billion dollar industry our food
supply depends on, the safest food supply
in the world a blue fog rolling through the lights
where they set up camp perfectly safe they said
but stay indoors pets and children with you, windows
shut, air conditioners off, a blue fog
hissing out of the nozzles of ground-rigs and tractors,
rolling down from helicopters and planes through
the flashing red white and blue of the cop cars
sheriff's vans the border patrol and highway patrol
the national guard and here and there in some of the more
out of the way places the regular army
rolling through the loudspeakers telling us
not to worry it's approved by the EPA
can't hurt people or birds or other living things
born or unborn only the Worm so please go home
let the trucks through the workers do their job
a blue fog rolling across the fields and orchards

the forests and rangelands wherever the Worm might hide
the lakes and streams rivers and coasts playgrounds and parks.

Pesticides in Mexico (1978)

Michael Gregory, *Citizens National Forest Coalition Southwest Newsletter* (4 August 1978)

Recent hearings held by the U.S. Senate Foreign agricultural Policy Subcommittee have resulted in some of the first hard data generally available on pesticides used on Mexican foods imported to this country.

Presentations to the hearings by the EPA and FDA, the two U.S. pesticide regulatory agencies, summarize the responsibilities of the agencies and their findings concerning residues on Mexican produced over the past two years. Some of the more interesting facts from the presentations are given below.

According to the *Federal Insecticide, Fungicide and Rodenticide Act* (FIFRA), the EPA is responsible for registering pesticides used in the U.S. Registration is dependent upon EPA's finding that the pesticide can perform its claimed function without "unreasonable adverse effects on the environment. . .taking into account the social, economic and environmental costs and benefits." Under FIFRA, all uses of a pesticide must be registered separately; i.e. a pesticide may be registered for use on one kind of plant or pest but not another.

Under the *Federal Food, Drug and Cosmetic Act* (FFDCA), the EPA and FDA are responsible for human safety in regard to food and feed products. Under FFDCA, tolerances are established on presentation of data by the petitioner (usually a manufacturer or shipper), that satisfies EPA that the residue at that tolerance will "protect the public health." Any food or feedstuff found to contain pesticide residues in excess of tolerance are considered adulterated and are subject to seizure by FDA, as are those containing residues for which no tolerance is in effect (Aldrin and DDT, for example).

Imported food and feeds (raw and processed) are subject to the same regulations and surveillance as domestic products; and though pesticides manufactured but not marketed in the U.S. are not required to be registered, tolerances are established for residues found on crops imported but not grown here (mangoes and bananas, etc.).

"Currently there are over 350 active pesticide ingredients and over 6,000 individual tolerances used on about 180 food and feed commodities and groups," according to Edwin Johnson of EPA. Spot checks by FDA determine whether or not residues exceed tolerance. (In addition, several states make independent checks.) In the case of Mexican imports, violative shipments may be halted at the border, and no shipments from the same locale or the same shipper are allowed into the U.S. until the FDA is satisfied that residue levels are within tolerance. Usually shipments are not resumed until the Mexican government certifies that the products are in compliance with EPA tolerances.

In fiscal year 1977, FDA tested 1,258 samples of Mexican produce. Of these, 90 were found to be in violation. From August 1977 to March 1978, 17 0f 531 samples were found violative. This compares to 25 violations of 3,034 domestic samples tested by FDA in fiscal 1977.

Violative residues included Azodrin, Monitor-4, Parathion, Methylparathion, Dimethoate and/or its oxygen analogue, BHC, Chlordane, Diazinon, Endrin, Guthion, Folpet, Chlorpyriphos, Acephate, and Carbophenothion (the last three in fiscal 1978 only). The most frequent violators were Azodrin and Monitor-4, on beans, strawberries and peppers.

No figures are available from either the Mexican or U.S. governments on which pesticides are used in what quantities on which crops in Mexico (nor which crops might be untreated). A cooperative effort by FDA and Mexican authorities should develop should information in the near future. Meanwhile, it seems that pesticide use in Mexico is not much different from that in the U.S. Residues are found on just about all imported Mexican produce (tropical specialities included). Beans, strawberries, peppers, cucumbers and squash have been most often in violation over the past two years.

For more information, write Edwin L. Johnson (US-EPA, Washington, DC 20460) for a copy of his statement and accompanying chart presented to the Subcommittee on May 25, 1978; and to John R. Wessel (US-FDA, Rockville, MD 20857) for a copy of *FDA Surveillance of Imported Mexican Produce for Pesticide Residues*. As always in writing to government agencies for information, keep a copy of your letter, request any available related materials, and ask that your name be placed on their mailing list for future information.

Arizona Farmworkers Resolution on Pesticide Safety (1979)

Michael Gregory, for PPEP Arizona (Personal Portable Educational Preparation) "Public Forum on Pesticide Usage and Safety," Tucson, Arizona (14 January 1979)

Whereas the health of farmworkers and other residents of rural areas is in constant and immediate jeopardy due to widespread misuse of toxic agrochemicals; and

Whereas current regulations concerning public and worker protection from the hazards of agrochemical intoxication are either unenforced or inadequate; and

Whereas changes to correct this situation have already been initiated by the Governor; and

Whereas the State should further commit itself to thorough research of the hazards of pesticide use and to the education of farmworkers and health care professionals in regard to such hazards:

Be it therefore resolved that we hereby petition the Governor to correct this situation of critical danger to public health by giving legal force to the following proposals for pesticide regulation the State of Arizona: Be it proposed

1. That the State begin immediate enforcement of existing state and federal laws, regulations and guidelines for protection of workers and their families from pesticide contamination, especially as those laws, regulations and guidelines pertain to

(a) Contamination of people, water, livestock and residences;

(b) Penalties for violations;

(c) Safe handling and application of pesticides;

(d) Providing of proper equipment, clothing, and decontamination facilities embodying the best current technologies and designs, including closed transfer systems for pesticides;

2. That farmworkers be immediately provided with soap and with uncontaminated water for drinking and washing while on the job and at their farm quarters;

3. That ambulance-equipped medical clinics be provided in farming areas; and

(a) Theat they be staffed with personnel trained in the symptoms and treatment and theory of pesticide poisoning, especially in children;

(b) That they shall enforce strict standards of sanitation in farm camps and at work sites, including the provisions by the employer of adequate water, toilet, lavatory and first aid facilities;

(c) That they conduct mandatory training sessions on pesticide safety for farmworkers, applicators and supervisors, emphasizing the hazards and possible long range chronic effects of exposure to pesticides;

(d) That they train farmworkers to train others;

(e) That there be a mandatory reporting of known and suspected cases of pesticide poisoning by growers and medical personnel.

4. That the Board of Pesticide Control be transferred from the Commission on Agriculture and Horticulture to the Department of Health Services; and

(a) That the Board be enlarged by the inclusion of two farmworkers and a health care specialist;

5. That range- and foragelands shall be posted against entry by people and livestock at least 72 hours prior to spraying and for as long after spraying as label instructions or the most prudent federal guidelines required for the chemical applied, but never before the chemical has dried (in the case of liquids) or settled (in the case of dusts); and

(a) That the signs posted shall contain information in English, Spanish and international Visual Code; and

(b) That the signs shall convey information on intended and actual dates of spraying, type of chemical used, safe re-entry date, and the phone number or location of the person to contact in emergencies or for more information;

6. That special precautions be taken in regard to the entry of children and pregnant women into areas sprayed with chemicals known to be or reasonably suspected to be mutagenic, teratogenic or fetotoxic or otherwise particularly angerous to such persons.

7. That where legally liable parties cannot be identified, the State provide disability compensation for workers and families incapacitated by pesticide exposure.

8. That the State petition the federal government to extend OSHA regulations to protect farmworkers.

9. That current federal pesticide control regulations and/or regulations such as those now legally in effect in the State of California be adopted by the State of Arizona when they refer to specific aspects of pesticide usage and safety not otherwise addressed by present Arizona law or these present proposals.

10. That federal inspectors work with state officials to regularly inspect pesticide operations, to ensure that inspection is independent of grower control.

11, That all safety and health regulations concerning farmworkers shall where applicable pertain to the protection of other persons exposed to pesticides.

What's in the Milk? (1979)

Michael Gregory, *Mule Mountain Observer* 2(13) (11 January 1979)

Although the FDA and EPA establish contamination tolerances or "action levels" for most pesticide residues; and though the state more or less regularly tests domestic milk and produce for some of them, there seems to be no state law requiring products grown and sold within the state to conform to federal standards. Federal regulations apply only to interstate and foreign imports.

The disclosure last summer that Arizona dairy products were contaminated with carcinogenic aflatoxin from mold-infested cottonseed fed to the cattle was par for the course. On resigning in December, ex-Dairy Commissioner John Gaunt revealed a few more standard operating procedures in Arizona dairy land. For instance, he noted that for the past four years he had knowingly allowed milk to be produced and sold here that contained twice as much DDT as FDA tolerance allows, and up to 14 times as much of DDT's close relative, Toxaphene.

Conversations with various state, county and federal health officials in the past week or so have convinced me that the milk was probably never put on market shelves until it had been diluted with purer milk from other sources to bring it within FDA tolerance. But by federal standards, at least, such adulteration is illegal.

DDT was banned in Arizona in 1969, before the federal restriction; its residues remain in our soil, however, and will for a long time to come. That is why they continue to be monitored and why federal rules allow any tolerance at all in our food. Toxaphene, another chlorinated hydrocarbon insecticide with many of the same properties, is still being used—not on dairy pasture, but on cottonfields from whence it drifts onto the cattle feed.

Many pesticides not allowed on food crops are sprayed routinely on non-foods like cotton; and many pesticides allowed on both are permitted, and applied, in much higher concentrations on the non-foods. (This is why many food stores refuse to sell products containing cottonseed derivatives or beef that has been raised on sprayed fields). Some spray drift inevitably occurs. Depending on spray formulation, thermal inversions, etc., pesticides, like nerve gas and nuclear fallout, will travel from a few miles to hundreds, to thousands of miles. A windstorm in Texas in 1965 carried 2, 4, 5-T, all the way to Cincinnati, some 1500 miles away. Some of the stuff gets carried around the world.

There is no way to stop aerially-applied chemicals from drifting onto non-target areas where they are breathed or otherwise ingested and/or absorbed through the skin by plants, animals and other living beings.

For the most part we don't know what these chemicals do to us. We don't know their separate or combined (synergistic) effects. Most studies are short-term tests for lethal dosage in rats and mice, the results of which are not necessarily applicable to us. (Dogs and monkeys, for instance, are much more similar to us in their toxic reaction to phenoxies). Long-term testing that may not show up for 20 or 30 years for chronic, low-dosage effects are difficult, expensive and slow in coming.

Those that have been done indicate that DDT and Toxaphene, like the phenoxies, are carcinogenic, mutagenic and phytotoxic, producing severe disruption of the nervous and reproductive systems. We know they are prone to lodge in fatty tissue, livers, kidneys, testes,

milk. We know that DDT, DDE, PCB, PCP, TCDD and a few others have already been found in warm-blooded creatures all over the world and frozen in the top layers of the polar ice caps. There is a lot we don't know, but we know enough.

The common citizen does not have access to all the information, nor time to read it if it were available. We depend on our professional community to get the facts and to protect us from the blind results of greed, fear, hate and ignorance. We pay them to do this, and in most cases they do it well despite tremendous handicaps. When they do not do it well, when they corrupt the office or consistently fail in their responsibility to protect public welfare, the people must fend for themselves with whatever means are available.

The state should immediately adopt FDA/EPA and in some cases much stricter regulations on toxic substances in animal and vegetable products and in the environment. The goal is zero residues. (Some of these chemicals are toxic in quantities too small to measure; they've already found the phenoxies to be mutagenic and teratogenic at a few parts per trillion). Other states are far ahead of us in this regard. Not to mention that due to federal controls you can buy cleaner Arizona milk in California than you can buy here.

We should fund the Arizona Department of Health Services to upgrade their research facilities so testing is prompt, accurate and comprehensive, and so they can develop a complete public information dissemination system.

In Arizona, private gain has sort of traditionally taken precedence over public good. It is high time we let our paid administrators know that public health is a, if not the, primary concern of government.

Tell Governor Babbitt what you think. Send copies of your letters to the Arizona Department of Health Services (1740 W. Adams, Phoenix 85007) and the Commission on Agriculture and Horticulture (1688 W. Adams). I wouldn't mind seeing a copy myself.

A series of open meetings on aflatoxin and pesticides regulation in Arizona will be held in Tucson, January 9-11 and 15-16. For more information, contact David Byrne, Council for Environmental Studies, U of A, Tucson 85721 (626-3576).

The Medfly, the Government, and Individual Rights (1985)

Michael Gregory

The current insistence of the Federal Government that tens of thousands of Californians be sprayed with pesticide is not especially unusual; in one way or another the government has had all of us poisoned with pesticides for 30 years or more. Under auspices of the Department of Agriculture or Department of War, the Bureau of Land Management or the Food and Drug Administration, or through some other Federal, State or local agency, we have all been subjected to a continual barrage of chemical poisons—in our food, in our water, in our air.

Most of us have been lucky in that we have managed to escape high-level exposure; instead, we have absorbed or ingested only so-called sub-lethal dosages, which means dosages not likely or not known to bring instant death to the statistically average human being.

Anyone else, of course, and especially the young, pregnant, elderly or physically impaired, is likely to be more susceptible, as are those who have suffered pesticide poisoning in the past—the millions of GI's exposed to Agent Orange, for instance.

As with most chemical poisons, so with pesticides: the more you're exposed, the higher the risk of sickness with additional exposure, even in small does. But then, public health is another statistical game the government plays with us; the death and disease of individual persons is always figured into government plans as so-called "acceptable risk."

That concept of "acceptable risk" is one of three points which I find worthy of note in the medfly spectacle. First, it is interesting to note that this is the first major invasion of individual privacy and aggression against private citizens to be carried out under the Reagan Administration, an Administration supposedly dedicated to conservative values like state's rights and individual liberty.

Second, note that this is not the usually wholesale spraying of rural people and lands, but direct poisoning of whole urban populations. Cities have been sprayed before—thirty years ago it was not uncommon for communities to douse themselves with DDT to control mosquitos, and many large population centers (New York and San Francisco, for example) were subjected to chemical and biological warfare experiments by the CIA and Department of War in the 50's and 60's.

But since we became more aware of the genetic dangers of manmade chemicals, and more aware of the government's covert activities, no US city to my knowledge has been openly poisoned against the will of the populace.

And, third, note that this is perhaps the main point, after all. It is important to understand how the government figures out its cost-benefit analysis in matters like this, important for us to realize that in deciding to spray x-thousands of people with an economic poison the government has already figured in probably death and disease for x-percentage. The diminished health of those people, those of us in the exposed population, is what they call "acceptable risk." Those lives are weighed against the financial benefits to a selected population, and a dollar figure is assigned to the lives and well-being of the people who will be adversely affected.

Notice that I say "will be." This is no statistical straw population we are talking about, but real people whose health the government knows ahead of time will be significantly impacted by the spraying. They may not know exactly who, but they do know pretty much how many. The issue

is Money *vs.* People and, as usual in Government thinking, people are expendable.

Industry and its apologists in the government and private sectors, of course, will argue that economic poisons are not really poison. Malathion, they will say, is a "safe" pesticide, and they will tote out statistics to show that "if used according to label instructions" no deaths, "have been shown" to be cause by the chemical, etc. The apologists always conveniently ignore the fact that no pesticide, malathion included, has yet undergone the full course of investigation for health effects required by 1972 amendments to the federal *Insecticide, Fungicide and Rodenticide Act*; they ignore the fact that none of the recommendations on mutagenic, teratogenic and oncogenic pesticides of the Department of Health, Education and Welfare's 1969 Select Committee have yet been carried out; they ignore the fact that it is almost impossible to use pesticides according to label instructions under real conditions, and that the EPA itself admits that its label requirements are inadequate to protect public health.

But we should not be sidetracked by these medical and economic arguments, important though they are, for in practical terms of regulating economic poisons they always devolve into moral arguments, and the morality of the financially disenfranchised private citizen is always at a disadvantage in arguments with the immorality of Big Business and Big Government.

And in a very significant sense, it does not really matter much, does it, whether Malathion—or any chemical or heavy metal or radionuclide—is toxic this way or that, in this much dosage or that much, whether we live long or short after being poisoned, whether we contract cancer, or gene damage or mental disorder.

We should not allow ourselves to get lost in quibbling about statistics or upholding moral stances. Those whose morality is based on money and power can always bend statistics and buy officials or scientists, and keep poisoning us while the debate goes on. Insofar as we are still living in a democracy, we must insist, loudly and clearly, as a minority in California keep insisting, that no one—no government, no business, no individual—has the right to spray us with anything against our will.

That is the main point behind all of the rationalizations about susceptible populations and acceptable risks, and that realization now being forced onto the people of California (and through the fumigation program onto all of us who eat California produce) may be the only hope we have left of turning around the plans of Big Business Government to insure corporate profit at any cost. We must be steadfast in our belief: they have no right to poison us.

Integrated Pest Management (IPM) and Forest Service Policy, 1979-1985 (1986)

Michael Gregory, in Dave Brown, Samuel M. Hitt, William H. Moir, eds., *The Path From Here: Integrated Forest Protection for the Future* (Santa Fe, New Mexico: USDA-Forest Service Region 3, January 1986), pp. 3.1-23, Exhibits A-1 - L-10.

Contents

Background

Since 1979, the Forest Service Manual (FSM) has included IPM terminology throughout the chapters on Pesticide-Use Management and Coordination (FSM 2150) and Forest Pest Management (FSM 3400), but implementation of IPM has been generally slow nationwide.

It may not be pure speculation to consider probable causes for the tardiness, and such consideration may help us better understand recent Regional pest management policy.

Some of the issues, however, ae less subtle, and more immediately pertinent to R-3 pest management policies. For instance, except for a brief period between 1978 and 1980, Regional policy, like Washington policy, has frequently been criticized for having a bias toward chemical use and for downplaying risks associated with pesticides. The agency has also been seen as a betting a rather uncritical acceptance of the efficacy and safety claims of pesticides manufacturers about their products.

NEPA requires the FS to find or develop data with which ti assess the potential impacts of its actions. Until quite recently, the agency has relied also uncritically upon the mere fact of Environmental Protection Agency (EPA) registration of pesticides as guarantees of the their safety (CNA III:36-41) and in general has contended that the EPA registration precludes the need for impact analysis studies because the risk from registered pesticides is not significant.

As the scientific community and the general public have become more conscious of the risks associated with pesticide use, the agency has encountered an increasing number of citizen appeals from agency pest management decisions (Merrell v. Block, NCAP v. Block, CIPM v. Block, *et al*), due in part to the public's perception that FS policy represents a "No Significant Risk" mind-set within the agency, [1]and that FS policy has resulted in repeated failures of the

[1]This was the central issue in the recent Ninth Circuit decisions against the USFS and BLM, in which the Court agreed with plaintiffs that ignorance of potential risks or ways to calculate them is no excuse for proceeding in that ignorance and disguising it under the rubric of "No Significant Risk." A review of IPM/IFP implications in the decisions and opinions of all pesticide-related cases to which the Forest Service has been party would undoubtedly provide pertinent data for a review of R-3 policy, but is beyond the temporal scope of this Working

agency to carry out its environmental and public disclosure responsibilities under various laws (NEPA, NFMA, *Clean Water Act*, *Clean Air Act*, *National Historic Preservation Act*, etc.).

The Ninth Circuit decisions have helped to clarify the responsibility of the FS and other federal agencies to provide their own toxicity evaluations and risk analyses since EPA's registrations are not based on NEPA impact analysis requirements.

As interpretations and opinions build a body of case law around these Acts and their attendant regulations, the regulations themselves change in response to, among other things, new scientific data, public opinion, and new Administrations or administrators. Official policy changes of the agency are documented in such changing regulations.

Official USFS policy on pest management is recorded primarily in titles 2150 and 3400 of the *Forest Service Manual*, the agency's operations manual, which is updated or interpreted at irregular intervals by handbooks, reports, papers, directives, and memoranda (see Exhibits G & H and FSM 2150.6), most of which seem to exist only ephemerally and have not been examined by this Working Group.[2]

A preponderance of such policy statements appear to issue from the Washington Office (WO) rather than from the Region, though *Regional Supplements* do appear from time to time, usually serving to document Regional reception of WO policy directives or memoranda (e.g., Exhibit G).

In addition to in-house documents, the FSM also incorporates by references so-called External Handbooks (FSM 2109.3), including titles on such topics as monitoring protocol and energy conservation.

Two major revisions of the pest management sections of the FSM have occurred within the past ten years. The first revision was made between 1978 and 1980, when the *Manual* was extensively rewritten to incorporate IPM methodology ad to begin implementation of IPM throughout the agency.

During the same period, a series of memos and directives from the Office of the Secretary of Agriculture and Executive Orders from the Office of the President were appended to the *Manual.* In general, these messages from Washington seem to have attempted to extend and clarify the IPM concept. Some prohibited agency personnel from using chemical pesticides except as a last resort (see, e.g., Cutler 197 9). Most seem to have encouraged the implementation of IPM methodology at all administrative levels (Exhibit E).

The second major revision of FS pest management policy occurred in 1981 and 1982. It consisted primarily in a rescinding of or decision not to renew the previous Administration's directives and orders, and a reordering of IPM concepts in the FSM, including elimination of the IPM chapter (FSM 2140) that had been issued in 1970.

One effect of these 1981-82 changes has been to impede implementation of IPM at the Regional

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Group.

[2]A study if amendments to the FSM in sequence would prove instructive of Regional policy, but various constraints have precluded this Working Group from making such a comparative study.

and Forest levels, and though the FSM is said to be currently undergoing extensive revisions to correct some of the impediments (Parker and Schmeckpeper 1986), much of the effect of the 1981-82 policy is still apparent in the Southwestern Region.

Semantical/Rhetorical Non-integration

The effectiveness with which an agency carries out its functions depends a great deal on psychosocial factors (Burke 1950; Miller 1983a; Miller 1984b; CNA III:39; Hendee 1984). One such factor which evidently has affected R-3 policy on pest management is a semantic discord which reflects a disunity in the format or physical presentation of the FSM.[3]

Made up, as it is, of supplements, emendations and revisions, the current FSM embodies many internal conflicts which the agency suffered during the 1977-1982 period. As a result, the FSM does not appear as a unified whole but contains, somewhat uncomfortably, several policies from different pest management eras. A resolution of these conflicting policies has not been complete in the primary pest management chapters (FSM 2150, 3400). The dialectic which emerges from this lack of unified structure tends to give mixed signals to resource managers, to the detriment of IPM implementation.

A rhetorical incoherence pervades the FSM, confusing the reader not only at the thematic or ideational level, but at levels of grammar, diction and syntax, all of which influence Regional and local interpretations of policy.

Disregarding the nuisance of infrequent typos and occasonal irregular punctuation, the FSM (and, consequently, implementation of IPM) suffers from several instances of unclear diction[4] and such gobbledegook as the following excerpt from the definition of *pest*:

> any noninfectious disease such as air pollution and environmental stress that is or has the potential of creating. . . .
>
> (FSM 2150.29)

or the identification of a *pest problem* as a "point" (FSM 3405).

Although usually mere annoyances individually, in sum these fits of nonsense contribute to managerial confusion and weaken the credibility of agency pest management policies.

More significantly, the current edition of the FSM fails to build the IPM concept into an overall Forest management structure. The *Manual* presents a particularistic rather than an integrated approach to management and, therefore, both confuses and prejudiced the organization against IPM.

By merely inserting IPM terminology into various resource sections of the FSM without fully integrating the concept, and by narrowly defining the scope of IPM (subordinating it by format, for example, to chemical pesticide-use), the FSM gives conflicting signals to Regional and local decisionmakers who, depending on their personal proclivities and constraints, tend to translate such ambiguity into unenthusiastic and partial implementation of IPM at best, or active

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[3]See Burke 1945, 1950 for format-theme relationships.

[4]E.g., the definition of *pesticide* states in part that a pesticide is "any substance. . .intended to. . .mitigate any pest."

opposition at worst. The latter occurs where the boas of the FSM motivates a traditional predisposition in favor of pesticide use or other attitudinal resistances to acceptance of IPM.

This particularistic theme implicit in the rhetorical structure of the FSM may result from deliberate choice; from inadvertent choices inherent in certain rhetorical stances (a stylistic preference of the authors for Aristotelian categorization, for instance, rather than for another divisional form); or from both, In either case, the particularistic approach implied by the categorical structure of the FSM is reinforced by the departmentalized corporate structure of the agency, and is liable to be interpreted as policy at the Regional and Forest levels. This perception of resource managers tends to become actualized in general management decisions, especially, at present, in the Forest Planning process.

The compartmentalizing of the FSM affects implementation of IPM sine it segregates subjects rather than integrates them. The administrative division of pest management into primarily forest and range categories, for instance, while arguably useful for commodity production, is not conducive to implementation of IPM. Nor is it consistent with the reality of forest ecosystems.

Since rangeland and forest land may be the same land for administrative purposes, herbicidal treatments for brush control or water yield may overlap with insecticidal treatments for forest insects. Between 1977 and 1985, the Southwestern Region applied 235,000 pounds of chemical insecticides and 28,254 pounds of herbicides to forested lands (Exhibits I and J). On Forest acres where both insecticides and herbicides have been applied, an IPM approach to Forest management would consider effects of insecticides on cattle, synergistic effects of herbicide-insecticide interactions on vegetation and animal life, etc.

In a 1981 study of Forest Service pest management programs, the Center for Natural Areas (CNA) suggests that one option for improving the implementation of IPM is:

> to combine the staff groups of the Forest Service responsible for pest management into a single unit. Currently staff responsibility for pest management is contained in the following staff groups: FPM/FI&DM; Range Management; Timber Management; Wildlife Management; Fire Management; FI&DR; Forest Environment Research; and Timber Management Research. The reorganization of the staff groups could be addressed by a task force working with top management.
>
> (CNA III:11)

The Forest Planning process mandated by the NFMA is an attempt to overcome the intrinsic departmentalization of the agency's approach to management. The goal of IPM is similar, since it must involve all components of the forest, but the FSM tends to work against the holistic principles of IPM.

This structural particularism in the agency has repercussions on the public participation level, for an informed segment of the public perceives it as a non-systematic or fragmentary approach to Forest management favoring short-term commodity production over more holistic management strategies, and as administrative resistance to implementation of IPM.[5]

It is clear on any careful reading of the text that the integrated management concept itself is not

[5]See, for example, *Newton Co. Wildlife Assoc. v. Bergland* (1977) and the resultant Pesticide-Use Advisory Memo 151.

integrated into the FSM. Instead, a standardized IPM terminology appears to have been inserted into various resource management chapters, but especially into those two chapters traditionally devoted to chemical-use, species eradication, type conversion, and other practices contrary to the principles of IPM.[6]

A traditional division of departmental powers continues to be manifested in the FSM, and the section on forest pest management planning (3408.9) gives little direction on how the several units are to cooperate in the management process. Consequently, a fragmentary approach is presented to the public in Forest Plans which, following the FSM, use IPM terminology without integrating the concept into overall resource management (cf. CNA III:23-26; USDA Policy Analysis Staff 1985, Problem Area III).

This failure to mesh IPM into the general Forest Planning effort is apparent, for instance, in the Carson National Forest's issuance of a Western Spruce Budworm Draft Environmental Impact Statement separate from the Land Management Plan which the Carson was preparing simultaneously (IPMWG 1984a, 1985a; Exhibit M). Similarly, the recently-issued Tonto, Gila, Cibola and Lincoln draft Plans do not integrate pest management into the total planning process, but would, at best, merely substitute biological for chemical insecticides in a perfunctory gesture toward IPM. None of these draft Plans for the Region seem to contain an integrated forest protection or a coherent IPM program or approach.

IPM Definitions

IPM is a product of the post-World War II application of systems analysis to pest management, a technological advance which encouraged "replacement of purely economic values for rating pest management systems with values that consider integrity of ecosystems and include social values" (Stage and Long 1977, citing Stark 1973).

In response to widespread awareness of pesticide hazards following publication of Rachel Carson's *Silent Spring*, the IPM concept had become familiar, ewspecially to ecologists, conservationists and entomologists, several years before it became embodied in the NFMA (1976) and subsequent Forest Service policy.

Following passage of the public health protection amendments to the *Federal Insecticide, Fungicide and Rodenticide Act* (FIFRA) in 1972, the EPA began promoting IPM as an ecologically sound means of reducing the risks inherent in chemical pest management.

In 1975, for instance, while NFMA was wending its way through the halls of Congress, the EPA released an *Environmental Information* bulletin on IPM which contained the following language:

> Integrated pest management (IPM) is a broad approach to pest control which utilizes a variety of techniques. IPM combines those techniques most suited to a particular problem to maximize yields of food and fiber
> I n an environmentally and economically sound manner. It is an interdisciplinary approach. . . . IPM emphasizes natural controls of pest populations. This approach may not only reduce pesticide pollution and hazard problems, but in most instances provides more effective and

[6]An analysis of past public comments to R-3 management documents for attitudes of the public toward pest management policies would be another interesting study pertinent to a comprehensive review. Cf. USDA-FS Policy Analysis Staff 1985, esp. Problem Area V.

economical control.

(EPA 1975)

In September 1977, Secretary of Agriculture Bergland circulated a memo to staff which laid out departmental policy on pest management and which, while it echoes parts of the EPA principles on IPM, also include references to the energy crisis and the application of IPM to other specific USDA concerns:

> It is the policy of the U.D. Department of Agriculture to develop, practice, and encourage the use of integrated pest management methods, systems, and strategies that are practical, effective, and energy-efficient. The policy is to seek adequate protection against significant pests with the least hazard to man, his possessions, wildlife and the natural environment. Additional natural controls and selective measures to achieve these goals will be developed and adopted as rapidly as possible. . . .
>
> How pests are controlled affects not only agriculture, forestry and natural ecosystems, but those who utilize their products, the consumers. . . .
>
> Effective integrated pest management has to be an integral part of the overall management of a farm, a business, or a forest. A thorough understanding of these complex operations can be accomplished by the systems approach. . . .
>
> Highly desirable components of many integrated pest management systems include the use of diseases, predators, and parasites that suppress reproduction of pests; and resistant plant varieties and livestock breeds. They also include cultural practices in raising crops, habitat management, protection of wildlife, attractants that divert and entrap pests, repellents and selective pesticides. . . .
>
> The Department continues to contribute in a major way to the development and expansion of integrated pest management. It recognizes that a number of levels of integration are necessary to deal with the diversity of pest problems [including] the integration of pest management systems into crop, livestock, and forest production and marketing systems. . . .
>
> (Bergland 1977)

The specificity with which Secretary Bergland spelled out the meaning of IPM methodology, indicative of the hands-on connotation IPM implies, became a feature of most later Forest Service policy statements, including the agency's regulations on planning under NFMA, and the FSM. The NFMA regulations (36 CFR Part 219), state that Forest Planning will be based on several principles, including the following:

> (8) Protection, through ecologically compatible means, of all forest and rangeland resources from depradations by forest and rangeland pests;
>
> (10) Use of a systematic, interdisciplinary approach to ensure coordination and integration of planing activities for multiple-use management.
>
> (USDA-FS 1982; 36 CFR 219.1)

IPM is specifically referred to twice in the NFMA regulations: once as a definition, once as resource protection requirement. The definition reads as follows:

> *Integrated pest management*: A process for selecting strategies to regulate forest pests in which all aspects of a pest-host system are studies and weighed. The information considered in selecting appropriate strategies includes the impact of the unregulated pest population on various resource values, alternative regulatory tactics and strategies, and benefit/ cost estimates for these alternative strategies. Regulatory strategies are based on sound silvicultural practices and ecology of the pest-host system and consist of a combination of tactics such as timber stand improvement plus selective use of pesticides. A basic principle in the choice of a strategy is that it be ecologically compatible or acceptable.
>
> (USDA-FS 1982; 36 CFR 219.3)

"The minimum specific management requirements to be met in accomplishing goals and objectives for the National Forest System" include the following resource protection requirement:

> Consistent with the relative resource value involved, prevent or reduce serious, long lasting hazards and damage from pest organisms, utilizing principles of Integrated pest management [sic]. Under this approach all aspects of a pest-host system should be weighed to determine situation-specific prescriptions which may utilize a combination of techniques, including, as appropriate, natural controls, harvesting, use of resistant species, maintenance of diversity, removal of damaged trees, and judicious use of pesticides. The basic principle in the choice of strategy is that, in the long term, it be ecologically acceptable and compatible with the forest ecosystem and the multiple use objectives of the plan.
>
> (USDA -FS 1982; 36 CFR 219.27(a)(3))

The NFMA regulations were first proposed in 1979 and the final rule was published in September 1982. In July 1981, the Forest Service had issued the latest edition of the FSM chapter on pesticide-use (FSM 2150); three months after the NFMA regulations appeared, the Forest Service issued a new edition of the chapter on forest pest management (FSM 3400). Both chapters are current with only relatively minor emendation since they were issued.

The first edition of the FSM to incorporate IPM terminology (1979) devoted one chapter (FSM 2140) entirely to IPM, and added IPM terminology to other chapters, especially the chapter on Forest Pest Management (FSM 3400). The intention was clearly to integrate IPM into overall Forest management, in accordance with the environmental policy of the Carter Administration.

Carter's environmental message to Congress had stressed the systems approach of IPM and use of chemical pesticides as only a last resort:

> IPM uses a systems approach to reduce pest damage to tolerable levels trough a variety of techniques, including natural predators and parasites, genetically resistant hosts, environmental modifications, and, when necessary and appropriate, chemical pesticides. IPM strategies generally rely first upon biological defenses against pests before chemically altering the environment.
>
> (CEQ 1979a, p.13)

In its response to the President's directives, the Council on Environmental Quality's Report to the President stressed the interdisciplinary aspect of IPM:

> Integrated pest management (IPM) is the selection, integration, and implementation of pest control based on predicted economic, ecological, and sociological consequences. IPM seeks maximum use of naturally occurring pest controls, including weather, disease agents, predators, and parasites. In addition, IPM utilizes various biological, physical, and chemical control and habitat modification techniques. Artificial controls ae imposed only as required to keep a pest from surpassing intolerable population levels predetermined from accurate assessments of the pest damage potential and the ecological, sociological, and economic costs of the control measures.
>
> (CEQ 1979b, p.v)

In accordance with the Presidential statements, the 1979 FSM emphasizes the use of natural, selective controls, environmental and public health protection, promotion of the IPM concept, reduction in chemical use, and less reliance on energy-intensive methods in general:

> Forest Service integrated pest management policy is to develop, practice, and encourage the use of IPM methods, systems, and strategies which provide protection of forest resources with the least hazard to man, his possessions, wildlife, fish, and the environment. This includes:
>
> 1. Use of natural controls and other selective methods that will reduce reliance on chemicals.
>
> 2. Management of forest resources in a manner that is not conducive to the development and perpetuation of pest problems.
>
> 3. Prudent timing of applications.
>
> 4. Demonstration of effective and workable IPM practices and strategies and encouragement of their acceptance.
>
> In addition, it is Forest Service policy to conduct and support research to develop and evaluate the effectiveness and environmental safety of new pest management technology, including new and improved silvicultural techniques, pesticide formulations, application and monitoring techniques, and alternative pest management methods and tools.
>
> (FSM 2140.3, 10/79)

The 1982 edition of the FSM srops entirely chapter 2140 on Integrated Pest Management, but retains much of the language in the new chapter on Forest Pest Management (FSM 3400):

> Forest Service policy is to protect forest and range resources of the Nation against unacceptable losses from destructive forest pests by methods that will not unacceptably affect the quality of the environment. To accomplish this, the Forest Service shall. . .develop, practice, and encourage the use of integrated pest management tactics and strategies which provide protection of forest resources with the least hazard to humans, their possessions, wildlife,

> fish and the environment
> . . . ." (FSM 3403, 8/82)

The 1982 version goes on to list seven more policies in language similar to the 1979 version, including policies on research and development of technology, and on preventing development and perpetuation of pest problems. But the 1982 edition has dropped the clauses on natural, selective methods, on reducing chemical-use, and on the directives to resource managers to demonstrate "effective and workable IPM practices and strategies." The aggressive tone that characterized the 1979-1980 policy on IPM implementation is missing from the 1982 edition.

On October 1, 1979, Assistant Secretary of Agriculture Rupert S. Cutler sent a memo to Forest Service Chief Peterson reiterating the departmental policy on IPM behind the new FSM:

> Departmental policy calls for aggressive implementation of integrated pest management strategies. . . . One intent of this policy is to eliminate any non-essential use of conventional chemical pesticides.
> Cutlter 1979)

The attitudinal differences between the editions of the FSM are apparent in this difference of tone or verbal mood. A similar distinction can be made between the respective definitions for IPM:

> A comprehensive systems approach to achieving economical pest control in an environmentally acceptable manner.
> (FSM 12140.5, 10/79)

> A systematic decisionmaking process and the resultant management actions which derive from the consideration of pest-host systems and evaluation of alternatives for managing pest populations consistent with resource management objectives.
> (FSM 3405, 12/82)

There are significant motivational differences between "a comprehensive approach" and "a systematic decisionmaking process." The 1982 edition defines integration of methods as choices among alternatives and shifts from a goal of "achieving economical pest control in an environmentally acceptable manner" to a "decisionmaking process and the resultant management action. . .for managing pest populations consistent with resource objectives." The first is forthright and understandable, the second is obscure, even to the point of syntactical ambiguity in the final clause. The latter definition emphasize not safe achievement of pest management goals, but administrative procedures. In the 1982 edition, acceptability is not necessarily determined by reference to environmental condition, but has primary reference to the attitude of managers.

The 1982 edition implies that IPM is a selection *among* alternatives rather than application of a *mix* of methods. In this respect, the 1979 language is closer to the intent of Congress, and more in keeping with the House-Senate Conference Report which, in speaking of cooperative efforts between EPA and USDA, referred to IPM as:

> the balanced use of such measures, cultural, biological, and chemical, as are most appropriate to a *particular* [sic] situation in the light of a careful study of all the factors involved.
> (U.S. Congress 1978, p.49)

The specific mix of methods requied by the ecosystems approach is repeatedly emphasized in the 1979 edition. Not selection, but combination is the principle advanced by the 1979 language.:

> The individual components of integrated pest management in forestry include cultural, chemical and regulatory means.
>
> (FSM 2141, 10/79)

The conclusion of § 2141 in the 1979 edition addresses the interdisciplinary planning and indicates some of the cautions required by management of multi-pest systems:

> Each of the components may be used alone or enhanced by combining and timing with other methods to produce a more effective pest management strategy. Success of integrated pest management programs is dependent on thorough planning. Care must be taken to ensure that the different integrated pest management components used are compatible.
>
> Another aspect of combing [sic] the various components of integrated pest management is to give multidisciplinary consideration to all of the pests (insects, diseases, rodents, weeds, etc.) that may be causing damage in the same forest ecosystem. Solving one pest problem without consideration of other pests or their causes may aggravate some situations.
>
> (FSM 2141.8, 10/79)

The history of the pesticide-use chapter of the FSM since 1978 is instructive of the policy changes of the Forest Service. In March 1978, Amendment No. 7 to FSM 2100 (Environmental Management) was added. This amendment incorporated the former pesticide-use chapter (FSM 8540) into then new Integrated Pest Management chapter (FSM 140). In October 1979, Amendment No.10 to Title 2100 was issued, extensively revising portions of FSM 2140 and adding a new chapter on Pesticide-Use Management and Coordination (FSM 2150). In July 1981, chapter 2140 was dropped, and changes were made to the 2150 chapter.

Especially noticeable in the 1981 edition is the loss of specific references to 2,4,5-T and dioxin and the strict procedures the 1979 edition required concerning them. In other respects, pesticide-use policy does not differ too much between the two editions.

The 1979 statement on pesticide-use policy begins as follows:

> Forest Service policy on pesticide use i
>
> > 1.Recommend and use pesticides only after consideration of alternatives —based on competent analyses of effectiveness, specificity, environmental impacts, and benefit-cost—clearly demonstrates that their use is essential to meet management goals. The full range of alternatives—including cultural, mechanical, manual, prescribed fire, chemical and regulatory—must be considered. High priority should be given to the utilization of employment opportunity programs to create jobs.
> >
> > (FSM 2150.3, 10/79)

Except for dropping the last sentence,[7] the 1981 edition retains this language verbatim. The rest of the pesticide-use policy statements are also nearly identical. The exceptions are that the 1981 edition drops the previous requirement for wilderness spray projects to be approved by the Assistant Secretary if Agriculture for Natural Resources and Environment (FSM 2150.3(5), 10/79; and that the 1979 requirement to

> post areas treated with pesticides with appropriate signs indicating the name of the material used and date of application to insure that potential forest users are informed of possible exposure to pesticides
>
> (FSM 2150.3.8, 10/79)

is changed in the 1981 version to

> As appropriate, post areas treated with pesticides with signs, indicating the name of the material used and date of application to ensure that forest users are informed of possible exposure to pesticides.

Besides correcting thr spelling, the 1981 version gives discretionary powers to the resource manager which were absent from the earlier version.

In terms of what the Working Group has called Integrated Forest Protection (IFP), perhaps the best statement on IPM in the current FSM is that on Forest Pest Management Strategies and Tactics:

> Integrated pest management is an ecologically based approach to pest management. It does not necessarily rely on single pest management tactics to provide lasting forest resource protection. Instead, it emphasizes the selection, integration, and use of a variety of tactics (FSM 3407) on the basis of anticipated economic and ecological consequences. Effective integrated pest management must be an integral part of overall forest management and requires a thorough understanding of complex ecosystems. In forest pest management, the approach combines methods and materials to manage pests in two basic ways—prevention and suppression.
>
> (FSM 3406, 8/82)

Combined with the list of tactics (FSM 3407), which is reminiscent of the list of IPM components in the 1979 edition (FSM 2141.8, 10/79), this section of the current FSM retains the 1979 effort to broaden the scope of IPM beyond management of single pests in crisis situations to fully Integrated Forest Protection, from reliance on single tactics to use of a variety, and from departmentalization to integrated forest planning.

Despite the unnecessary (and thus confusing) insertion of the word *necessarily* in the second sentence and the perhaps overly simplistic division in the final sentence, and the de-emphasis on the complexities of multiple-pest management, this statement of strategies and tactics is more or

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[7]The work opportunity clause contained in the Carter Administration policy statements complemented IPM objectives by encouraging labor-intensive rather than energy-intensive (e.g., chemical-use) practices. The employment-opportunity policy was a major incentive to formation of forest co-op crews in the private sector which in recent years have contracted thousands of acres of work on national Forests nationwide, resulting in positive impact on normally-depressed local community economics.

less consistent with the NFMA, FIFRA, and the guidelines of the Counciol on Environmental Quality.

Implementation/Evaluation

Following a national symposium on IPM in 1978, the Forest Service awarded a contract ti the Center for Natural Areas (CNA) to conduct a study and evaluation of Forest Sevice pest management programs in order to determine the program direction"and to provide options for program adjustment where appropriate," especially in regard to implementation of IPM (CNA III:i).

The study results were published in seven volumes in 1980 and 1981, consisting of background documents on weed and forest pest management, including a volume on economic and budgetary backgrounds (CNA I); an analysis of recent pest management projects, including a volume that presents a conceptual model for IPM (CNA II); and a concluding volume on "Conclusions and Options for Program Adjustment" (CNA III).

The concluding volume of the program evaluation synthesized nearly 100 conclusions from the first phases of the study, classified them into six general problem areas, and offered options for program adjustment in each area (Exhibit K).

The CNA evaluation was begun just before the 1979 edition of the FSM was issued, and was finished just before the 1981 edition appeared. The CNA found that the policy it had contracted to study was a moving object evolving rapidly as the agwncy tried to reform the FSM arounud IPM principles.

One of the CNA conclusions is that the main problems with Forest Service pest management programs is not IPM policy *per se*, but implementation:

> Many changes have been made in pest management policy. However, most of the changes are still in need of implementation. (CNA III:5)

Since the FSM was rewritten again a few months after the CNA report was published and, as noted above, policy under the new Administration has not been so enthusiastic about IPM as the previous one, many of the conclusions and options in the CNA final report are still pertinent.

For instance, the CNA concluded that "analyses and evaluations of Forest Service pest management projects and programs need improvement (CNA III:iv, 27-34),.The current number of Working Group recommendations on project design and evaluation attest to the continuance of this problem area.

Similarly, the CNA study noted that monitoring or lack of it is one of the aspects of pest management most heavily criticized by the public (CNA III:37-42). It continues to be so. The FSM contains the same language on monitoring in both the 1979 and 1981 editions:

> Projects requiring pesticide residue monitoring will be determined on a case-by-case basis. On controversial operational pesticide projects, residues monitoring may be used to elucidate the presences or absence of unacceptable environmental effects. . . . The need for pesticides residue monitoring and specific sampling protocol will be identified in the environmental assessment for the specific pesticide-use project. Funding for monitoring activities is covered in FSM 3451.43.

> Whenever determined necessary, pesticide residue sampling may be used to measure th accumulation, movement, and degradation of pesticides following [their] introduction into the environment. Residue-monitoring activities may include air, soil, water, vegetation, aquatic and terrestrial animals, and/or humans.
>
> (FSM 2155.42b)

Despite documented spraying of pesticides in rivers and other sensitive areas, the Regional environmental assessments rarely decide that residue monitoring is "necessary". As a result, budgeting seldom occurs, and residue monitoring is seldom done. The motivation for this seeming reluctance of the agency to monitor the fate of pesticides in the forest environment seems to accompany a Regional attitude that "most pesticides are really safe, or safe in amounts of actual exposure or dosage, and so monitoring is just a waste of time and money."

Aspects of this attitude ae recognizable, for instance, in this *caveat* from a 1979 R-3 publication on Arizona Five-spined *Ips*:

> The material suggested [i.e., lindane] is safe, but read the entire label on a container and follow the directions.
>
> (Parker 1979)

Neither the FSM nor this manual on *Ips* provide much incentive for residues monitoring, yet accurate monitoring is an essential component of any IPM/IFP systems.

The CNA report was generally approving of the 1979 edition of the FSM:

> The Manual, as presently written, does convey the concepts of IPM, or its value. This applies to th Forest Insect and Disease Management section (FSM 3400), the recently developed Integrated Pest Management section (FSM 2140), and particularly the resource management staff sections, e.g., Timber Management (FSM 2600), and Lands (FSM 2700). Including IPM policies in the resource management sections is important because people in the field are more likely to be aware of changes in their specialty area than changes in other sections, such as pest management. IPM is currently lightly addressed in the land management planning policies (FSM 1920).
>
> (CNA III:10)

As noted, the 1981-82 edition of the FSM retained IPM terminology in the staff sections, but nonetheless, IPM has for the most part remained unimplemented. One reason for this seems to be that the 1981-82 edition does not contain the central chapter on IPM which gave direction and impetus to the IPM principles included in the staff sections. Chapter 2140 was the central impelling force of th 1979 FSM. Without that center, IPM implementation tends to become particularized and to lag behind other staff section concerns.

THE CNA suggested that integration of IPM into the overall forest planning/management process could be facilitated by expanding the role of Forest Pest Management (FPM) to implement IPM in all the staff sections (CNA III:11), a suggestion perhaps even more appropriate since chapter 2140 was dropped from the FSM. But the CNA also notes that "resource management, not pest management, is the basic goal of IPM" (CNA III:10).

The 1979 FSM called for creation of IPM Work Groups at the National and Regional levels

(FSM 3404.31, 3404.52, 2151.13, 21140.43, 2140.45). The responsibilities of the Washington Office IPM Work Group included acting as "a forum for reviewing , coordinating, and advancing IPM in the Forest Service" (FSM 2140.43).

The 1982 edition of the FSM retains this language, and adds several more specific functions toward the goal (FSM 3401.31, 12/82). The 1979 edition directed Regional, Field IPMWGs to "coordinate integrated pest management (IPM) activities with the overlapping Forest Service jurisdictions" (FSM 2140.45a).

Major responsibilities of the Field IPMWG include (FSM 2140.45b, 10/79):

1. Encouraging the implementation of Forest Service IPM policy. . . .

2. Reviewing Manual supplements on IPM and pesticide use management and coordination.

3. Reviewing and approving certain proposed pesticide uses (FSM 2151).

4. Reviewing and making recommendations on the selection, use, and monitoring of IPM activities.

5. Identifying IPM research needs and encouraging use of new technology in pest management programs.

6. Ensuring that adequate training is available so that pesticide applicators and contractors can be certified in accordance with appropriate requirements.

A 1984 amendment to the FSM changes the term "major responsibilities" to "objectives" and lists the following (FSM 344.52, 2/84):

1. Encourage the use of new integrated pest management technology. . . .

2. Make recommendations on proposed FSM supplements on pest management and pesticide-use management and coordination.

3. Review and concur with certain proposed pesticide uses (FSM 2151).

4. Make recommendations on the selection, use, and monitoring of pest management activities.

5. Assist in identifying integrated pest management research needs.

The two versions are quite similar, except for a de-emphasis on the training responsibilities included in the earlier version, and the change from making recommendations in *IPM activities* to making recommendation on *pest management activities*.

Region 3 adopted a charter for its Field IPMWG in 1980 (Exhibit G). The objective of the Field IPMWG is

> to insure [sic] the effective and safe use of all pesticides in Forest Service and cooperative programs and projects, when, after considering the benefits and risks, their use is determined to be necessary, and in a manner

> that will achieve the specific management objective with the least hazard to the natural environment with reasonable costs.
>
> (FSM 2140.45 R-3 SUPP 15, 6/80)

t There is little about IPM in the Field IPMWG charter but the name. The charter lists fourteen "activities and services" provided by the Field IPMWG. of the fourteen, one deals with IPM, one sets down the relationship between the Field IPMWG and Washington IPMWGs, one provides for public information on pest management in general, and the remaining eleven deal almost exclusively with pesticide-use.

The Field IPMWG is, in fact, not particularly concerned with IPM but functions solely in the capacity of the defunct Pesticide-Use Coordinating Committee (PUCC) which the Field IPMWG was created to replace. Annual Reports of the Field IPMWG do not address IPM activities but are, instead, simply pesticide use reports filled out on the same forms (FSM 2100-1) formerly used by the PUCC to list pesticide use projects.

The nominal but not actual change from PUCC to IPMWG is responsive to Pesticide-Use Advisory Memorandum 214 (3/20/79) which is entitled, "PUCC Name Change to Integrated Pest Management Group to IPMWG."

The fact that the Field IPMWG bears little relation to IPM, if not purposely deceptive, is at least another semantic obstacle to implementation of IPM/IFP in the Southwestern Region. One of the first principles of good communication is that things ought to be called by their proper names (Pound 1934, chp. 3).

The failure of the IPMWG to live up to its name is especially significant since the IPM chapter was dropped from the FSM. The central position could have been filled by the IPMWGs and implementation of IPM accomplished in all the staff sections through the activities of the an FPM staff given a strong IPM mission (CNA III:11). Instead, the Field IPMWG has served as a PUCC, FPM activities are severely constrained by staff section demands, and IPM/IFP remains unimplemented.

The CNA noted in 1981 that

> significant improvement in understanding the IPM philosophy and techniques could be made by incorporating IPM concepts into current training activities, e.g., the silvicultural and range certification programs . . . . Another method of improving the understanding of IPM is to develop IPM handbooks for resource managers.
>
> (CNA III:10)

The R-3 Field IPMWG has not been involved in such activities. The net result is that implementation of IPM is impeded. Although IPM policies are no longer new, the rest of the following CNA assessment of the 1980 situation is still applicable today:

> While these policies [e.g., the 1979 FSM] clearly show the desire to get away from using pesticides, they are new and field personnel often have either attitudinal problems with this new philosophy or inadequate methodologies and training for implementing or exploring non-pesticide strategies.
>
> (CNA III:39)

Conclusion

Despite the strong initiative toward Integrated Pest Management embodied in the 1979 edition of the *Forest Service Manual,* implementation of IPM is rudimentary throughout most of the agency, including Region 3. This is due, in part, to revisions of the FSM made by the WO in 1981 and 1982, which eliminated the IPM chapter (FSM 2140) and redistributed IPM terminology primarily under the Pesticide-Use and Forest Pest Management chapters (FSM 2150, 3400), without achieving an integration of the new PM concept itself into the FSM.

By removing the central IPM title and relegating the concept to fragmented presentation or cameo appearances (i.e. by subordinating IPM under the dialectically-opposed pesticide-use heading) the agency removed much of the imperative mood and impetus toward IPM implementation.

The policy change at the Washington level has impeded implementation of IPM by fostering hesitancy among managers and, in some instances, by potentiating existing local biases against IPM. The 1981-82 edition of the FSM and the policy it presents have also aggravated managerial uncertainty by becoming the grounds for several recent court decisions that have found the agency's pest management procedures in violation of the *National Environmental Policy Act*.

The fragmented approach to pest management and forest protection presented in the FSM is manifested in R-3 Forest Plans which generally avoid an integrated approach to Forest Planning in favor of a compartmentalized approach to resource management which typically fails to integrate pest management into overall forest management (*vide*, e.g., the recent issuance of a Western Spruce Budworm DEIS on the Carson National Forest separate from the draft Forest plan which was being written at the same time). The proliferation of single issue impact studies is an admission of failure to implement IPM.

A major impediment to implementation of IPM appears to be the Field IPMWG which functions solely as a Pesticide-Use Coordinating Committee rather than providing the coordination and impetus required to incorporate IPM/IFP within all staff sections.

Although the central chapter on IPM has been dropped from the FSM and the IPM concept is inadequately merged into the staff sections of the FSM and Forest IP program at the Regional and Forest levels, The FSM chapter on Forest Pest Management (FSM 3400) is the repository for most IPM directives, and could serve as the basis for IFP implementation throughout the Region.

Given the public concernover pesticide use, the alternative to IPM implementation seems to be an even greater degree of external interference in agency affairs. As the Center for Natural Areas study predicted, if the Forest Service does not adequately satisfy the public concern over pesticides, the decisions relating to pesticide-use will increasingly continue to be made politically and externally to the professional resource manager. (CNA III:41)

References

N.B. The following bibliography is not meant to be exhaustive of the policy-related materials, but is a selection of documents that are pertinent to a comprehensive review of R-3 pest management policy. Not all of the references included here and in the Exhibits that follow, have been examined by this Working Group.

Ault, Charles.1985a. Personal communication to the IPMWG meeting, Albuquerque, 30 January

1985.

____ .1985b. Monitoring the Effects of Chemical Insecticides on Fish and Wildlife Populations. Paper presented to the IPMWG. 4 p.

Burke, Kenneth. 1945. *A Grammar of Motives*. (Englewood Cliffs: Prentice-Hall).

____. 1950. *A Rhetoric of Motives*. (Englewood Cliffs: Prentice-Hall).

____. 1954. Statistical Motives. In, *Permanence and Change* (Indianapolis: Bobbs-Merrill).

Bergland, Bob. 1977. USDA Policy on Management of Pest Problems. Secretary's Memorandum No, 1929 (12 December 1977), 3p.

Center for Natural Areas (CNA). 1980-1981. *Evaluation of Forest Service Pest Management Programs*. 7 vols. USDA Contract No. FS-53-3187-9-30. 7. (Washington, D C.:USDA Policy Analysis Staff.

CNA Ia. Background for Insect/Disease Management Programs.
CNA Ib. Background for Weed Management Programs.
CNA Ic. Addendum: Economic and Budgetary Background.
CNA IIa. An Analysis of Insect/Disease Management and Research.
CNA IIb. An Analysis of Weed Management and Research.
CNA IIc. A Decisionmaking Model for Integrated Pest Management.
CNA III. Conclusions and Options for Program Adjustment.

Citizens Against Toxic Sprays (CATS) v. Bergland. 1977. USDC Oregon Civil #76-438.

Committee for Integrated Pest Management (CIPM) v. Block. 1984. USDC New Mexico Civil #82-9570-JB.

Council on Environmental Quality (CEQ). 1978. Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act. 40 CFR 1500-1800. Fed Reg 43:55978-56007.

____. 1979a. The President's Environmental Program. Mesage to U.S. Congress (2 August 1978). 57p.

____. 1979b. Integrated Pest Management, by D.R. Bottrell. Report to the President. USDA-FS Pesticide-Use Advisory Memo 255 (1980).

____. 1984. NEPA Implementation Procedures, Appendices I, II and III. Fed Reg 49 (247):49750-49782.

Cutler, Rupert S. 1978. Remarks to the USDA/EPA Symposium on the Use of Herbicides in Forestry, USDA-FS Pesticide-Use Advisory Memo 187,

____. 1979. Memorandum to R. max Peterson, Chief, Forest Service (10 October 1979). 1p.

Hassell, M.J. 1984a. Communication to Forest Supervisor, Carson NF, concerning IPMWG Recommendations for Western Spruce Budworm DEIS (30 November 1984). 2p.

____. 1984b. Communication to IPMWG on Western Spruce Budworm DEIS (4 December 1984).

Haug, P.T. et al. 1984. A Systematic Interdisciplinary Language for Environmental Analysis under the National Environmental Policy Act. *Journal of Environmental Management* 18:1-13.

Hendee, John C. 1984. Public Opinion, and What Foresters Should Do about It. *Journal of Forestry* 92(6):340-344.

Integrated Pest Management Working Group (IPMWG). 1984 a. IPMWG Recommendations on Carson NF DEIS (23 November 1984). 2p.

____. 1984b. Comments on the Santa Fe NF Preliminary DEIS on the Western Spruce Budworm Management Program (30 November 1984). 3p.

____. 1985a. Comments on the Carson NF DEIS on Western Spruce Budworm Management Program (11 March 1985). 2p.

____. 1985b. Communication to Santa Fe NF Supervisor, Concerning Comments by IPMWG Members Will Moir and Sam Hitt on the Symbiotic and Mutualistic Effects of WSBW in Southwestern Coniferous Forests. (3 April 1985). 10p.

____. 1985c. Minutes of the Meetings of the IPMWG (July 1984-September 1985). 3p.

Jellinek, Steven D. 1977. Statement before the Subcommittee on Agricultural Research and General Legislation, Committee on Agriculture, Nutrition and Forestry, U.S. Senate (1 November 1977). 9p.

Merrell v. Block. 1983. USDC Oregon Civil #81-6138-E.

Miller, Alan. 1983a. The Influence of Personal Biases on Environmental Problem-solving. *Journal of Environmental Management* 17:133-142.

____. 1983b. Integrated Pest Management: Psychosocial Constraints. *Protection Ecology* 5:253-267.

National Coalition Against the Misuse of Pesticides (NCAMP) et al. 1983. Getting the Bugs Out of FIFRA: A Briefing Book for H.R. 3818, Federal Insecticide, Fungicide and Rodenticide Reform Act. Washington, DC: NCAMP. 72p.

Newton County Wildlife Assoc. v. Bergland. 1977. USDC Arkansas Civil #LR-75-C-173.

Northwest Coalition for Alternatives to Pesticides v. Block. 1984. USDC Oregon Civil #83-6272-E.

Parker, Douglas L. 1979. Integrated Pest Management Guide: Arizona Five-spined Ips, *Ips leconte* Swaine in Ponderosa Pine. Albuquerque: USDA-FS-R3. 17p.

____ and Thomas Schmeckpeper. 1985. Communication to IPMWG. Santa Fe (16 May 1985).

Pound, Ezra. 1934. *ABC of Reading*. (NY: New Directions).

Stage, Albert R. and Garrell E. Long. 1977. Forest Stand Dynamics as a Basis for Integrated Management of Forest Pests. In, Proc. XIV IUFRO World Congress (Oslo, Norway), pp. 19-28.

Stark, R.W. 1973. Systems Analysis of Insect Populations. *Annals of the New York Academy of Science*s 217:50-57.

U.S. Congress. 1978. Conference Committee Report, House Report 95-1960. 95th Congress.

U.S. Department of Agriculture, Forest Service (USDA-FS). 1978. Methods for Sampling and Assessing Deposits of Insecticidal Sprays Released over Forests. USDA-FS Technical Bulletin 1596.

____. 1979. Proceedings of the Integrated Pest management Colloquium. R.D. Gale, ed., USDA-FS General Technical Report WO-14. 76p.

____. 1982. National Forest System Land and Resource Management Planning, Final Rule. 36 CFR 219. Fed Reg 47(190):43026-4352.

____, Methods Application Group. 1980. *Pesticide Safety: Guidelines for Personnel Protection*, prepared by James Singer.

____, Policy Analysis Staff/ 1985. *Current Situation Statements and Action Plan in Response to the CNA Evaluation of Forest Service Pest Management Programs*.

U.S. Environmental Protection Agency (EPA). 1975. *Integrated Pest Management*. (Washington, DC: EPA). 5p.

U.S. General Accounting Office (GAO). 1981. *Better Data Needed to Determine the Extent to which Herbicides Should be Used on Forest Lands*. US-GAO Report CED-81-46.

Exhibits

A. R-3 Documents related to pest management policy not examined by the IPMWG.
B. FS Titles related to pest management.
C. Forest Service Handbooks related to pest management.
D. Selected Agriculture Handbooks related to pest management.
E. Selected Executive Orders, Directives and Memoranda related to IPM.
F. NEPA implementation procedures related to IPM (1984).
G. R-3 Field IPM Work Group Charter (1980).
H. Selected list of Pesticide-use Advisory Memoranda.
I. R-3 forest chemical insecticide use, 1977-1984.
J. Southwestern Region non-rangeland herbicide use, 1977-1984.
K. CNA Problem Areas and Options for Program Adjustment (1981).
L. USDA-FS Current Situation Statements and Action Plan (1985).

On the APHIS *Rangeland Grasshopper Cooperative Management Program Draft Environmental Impact Statement as Supplemented 1986* (1986)

Michael Gregory, for the Southwest Regional Conservation Committee of the Sierra Club, presented to USDA-APHIS (22 February 1986)

Dear Mr. Bare,

The following comments of the Southwest Regional Conservation Committee (SWRCC) of the Sierra Club are in response to the APHIS *Rangeland Grasshopper Cooperative Management Program Draft Environmental Impact Statement as Supplemented 1986* (DEIS).

The Sierra Club is a nationwide conservation organization with a long-standing concern for environmental actions of governmental agencies, particularly those involving western rangelands and those involving use of pesticides. The Southwest Regional Conservation Committee SWRCC is the Sierrra Club's coordinating body for conservation issues in the four state area of Utah, Colorado, New Mexico and Arizona.

The 1986 APHIS DEIS, like the programmatic 1980 *Final Environmental Impact Statemen*t (FEIS) and the program both documents are meant to support, is seriously flawed; flawed in terms of NEPA compliance and flawed in terms of effective pest management. The design and purpose of the program and the supporting documents should be thoroughly reworked or dropped altogether.

In the following comments, I will mention only some of the more glaring problems, beginning with the public notification and involvement process.

Availability of the DEIS was not published in an effective way, so a very small segment of the affected public is aware of the proposed action and so can have no input to the process. I have spoken recently to several government officials and legislators, media people and public lands specialists, ranchers and representatives of conservation organizations throughout the West, none of whom knew of the DEIS, though many were aware of previous APHIS spray programs and were concerned about future plans of the agency.

Since I did not hear about the DEIS myself it had already been out for some time, it is clear that none of us (all of whom has fairly direct concern with the program) really has been allowed sufficient time to review and respond. Even with the minimal extension of the deadline to March 3d, the general public still has had no opportunity to become involved and to comment.

Some of us not notified have been in direct contact with APHIS about prior agency actions, including the grasshopper program, and such direct contact alone should have been sufficient reason for the agency to contact us about the DEIS. My own name was omitted from the distribution list despite the fact that I had asked you personally (during one of our phone conversations prior to the 1985 spray program) to include it.

Failing to contact the public, especially the public with a clear concern, gives an air of secrecy to the agency's actions, a taint which could be avoided by implementing a notification procedure that goes well beyond minimal NEPA requirements.

Since it is flawed in so many ways, the DEIS especially needs public scrutiny and comment, but

this is discouraged not only by the inadequate notification procedure but by inadequacies at the basic communication levels within the document itself. From the simplest levels of format, grammar and syntax to the more ideational levels of rhetoric and semantics, the DEIS continues that confusions and obfuscations of the FEIS.

The garbled sense of the definition of rangeland ("areas. . . which. . .is. . . .) is not the only instance of inattention to details of basic communication in the DEIS. Such inattention gives the public little confidence that the agency is competent to attend to ecological details in multi-million acre spray projects. The suspicion is deepened by semantic discords in the DEIS which suggest deliberate attempts at obfuscation.

For instance, the bare citing of 2,642,000 acres as the average annual project size is a misleading use of statistics, and the description of the preferred alternative as Integrated Pest Management (IPM) is clearly a deliberate misnomer.

Although the 2,642,000 figure may be accurate, it is certainly not indicative of typical agency projects. The DEIS does not discuss the more significant figures. For instance, from 1972 through 1984, the average project size was 1.8 million acres, only 70% of the 1972-1985 average, and only 23% of the acreage sprayed in 1985. The 13 million acre project in 1985 was the largest listed in the DEIS, and amounted to more than half the total acreage (24 million) sprayed since 1972. Before 1985, the largest projects were 7.2 million acres (1979) and 5.3 million (1980). All the others were 2.6 million (1973) or lower. Stating the average without further explanation implies that the average is typical, which is far from the case.

Calling the preferred alternative IPM is even further from reality. The preferred alternative is not IPM but merely the chemical alternative with a different name. The DEIS indicates that the difference between the chemical alternative and the so-called IPM alternative is that assessment of grasshopper population sizes would not be part of the chemical alternative.

This is patently deceptive. Population assessment has always been part of APHIS' chemical programs, and spraying when target species are not there would be a preposterous action even for a most spray-happy agency.

Actually, the DEIS, in violation of NEPA, presents only three alternatives, No Action, Chemical and Biological.

To qualify as IPM, the APHIS program would have to consider not only population size, but carefully plan its treatment program based on such ecological considerations as other aspects of population dynamics; weather conditions; population dynamics of host and predator species; role of target species in the ecosystem(s); effect of treatment(s) on non-target species; and value of the rangeland outputs the program is supposed to be preserving. The DEIS and FEIS treat these matters skimpily or not at all.

In addition, IPM is based on implementation of an integrated mix of treatment methods (cultural, biological, mechanical, chemical, fire, no action, etc.), not just one or another of the various possible methods, and the mix finally chosen is determined primarily on the basis of which methods will present least risk to people and the environment while providing long-term efficacy. The all or nothing approach of the DESI/FEIS is directly contrary to the principles of IPM.

Furthermore, IPM stresses site-specificity and prevention, neither of which is addressed in the DEIS. Site specific considerations are obviously not addressed when the affected is described as

more than a billion acres of rangeland including most of the grasslands of the western US, and when the minimum operational unit is 10,000 acres, and when action levels are arbitrarily set for these huge areas at a uniform 8 arthropods/acre and is triggered on the basis of grossly inadequate monitoring.

If the agency were truly interested in IPM alternatives, the DEIS would at least consider treatment of 40-160 acre dense breeding "hot spots" by fire, cultivation or groundrig, any of which methods would present a feasible cost-efficient alternative to the total biome sprayings called for in the three action alternatives of the DEIS.

Any attempt at a permanent solution to or mitigation of the grasshopper problem is precluded by the agency's insistence on taking only emergency actions. This is not Integrated Pest Management, but crisis management, more effective as a means of perpetuating the agency's programs than of dealing with grasshoppers. IPM does not react to symptoms, but plans ahead with an understanding of causes in all their complexity.

The DEIS rejects biorational alternatives to chemicals because they are said not to produce the immediate kill that the agency sets as its objective, but from an IPM perspective specific predators like *Nosema locustae* offer a low-risk, long-range control method that chemicals do not. The application of millions of pounds of chemical insecticides on millions of acres of rangeland over the past quarter century has not lessened the grasshopper problem one bit. The APHIS program, i.e., the chemical program, is cosmetic at best and self-perpetuating at worst. The spray program normally has to be repeated on individual spray units every five years or less, and the DEIS presents no way out of this perennial drain on the federal budget and private pockets.

Arguably, the APHIS program has done more harm than good since by providing publicly-financed cosmetic treatments the program prevents efforts at permanent solutions. The APHIS program is analogous to quack cancer treatments that kill their patients by keeping them from seeking more efficacious remedies.

In the long run the solution to grasshopper plagues is treatment not of the population explosion but of the environmental conditions of which the explosion is a symptom. As the DEIS says, healthy diversified rangelands are highly resistant to arthropod epidemics; grasshoppers and Mormon crickets are, after all, natural components of the grasslands they inhabit and have been for eons.

The best method of managing grasshoppers is to improve the range, which can be done most effectively, with least cost and least risk (i.e., in accordance with NEPA) by correcting the overgrazing that makes our rangelands susceptible to epidemics of primary consumers. Cattle and sheep are the most serious plague on our western ranges and are a major cause of so-called "economic outbreaks" of hoppers.

It would be nice to see a real IPM program in APHIS. I strongly urge you to begin one. Part of it should be an active participation among APHIS, SCS, USFS, BLM and other federal and state agencies to correct the overgrazing problem which is at the root of many of out grasshopper problems. APHIS would be the ideal agency to initiate such as inter-agency program, and could do so under the emergency powers the agency holds. Proven and intended protection of a cooperator's range through ecologically nondisruptive livestock management should be part of any agreement between a cooperator and the agency. Before the agency spends public money to treat range, the agency should have some guarantees that the range to be treated is not being made susceptible to the target species by poor range management.

One of the flaws in the format of the DEIS and FEIS is lack of a glossary. APHIS assumes a great deal of discretionary powers in these documents as to what, when, how and how much to spray; the absence of definitions for key terms adds inordinately to these powers. Among other definitions such a glossary should contain are those for action levels, range condition and trend, monitoring methodology and livestock management ratings. The glossary should contain a hazard rating system for rangeland susceptibility to hoppers similar to the systems the Forest Service has developed for spruce budworm and other pests, and the agency should not treat lands of low susceptibility. The glossary should make a clear distinction between the rangeland resource and the livestock that use that resource, and should clearly quantify what conditions of the resource will trigger the agency's spending of what amounts of money for what kinds of actions.

The economic analysis of the DEIS/FEIS is overshot and oversimplified. For example, in response to a question from the Forest Service concerning the agency's apparent equation from the Forest Service concerning the agency's apparent equation of rangeland values with cropland values, the FEIS responds simply that "We believe the benefits do justify the costs of treatment of rangeland." This belief is not backed up in the FEIS or the DEIS by any coherent cost-benefit analysis.

Perhaps the most thorough analysis of cost-effectiveness in the grasshopper control business is that of Hewitt and Onsager (1983). They concluded that on most U.S. acreages the cost of grasshopper treatment usually was about the same as the value of the forage supposedly saved by treatment. On marginal rangelands (those overgrazed, e.g.) treatment is not cost-effective. On lands where treatment may be cost-effective, Hewitt and Onsager conclude that treatment "would seem rational only if the treatment option were less expensive than other management alternatives, which include. . . replacement of range forage with hay, and the forced reduction of herds to prevent overgrazing."

The DEIS expresses concern for the effects of hoppers on "low-cost red meat production," but it does not define the term *low-cost*. Does the agency include in its estimate of cost of production the costs to the public of repairing the range, spraying it, surveying it, and all the other public subsidies of the red meat industry? Does the agency include the cost to the public of breathing and ingesting chemicals?

Even without figuring in such significant externalities, the science of range economics is hardly exact, and not so cut and dried as the DEIS and FEIS suggest (see, for instance, the conflicting theories of valuation presented in the Proceedings of the Range Economics Symposium and Workshop, USDA-FS GEN TECH REP INT-149). One of the alternatives the agency should consider is that in the long run it might very likely be cheaper and more beneficial to the rancher, to rehabilitate our deteriorated rangelands than to keep pouring millions of dollars into cosmetic relief.

The agency should also factor into its economic analysis the value "of cheap red meat production" on western ranges in terms of the overall red meat market. The small amount that western ranges contribute to beef nationwide does not justify the millions of dollars being spent to sustain the western beef industry.

One of the most glaring NEPA violations in the DEIS is the omission of a worst-case analysis for the chemical alternatives. Even if saving the red meat industry were justifiable, NEPA requires the agency to conduct a worst-case analysis whenever there are data gaps or scientific controversy about the impacts of treatment. The federal courts have determined that the agency

may not rely on the mere fact of EPA registration of a chemical as proof of insignificant risk, but must conduct its own analysis of potential impacts, including a consideration of impacts that would result were the unknown data to prove catastrophically significant.

Each of the chemicals proposed for use in the DEIS meet the criteria for worst-case analysis. EPA has recently announced that its registration of carbaryl is based on incomplete data on the chemical's teratogenic properties; malathion's registration has been the basis of heated debates among scientists inside and outside EPA and the scientific community is clearly in controversy about the chemical's carcinogenic properties; and the risks posed by acephate's long persistence have not been adequately studied.

The risk evaluations and estimates of Acceptable Daily Intake in the DEIS do not satisfy this NEPA requirement (besides begging the question of acceptable to whom).

To conclude, the agency should rethink and rewrite the DEIS rather than proceed to a final supplement, and should include a real IPM alternative and proper NEPA apparatus in the new draft.

Before the Arizona Joint Legislative Pesticide Oversight Committee (1987)

Michael Gregory, for the Sierra Club Grand Canyon Chapter, Phoenix, Arizona (30 October 1987)

Messrs. Chairman and members of the committee, ny name is Michael Gregory. I live in McNeal, Arizona and serve as conservation chairman for the Grand Canyon Chapter of the Sierra Club, representing some four thousand members in the State of Arizona. For the past several years I have also served as pest management and pesticides specialist for the Sierra Club at state, regional and national levels.

The Sierra Club has been involved with the pesticides and pest management portions of the *Environmental Quality Act* since its passage and we have participated in the rulemaking of the Commission of Agriculture and Horticulture since last December, when the former Governor interceded with the Commission to open its rulemaking process to greater public involvement.

We are also participating in the Department of Environmental Quality's rulemaking on pesticides. We have, however, had little input to the Industrial Commission's rulemaking. When I called the director of the Industrial Commission in June requesting that I be sent a copy of the current draft rules and be included in all further workshops, negotiations, etc., I was told that the draft would not be sent, that the process was already too far along, and that I would have a chance to comment on the final draft. I have not heard from the Industrial Commission since then.

Consequently, my remarks today will concentrate on the Commission of Agriculture and Horticulture rules and on certain aspects of the Act itself.

Many of our criticisms of the Commission's rules wre presented last May in our comments on the proposed rules. Since the final rules were very little changed from the proposals we commented on then, our comments are still relevant. Rather than take time now to go over those comments, we request that a copy of our earlier comments be entered into the record and be considered by the committee members in their review of the Commission's rules.

I will be glad to discuss any of the points made in those comments but I will confine my present remarks to certain statements made in the Commission's first annual report from its Agricultural and Environmental Services Division, and then make a few recommendations for improving the *Environmental Quality Act* in regard to pesticides and pest management.

The annual report stats that the Commission's rules "specify requirements for permits for sellers of pesticides and regulated growers." Like many statements in the report, this is a misleading, and dangerous, oversimplification which leave a great deal of importance unsaid. In fact, contrary to the intent of the Act, the Commission's rules require that only some sellers get permits. Approximately half the pesticides in this State are sold by dealers who have had no training in the proper handling, storage, application or disposal of these toxic chemicals.

The Commission's report states the broad categories of pesticide users who must obtain permits, licenses and certification, but it does not describe the actual training and examination users must go through. We have discussed the inadeqaucy of the training and examination procedure in our May comments on the rules and will not go into tem here except to say again that they are inadequate for protection of the public and the environment from the risks of pesticide misuse.

The Commission's report cites rules requiring that certain records of pesticide use must be kept. Again, the omissions are significant. For instance, only some sellers are required to keep sales records of only some pesticides. Most sellers and most pesticides are exempt from record-keeping and reporting requirements. The annual report states that "private applicators are required to keep records of their use of restricted use pesticides"; it is significant that private applicators are required only to *keep* records, not report use. And it is also significant that private applicators are exempted from the requirement to record and report use of so-called "general use" pesticides, many of which are known to be carcinogenic, teratogenic, groundwater leachers, etc.

All in all, the Commission rules do not fulfill the intent of the Act, which was to establish a cradle-to-grave record of *all* pesticide use within the state.

The intent of the law as also that all pesticide users, especially users engaged in pesticide use commercially, should be required to obtain basic training in pesticide application, handling, toxicity, etc. The Commission's rules do not fulfill this intention. Growers and sellers, for instance, are not required to do anything to obtain a permit except pay a nominal fee (a fee so low, by the way, that it doesn't even cover the State's costs of processing the applications).

The statutory requirement for continuing education of users is narrowed by the Commission's rules to certified applicators and pest control advisors. The education requirement can be met by minimal exposure to data at chemical company seminars which may often be little more than afternoon cocktail parties. Even this questionable "education" is not required of custom applicators, growers and dealers.

The Commission should be given more specific legislative guidance on what constitutes adequate training and testing, and the educational functions should be turned over to the university agricultural extension service which has the necessary expertise and facilities to do the job right.
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The Commission's report states that "custom applicators must maintain adequate liability insurance," but this is a misleading statement in two ways. First, the definition of "adequate" as used by the Commission does not mean adeqwuate in its normally accepted sense; the $300,000 coverage required by the Commission is not adequate to cover the costs of a catastrophic accident such as might occur. In the event of such a catastrophe, clean-up and medical costs would have to be covered by the state and federal governments, that is, at public expense. Second, other commercial users are not required to carry any insurance at all. The intent of the Act was to establish the principle known as "polluter pays," but under the Commission's rules, growers, dealers, advisors and most applicators are exempt from insurance requirements.

The Commission's report states that its rules provide "nonexclusive lists of serious, nonserious and de minimis violations." If the potential consequences of the rules were not so disastrous, this statement would be laughable. In fact, the Commission has made only one action a "serious violation," the spilling of a concentrated form of restricted use pesticide onto an individual who is not dressed properly for the occasion. Someone could be killed by misuse of pesticides and the perpetrator not lose his license or permit under these rules.

I will not take time now to go into the inadequacies of the enforcement portions of the Commission's rules, but will refer you again to the extended list of violations proposed in our May 7th comments.

Before passing on to some recommendations for amending the Act, however, I would like to bring to the committee's attention (and have included in the record) a letter sent to Governor Meacham on June 2d, 1987, protesting the Commission's proposed rules for pesticide use. That letter was signed by representatives of twenty-seven conservation, environmental and public interest organizations in Arizona with a combined membership of some 25,000 people. One of the main complaints of those organizations was the failure of the Commission to establish a list of serious violations and stiff penalties to provide a strong deterrent against exposure and contamination of the public and the environment.

The first point on that letter called for official recognition of the public's right not to be exposed to toxic pesticides without consent. "No toxification without representation" is a legitimate demand of the public. The Commission insists on viewing pesticide use as a matter of user economics, but it must be seen as a matter of civil rights and environmental toxicology, both of which aspects are recognized in the spirit and letter of the *Environmental Quality Act*.

(It is interesting to note that despite assurances from the Governor's aide Sam Steiger that the complaints listed in that letter would be investigated by the Governor's office and a list of independent experts consulted for their opinions about the validity of the complaints, nothing was done by the Governor's office, none of the experts were consulted, and the Commission adopted rules in question with little more than syntactical corrections. Unlike the previous Administration. the present one seems to have little interest in responding to public concerns or in protecting the public from industrial poisons. This lack of interest and guidance from the top may well be an important factor in the Commission's own *laissez-faire* attitude toward the public. A similar lack of guidance seems to be apparent in the weak rules being proposed by the Industrial Commission and the Department of Enviornmental Quality and in the disarray at the Structural Control Board.)

In turning to the *Environmental Quality Act* itself, I would like to note first that the pesticide portions of the Act, even more than the rest of it, were compromises arrived at in the heat of a rush toward passage. Rather than being a fresh start on regulation of toxic substances in Arizona, the Act did little more than guarantee business as usual. This is one of the main reasons why the Commission's rules have turned out to be little more than variations on the rules of the defunct Pesticide Control Board.

The Act, when it is amended, should take a fresh look at pesticides, not from the poiint of view of the farmer and applicator who are o\hooked on chemicals, but from the point of view of the general public who are exposed to these toxic chemicals in their homes, in their public buildings, on their foods, in the air, in the water, and in all aspects of their lives.

Over, 5,000,000 pounds of toxic pesticides are released into the Arizona environment every year. They are in our air, in our soil, in our food and homes. Fish in parts of the Gila River are unsafe for consumption due to pesticide contamination. Some are already in our groundwater and more keep showing up as our investigations get started.

Because of our long growing season, semi-tropical climate and patterns of extensive monocultural cropping, Arizona farmers use three or more times as much chemicals per acre as the national average. And they use some of the most toxic ones. For some of the same reasons, the general public in Arizona tens to be exposed to these toxins more than people in other parts of the country, especially where growing urban centers encroach upon agricultural areas. It is this proliferation of toxic pesticides that the law should focus upon, not just their short-term use by the agricultural industry.

One of the most important parts of the *Environmental Quality Act* is the inclusion of a mandate for reducing pesticide use by the adoption of an Integrated Pest Management (IPM) program in the state. But the Commission's implementation of IPM has been lukewarm, at best. For instance, the nearly unanimous opinion of cotton entomologists nationwide is that the safest and most economical way to control pink bollworm and boll weevil, our two most damaging cotton pests, is not by pesticides but by the simple cultural practice known as "plow-down," which means maintaining a host-free period between cotton crops by plowing under the stalks from th previous crop and leaving the land fallow long enough to prevent reinfestation. The experts agree that a 90-120 day host-free period is essential to obtain nearly total elimination of the bollworm and weevil problem, while at the same time cutting expensive pesticide use by thousands of pounds.

Yet, in dealing with the bollworm and boll weevil problem in Maricopa County this year, the Commission refused to enforce the necessary plow-down period. Not only did the Commission require only an inadequate 45-day no-host period, but it failed to enforce that, leaving many infested fields standing as late as April, thereby ensuring another infestation in the next crop.

The Commission and its director pay lip service to IPM, and have even gone so far as to hire someone for the position of staff IPM specialist. But the reality is that the Commission is committed to pesticide use, not pesticide reduction. Neither the IPM specialist, nor the dir4ector, nor anyone else on the Commission or its staff has any particular training in IPM.

To give just one more example, the Act calls for the Commission to "reduce the use of chemical pesticides" in the state; to "develop systematic insect, disease and weed pest management strategies"; and to "develop nonpesticide methods of pest management." None of this is being done. Even a very simple step like requiring use of less toxic pesticides, to counter the growing problem of pest resistance, is not taken. The Commission and its staff continue to act like agents of the chemical industry instead of being responsive and responsible public servants.

The intent of the law should be clear, but perhaps it needs to be amended to make that intent even clearer. The emphasis of the law should not be on pesticides, but on *pest management*. The IPM section of the Act should be expanded to form the basis for all pest management practices in the state. IPM principles should be the basic information in all pesticide user training and the major portion of all examinations for pesticide use permits, licenses and certification.

The Act should require that at least one member of the Commission be an IPM specialist and that the director of the Agricultural Chemical and Environmental Service Division also be an IPM specialist, that is, someone with specific education and credentials in IPM. To continue hiring entomologists (who are often little more than trained bug killers)to implement the Act , is to focus too narrowly on only one aspect of the total pest management situation.
It may well be, as was suggested during the writing of the Act, that the Commission of Agriculture and Horticulture is far too mired in the outmoded methodology and quick fixes of chemical agriculture to carry out the letter and spirit of the Act. Our experience with the Commission so far would certainly support an amendment giving pesticide regulation to the Department of Environmental Quality, which should be more responsive to the concerns of the public and the legislature.

Another amendment to the law should prohibit employees of pesticide manufacturers and registrants from becoming pest control advisors. At the present time, well over half of the licensed PSAs in Arizona ae on chemical company payrolls. It is naive, at best, to suppose that non-chemical pest management will be advocated by advisors whose paychecks depend on their pushing chemicals. Pest control advisors should be independent agents trained in IPM, and IPM

considerations should be required in writing on all recommendations for pest management, including a statement as to a\why particular non-chemical methods were *not* recommended when chemical alternatives were.

The law should emphasize the responsibility of the administering agencies to educate the public as well as the industry not only in pesticide risks and proper handling, but in IPM principles and practices. IPM should be considered a best management practice for all commercial pest management operations, with appropriate penalties for not applying IPM methodology.

In short, the legislature should become serious about reducing the exposure of the public and environment to toxic pesticides by reducing the *use* of the chemicals. This is the intent of the law as currently written, but it should be amended to make that intent clearer and more lkely to be fulfilled.

In addition to this general change in focus, we would recommend several specific changes in the law, including (but not limited to) the following:

1. The State Chemist's office should be made more open to public participation, including timely notification of and requests for input on all pesticide registration decisions.

At present, the public is effectively excluded from almost all decisions in the office. When public notices are sent out, they are typically non-informative and so late as to make public participation impossible. It is especially important that decisions on special local needs (SLN) registrations be opened to public scrutiny and participation.

2. The Structural Pest Control Board section of the law should be completely revamped, the functions of the Board given to the Department of Environmental Quality and the whole process of decision-making, like that of the State Chemist's office, opened to public scrutiny and participation.

The recent media coverage of the scandal within the Structural Board has revealed only the tip of the iceberg. Perhaps in no other area of commercial pesticide use is the threat to public and environmental health as great. At a minimum, structural control applicators should have to go through a rigorous training and examination process, and treated areas should have to be posted as a warning to residents o nearby homes and offices. The right of the public to know what they are being exposed to is totally ignored in the section of thr law dealing with the Structural Control Board.

3. Fees for registration of pesticides, and applications for permits, licenses and certifications are ridiculously low, as ae penalties for violations. The law should include a mill tax provision which would cover costs of administering the law by a tax on pesticide sales. The State Chemist's salary and budget should not depend on registration of pesticides since this creates a presumption in favor of registration.

4. The buffer zone provisions of the law should be revamped to provide adequate protection against pesticide drift, not only of pesticides recognized as acutely toxic, but those which can cause delayed, chronic or developmental effects. Pesticides are known to drift thousands of miles. They are found in the polar icecaps. Establishing a quarter-mile buffer (or worse, a 300-foot buffer) around schools, hospitals, residential areas, etc is clearly inadequate. Again, it must be stated that we all have the right not to be exposed against our will.

5. The pesticide management area section of the law should be re-written to favor protection

rather than application. The current law qualified notification requirements so much that spraying can occur without adjacent families being notified in advance at all. No one should have to be exposed without prior consent. Notification, *without exception*, must be required for e everyone living in areas subject to drift, *prior* to application.

6. The section of the law dealing with emergency use of pesticides should be rewritten so that *emergency* is defined in terms of benefit to the public, not to a grower or to an applicator whose license has been suspended or revoked.

7. The IPM section of the law should be expanded to include pest management practices in forestry and rangeland situations, and should provide funding for development of the broad IPM program envisioned by the existing statute and by the comments above.

Thank you for the opportunity to make these recommendations.

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Toxic Farming (1989)

Michael Gregory, *Arizona Daily Star* (26 September 1989)

More than 2 billion pounds of toxic pesticides are applied every year are applied every year in this country, about half of them to human food and animal feeds. Agricultural use of pesticides has increased tenfold sine World War II. Arizona farmers apply over 5 million pounds per year on about one million acres.

Due to length of growing season, kind of crops and other factors, per-acre application rates in Arizona are two to four times the national average. Depending on the market, a third to a half or more of Arizona's farms are planted in cotton of the crops most heavily treated with pesticides. Cotton accounts for about half of all agricultural water use in the state, and for about the same percentage of agricultural use of toxic pesticides.

EPA currently registers about 600 chemicals as active ingredients in 50,000 commercial pesticide products. Nearly 400 are registered for use on food crops, 80% of which carry only "conditional" registrations because they were registered before modern testing requirements were mandated by Congress in 1972. More than 70 active ingredients are know to be carcinogens , as are 15 of the so-called "inert" ingredients in pesticides, including solvents like formaldehyde and trichloroethylene (TCE).

In 1987, the same year EPA announced that pesticides in food were one of the nation's top three health threats, the National Academy of Science reported that legally permitted residues on raw produce from 28 of the most commonly used pesticides could account for 20,000 cancer cases a year. The Natural Resources Defense Council study that exposed the Alar scandal calculated that children receive an average of four times more exposure than adults to just eight of those cancer-causing pesticides.

Some pesticides find their way into the environment. In Arizona, for instance, the U.S. Fish and Wildlife Service has declared fish in the Gila River from its confluence with the Salt River to Painted Rock Lake and fish in the lake itself unsafe to eat due to agricultural pesticides and dioxin. Some Yuma wells are contaminated with the citrus fungicide DBCP, a male sterilant. The Department of Environmental Quality has found other pesticides in over 100 production wells in the state.

The call for safe food has not gone unheard in Washington. In the year since the food safety issue became public, several proposals have been introduced by by government and industry, none of which responds adequately to the public's concerns.

The Bush administration position, exemplified in Environmental Protection agency policies and proposals, continues the Reagan approach, two main features of which are "cost-benefit analysis" "negligible risk" health standards. In weighing costs against benefits, the Reagan/Bush era typically projects high costs of risk reduction while uncritically assuming high benefits from pesticide use.

Simply stated, ""negligible risk" means that some cancer-causing chemicals in our food supply would be acceptable as long as the agency decides that only a "negligible" number of people are likely to get cancer as a result. In cases where the agency finds that banning a chemical would cause economic disruption in the agricultural industry, the health standard can be set aside.

Identical bills introduced by Democratic stalwarts Rep. Henry Waxman, D-Calif., and Sen. Ted Kennedy, D-Mass., are disappointingly similar to the Reagan/Bush approach. The Waxman-Kennedy bills would give the Congressional stamp of approval to the negligible-risk standard by writing it into the *Federal Food, Drug and Cosmetic Act* (FFDCA).

As amended in 1958, the FFDCA says that, with a few exceptions, no amount of cancer-causing adulterants, including pesticides, are allowed in our food. Although EPA has used the non-cancer clause to ban additives like dyes and heavy metals, the agency has never enforced the clause against carcinogenic pesticides. According tot he EPA, the nation's pure food law does not mean what it seems to mean and what everyone has thought it meant; rather, it means that some cancer is OK as long as the EPA figures that no more than one in a million people will get cancer from it.

In some cases, EPA would like an even less stringent, more "flexible" standard. According to EPA Assistant Administrator Jack Moore, allowing a greater exposure sometimes gives a greater benefit to society. An industry-backed bill sponsored by Reps. Pat Roberts, R-Kan., and George Brown, Jr., D-Calif., would give the EPA complete discretion in setting tolerances. The Waxman/Kennedy bills would would mandate one-in-a-million as the "acceptable limit."

Late in July, EPA proposed another bill to validate its "negligible-risk" policy. The bill offers some long-overdue amendments to the *Federal Insecticide, Fungicide and Rodenticide Act* (FIFRA), the law governing pesticide and applicator registrations. Among other improvements, the bill would give EPA authority to ban dangerous pesticides more quickly by streamlining the appeals process. The bill's good points, however, are outweighed by its insistence on the negligible-risk standard.

Millions of pounds of pesticides are used not for pest control, but as marketing and production aids. Alar, for instance, was not used against a bug or disease, but as a growth regulator to assure standard firmness and color, to increase shelf life and to manipulate ripening time for easier harvest.

Over 50% of the pesticide load on some crops (California tomatoes, for instance) is for cosmetics and marketing. The high percentage of pesticides used for something other than pest control may partly answer the question of why, though agricultural use of pesticides has increased 10 times in less than 50 years, the percentage of farmers' crops lost to pests has more than doubled during the same period.

Starting with the discovery that apples and apple products wee routinely and legally contaminated with a cancer-causing pesticide and that children are the most at risk, the public demand for safe foods has become increasingly widespread and urgent. Besides Alar in the apples, in recent months the nation has been confronted with EDB in flour and cereal, heptachlor in the chickens and milk, lead arsenate inj the grapefruit, aldicarb in watermelons, cyanide in grapes and EBDCs in fruits, grains and vegetables. Not since the struggle for Vietnam veterans to get compensation for Agent Orange exposure have so many people been concerned about pesticides.

None of the proposal being considered in Washington provides the quality assurance consumers are demanding in the marketplace. The fixation in Washington on negligible risk serves only to erode further what little confidence the public still may have in the government's ability to provide protection.

When the public lost confidence over Alar, sales of apples and apple products plummeted. The apple industry petitioned EPA to ban the chemical. Several states took independent action and the manufacturer eventually withdrew the product from sales in the United States. Supermarket chains took great pains to assure shoppers that there was no Alar in their products or that their products were otherwise safe.

Some grocery chains, like ABCO in Arizona, now have their produce routinely tested and have pledged to reduce pesticide residues in the food they sell. Pesticide reduction promises to become a major theme within the food industry. The more retailers who join the movement, the more market incentives farmers will have to break the pesticide habit.

Another encouragement was provided earlier this month when the Academy of Sciences reported that non-chemical farming can be more profitable than chemical methods. Chemicals are expensive, and sustainable agriculture has cut costs for some farmers while increasing productivity. “Least toxic” farming on some Arizona crops, for instance, has been shown to handle pest problems t least as effectively as chemical poisons while cutting pesticide use up to 50% and yielding higher profits.

According to the Academy, it was not so much the promise of or need for ultimate pest control that led farmers to switch from traditional to chemical methods during the past 50 years; rather , it was the badgering demands for chemical use by financial lending institutions and the U.S. Department of Agriculture. In a remarkable turnabout after half a century of touting pesticide use, the USDA now admits that the Academy report is correct and that millions of pounds of toxic pesticides could be done away with without disrupting the nation’s agricultural economy. The question is not if, but when.

The public does not expect or ask for a no-risk situation, but exposure to unnecessary and avoidable risks is another story. How necessary is it that our apples have uniform shape, size, crispness and color? How necessary are pesticides if their increased use has allowed a 300% increase in pest damage? How beneficial are they when least-toxic pest control can do the job just as well?

Instead of lowering the standard from no-cancer to some-cancer, both federal pesticides laws should be strengthened and strictly enforced. The Food and Drug Administration should be adequately funded so it can do a better job. The agency now monitors less than 1% of the nation’s food for residues and its routine sampling can detect less than half of the pesticides commonly used on foods.

The *Food and Drug Act* prohibitions against carcinogenic adulterants in food should be expanded to include substances that cause nerve damage, birth defects and other reproductive disorders, immune-system disruption and other chronic or developmental health problems. Tolerances for residues in food should be based on risk to infants and children and other most-exposed individuals.

As for FIFRA, it was never meant to be a health-based environmental protection law, but was written as a trade-protection and commercial licensing statute to establish registration procedures for pesticides and certification of some pesticide applicators. Rather than trying for more quick fixes, Congress should admit that FIFRA is an embarrassment and completely overhaul it to guarantee public, occupational and environmental health protection against toxic pesticides.

Pesticide Reform in Arizona: Moving Beyond Risk Assessment and Clean-up to Exposure Prevention (1991)

Michael Gregory, presented to the Community Pesticide Watch Group Forum, "Agriculture in Transition: Farming and the Suburban Community," Phoenix, Arizona (12 March 1991)

Let me begin by saying that in the twenty years I have been tracking environmental issues it has become very clear that the main environmental problem in Arizona is not agriculture, but the urban mentality that keeps paving over our desert and filling our air and water with pollution.

But having said that, let me also say that I have a very strong belief in our right not be poisoned, which in the case of carcinogenic pesticides means the right not to be exposed. I have great sympathy for a man named Harmon Seaver who, a few years ago in Minnesota who, after having his wells poisoned and his family made critically ill by herbicides, fired a rifle at the helicopter the Forest Service had hired to spray more herbicides in his watershed. Seaver was arrested and subsequently acquitted by the jury who said his actions were taken in self-defense. I whole-heartedly agree with that jury.

Annual surveys by the States Pesticide Coordinator's office at the University of Arizona indicate that about 5 million pounds of agricultural pesticides are sold in Arizona every year, but the U of A figures are based only on voluntary reporting by 10-12 dealers. More accurate totals, based on a thorough questioning of dealers and a search of actual use reports, were compiled by the Arizona Auditor General in 1990.

The Auditor General's study (*Pesticide Management Performance Audit: Report to the Legislature*, November 1990, Programwide Issues, pp. 22-23, I-1 to I-12) found that annual agricultural use in the state is actually closer to 11 million pounds, including about 3.9 million pounds of insecticides; 4.4 million pounds of herbicides, desiccants and defoliants; 2.7 million pounds of fungicides, fumigants, and bactericides; and about 100,00 of assorted other miticides, nematicides, rodenticides, biologicals etc.

Long growing seasons and other conditions lead to use of about four times more poundage per acre in Arizona than the national average. We don't know how many pesticides are used for non-agricultural purposes because the state does not require reporting of non-agricultural sales, but judging by national statistics, it may be another 10-11 million pounds.

A high percentage of the pesticides used in the state are used for cotton, which is our biggest crop, usually amounting to 30-50% of the million or so acres planted every year. Cotton not only accounts for 30-50% of the agricultural land use of the state, and 50-60% of all agricultural water use, but 60-70% of all agricultural pesticide use, including some of the most toxic chemicals.

Pesticides and Cancer

In 1972, Congress told the Environmental Protection Agency (EPA) that before any new pesticides could be registered for use they had to undergo stringent health and safety testing for their ability to cause cancer, birth defects and mutations before they could be registered, and that all pesticides already on the market would have to be reregistered under the same standards. In 1976, because EPA hadn't made much progress, Congress extended the deadline until 1978. In 1978, the deadline was again missed, so Congress waived any specific deadline; but when EPA still had tested only a dozen or so pesticides by 1988, Congress mandated that all reregistrations

had to be completed by 1997, in five phases. The first phase deadline was October 24, 1990, and again EPA missed it, having completed registration standards and identified data gaps for only 315 of more than 700 active ingredients. And that was just completing the standards; only a handful have actually been tested.

As of 1985, when there were still only about 600 registered pesticides, EPA had identified 53 of them as carcinogenic. This was the list EPA sent in response to Rep. Henry Waxman's request during Congressional hearings on food safety. Based on EPA figures, in 1987 the National Research of the National Academy of Science estimated that about 60% of all herbicides, 30% of all insecticides and 90% of all fungicides "are oncogenic or potentially oncogenic," including 2 herbicides (atrazine and 2,4-D) not on the Waxman list. (NRC, *Regulating Pesticides in Food: The Delaney Paradox*, 1987, pp.4-5)

The National Research Council also reported (p.46) that "approx-imately 480 million pounds of [24,000 tons] of herbicides are used annually in the United States. Of these, about 300 million pounds [15,000 tons] are agents that the EPA presumes to be oncogenic or for which positive oncogenicity data are currently under review by the agency. . . . The agents account for about 50 to 60 percent of all expenditures on herbicides in U.S. agriculture."

Although in terms of total pounds, the percentage of oncogenic insecticides is small, in terms of acreage treated the percentage is much higher. According to the NRC (pp.47-48), "presumed oncogens make up between 35 and 50 percent of all insecticide treatments and expenditures."

Fungicides are by far the worst case. As the NRC says (p.48), "about 90% of all agricultural fungicides show positive results in oncogenicity bioassays. These oncogenic fungicides represent from 70 million to 75 million of the 80 million pounds of all fungicides applied annually in the United States."

If we extrapolate the NRC figures to Arizona statistics, that means agriculture in the state uses about 2.6 million pounds of carcinogenic herbicides and defoliants, 2 million pounds of carcinogenic insecticides, and about 2.4 million pounds of carcinogenic fungicides and fumigants, for a grand total of 7 million pounds every year.

Food Tolerances

About 289 of the 700 registered active ingredients are used on foods in the U.S.; residue tolerances have been set for these pesticides on about 2,500 raw food commodities and about 30 processed foods or feeds. The Food and Drug Administration (FDA) has found that about 80% of the foods it samples contain residues of these pesticides. That is, every time you eat one of these foods, you are likely to be ingesting one or more (in some cases several) pesticides in amounts up to the tolerance. Tolerances are based on the estimated risk of cancer from each individual active ingredient, not for the combination of active ingredients that you get in reality. Even if you could trust the risk figures for any given pesticide (which you can't, for various reasons I don't have time to go into here), nobody knows what the supposed risk would be a from the whole plate of food and its residues.

Inert Ingredients and Active Ingredients

So far everything I've said applies only to what are called "active" ingredients, which in many cases accounts for only 1% or less of the total pesticide formulation. Active ingredients are the only part of a pesticide product registered by EPA and usually the only ingredients listed on the product label. The rest of the formulation is what are called "inert ingredients," a legal term that

is very misleading.

"Inert" as used by the EPA does not mean "inert" in its common sense; it only means that it is not the ingredient being registered. In fact, in the biological sense, many inert ingredients are very active; some of them are more toxic than the registered active ingredient in the formulation, but because they are not identified as the active ingredient they do not have to go through any of the health tests that the active ingredients do. Some chemicals that are called inert in some pesticide products, are even registered as the active ingredient in other products, but they don't have to be listed on the label when they are being called inert.

Methyl bromide, for instance, is a highly toxic fumigant so dangerous that EPA allows only certified applicators to use pesticides that contain it as an active ingredient. But EPA also classifies methyl bromide as in inert ingredient in other products that anyone can use.

Most inert ingredients are not listed on labels because pesticide manufacturers claim that they are proprietary ingredients protected from disclosure by trade secret laws. In response to several Freedom of Information suits filed by citizens, EPA has admitted that there are some 2000 inert ingredients" used in pesticides. The agency has not yet made full disclosure about the health effects of these chemicals, but so far has revealed that 40 of them are classified as being of "toxicological concern," a term that means they are either probable human carcinogens, known animal carcinogens, brain or nervous system toxins, capable of causing other chronic or adverse reproductive effects or are acutely toxic at concentrations of 1ppm or less in tested species.

Another 64 so-called "inerts" have been classified by EPA as "potentially toxic" and a high priority for testing because they are chemically similar to other compounds known to be toxic. In fact, EPA admits that it has adequate data to assess the health risk of less than 30% of all the "inerts". Among the inert ingredients that have been identified are recycled hazardous wastes and banned solvents like carbon tetrachloride. The herbicide glyphosate (sold under the brand name "Roundup"), for example, contains the chemical POEA (polyoxyethyleneamine) which, though it is not listed on the label, is more acutely toxic than glyphosate itself. In addition, many inert ingredients are manufactured containing contaminants like DDT and dioxins.

Multiple Exposures

Not only do we get multiple exposure from the whole plate of food (the "chemical feast," as one author has called it), but we are exposed from many other sources. Pesticides are everywhere. In the past 50 years or so since we entered the Green Revolution of synthetic chemical agriculture, we have literally covered the earth with toxic pesticides.

Those most at risk are farmworkers and workers in pesticide manu-facturing plants (or, like the people in Bhopal, those who live near pesticide plants). There are not many epidemiological studies, but those we do have show that some of the highest rates of certain cancers are found among midwest farmers in areas with high herbicide use.

But we are all exposed to greater or lesser amounts everywhere we go: at work and at home, in our food and yards and gardens and parks and playgrounds, in schools, restaurants, hotels, motels, airplanes, golf courses, hospitals. Even our lakes and swimming pools are doused with chemical poisons.

As many of you know, some of the most likely areas of exposure in Arizona are in agricultural/residential interface areas where new communities have sprung up in what used to be farmlands. There are two kinds of problems in these areas: existing contamination of soil and

water from past use, leading to superfund cleanups like the Marsh Aviation site, and drift problems from current use.

Most pesticides fall within about 1000 feet of their target, but pesticide drift inevitably occurs from aerial spraying of pesticides, especially in hot climates like Arizona where pesticides become highly volatilized and can be spread many miles from the point of application. Studies have shown that as much 90-99% of the pesticides applied from airplanes miss their target, and applicators typically spray far more than is necessary for pest control in order to compensate for loss by drift.

All of this exposure adds up in our tissue, especially in fatty tissues like our brains and livers and reproductive organs, because many of the persistent pesticides are soluble in fats and oils rather than in water. Every one of us already carries trace amounts of toxic pesticides. Persistent chlorine-containing pesticides like DDT and PCP (pentachlorophenol, the wood preservative used in many plywoods and commonly sold in hardwares) are found not only in all people, but in the oceans and the polar ice caps.

And nobody knows what health effects this continually increasing chemical assault has. Nobody knows how to measure the synergistic effects of these chemicals as they interact with each other and with our body parts; and even if we did know how to measure the effects, we wouldn't know the answers to our questions because the kinds of problems likely to occur take forty years or so to show up in individuals and may not show up for many generations.

Acute and Chronic Toxicity

Pesticide toxicity is usually explained by chemical companies and other purveyors of pesticides in terms of EPA's 3-level toxicity ranking. Class I (Tox I) pesticides are those EPA classifies as "highly toxic" and requires that applicators be certified to use them. Tox II pesticides are considered to be moderately toxic, and Tox III are considered of low toxicity. These three levels are sometimes described in terms of how much of the pesticide it takes to kill you if you drink it (a teaspoon, a cup, a pint, etc.). This is what is known as *acute toxicity*, the ability of a pesticide to knock you down in your tracks.

But acute toxicity is only one of the kinds of toxicity. and not usually the one of most concern to the public. Of more concern is *chronic toxicity*, the ability of the pesticide to cause long-term or delayed effects on the genetic makeup of the body, or the immune, nerve or reproductive systems. Chronic toxicity is not generally considered by EPA when it ranks pesticides in the Tox I, II III categories, so when you hear someone say a pesticide is not even as toxic as table salt or aspirin (both of which are common claims of pesticide supporters), you have to ask what kind of toxicity is being referred to. Salt doesn't cause cancer.

Cancer is the chronic effect usually thought of, and it is cancer, birth defects and genetic mutation that Congress required EPA to test for in the 1972 amendments to FIFRA. But cancer birth defects, immune system destruction and nerve damage are not the most frightening kinds of damage pesticides can cause. Rather, it is those subtle, transgenerational effects that may be mutating our gene bank and won't be noticeable as inheritance for many generations after we and our grandchildren are gone.

And if we aren't even keeping up with the legal testing require-ments for cancer, birth defects and mutations, and have just begun to look at immune, nerve and reproductive system toxicity, and even less at synergistic effects, you can be sure that testing for transgenerational effects is a long way in the future. The science just isn't there yet, and won't be for some time to come.

Nonetheless, we keep producing, registering and using more and more pesticides. In effect, we are all being used as guinea pigs in a colossal experiment in public and environmental health. And rather than try to eliminate the problem, EPA and state and federal agriculture departments try to define the problem away with gobbledegook language and sham science like risk assessment.

In the past couple of years, for instance, the Bush administration has decided that rather than enforce the existing pure food law prohibition against carcinogenic pesticide residues in food (the Delaney Clause), they will instead try to get Congress to repeal the Delaney Clause and substitute a "negligible risk" standard that will allow so-called "negligible" amounts of carcinogenic pesticides in our food. As long as they figure that no more than one person in a million will get cancer from eating a given active ingredient, that will be ok, an "acceptable risk."

I don't know about you, but I don't think any amount of cancer-causing residues in my food in negligible. The whole concept of risk assessment is phony science, and any good statistician can make the risk figures come out any way he likes. It only takes one molecule of a carcinogen in the wrong place at the wrong time to cause cancer. Exposure to a carcinogen is tantamount to poisoning. The existing law should be enforced rather than repealed so that we don't have to be exposed to even that one molecule. There are enough risks in this world already, life is already very short, and no additional risk is acceptable if it's avoidable, if it's unnecessary, and especially if it's a risk being placed on us against our will, or without our knowledge, and for someone else's profit.

Some Steps Towards Pesticide Reform

As pointed out in the Auditor General's report last December, there are some serious problems with pesticide management, or lack of it, in Arizona. We are not alone, there are problems all over the country, all over the world. Before the problems are solved, we are going to have to make some major changes in the way pests are managed and the way pesticides are manufactured, sold and used. Those changes are going to have to be made at the international, national, state and local levels.

In the next few minutes, I'd like to suggest just a few reforms we can make in Arizona. Where applicable, reference are made to recommendations of the Auditor General's report. As always in dealing with toxic substances—whether its hazardous waste, nuclear waste, air pollution or water contamination—the goal is pollution prevention, stopping the problem at its source so we don't have to deal with hospital bills and multi-million dollar environmental cleanups.

Phase Out of Pesticides that Cause Chronic Disease

1. Phase out over the next five years manufacture, sale and use of pesticides known to cause cancer, birth defects, or other genetic or immune-system disease and other pesticides that are just too dangerous to use even if used according to label instructions.

2. Require The Arizona Department of Health Services (ADHS) to institute a sampling and testing program for pesticide residues on and in domestic and imported produce sold in the state (cf. Aud Gen Rpt Programwide p. 27; ADHS, pp. 13-17).

Disclosure

3. Require labeling of produce sold in the state to identify which pesticides were used in growing the product and what residues remain on and in it, and to disclose which of the pesticides so identified are known to cause cancer, birth defects, or other genetic or immune-system disease, and which are on the state's Groundwater Protection List as potential or actual leachers.

4. On the analogy of existing requirements for proving assured water supply, require developers of subdivisions to disclose to buyers the pesticide use history of the area, the results of soil and water testing all and the current pesticide use in the area.

5. Require the same disclosures in the sale of any home.

6. Require developers to use construction methods and materials (adobe, for instance) that prevent termites and other wood-destroying pests and, therefore, also prevent the need for pesticide treatments.

7. Require structural pest control applicators to let potential customers know ahead of time exactly what pest conditions are there, what pest management options are available, and what the potential health and environmental effects of those options are.

Integrated Pest Management (IPM)

8. Mandate the Cooperative Extension Service to "emphasize IPM education and field demonstration activities" (cf. Aud Gen ACAH Rpt, p.47) by requiring an IPM component in all applicator/grower education courses.

9. Require all pest control advisors (PCAs) to receive at least 3 hours/year continuing education in IPM from Coop. Extension, and offer a specialty PCA certification in IPM.

10. Require agricultural and structural applicators to use least-toxic/least-persistent alternatives when feasible, and to certify on their reporting forms what alternatives they have considered and why they chose not to use least-toxic/least-persistent alternatives when they did not.

11. Require school districts 1) to allow pesticides to be applied only by certified applicators trained in IPM, and (2) use only least-toxic, least-persistent alternatives.

Protection of Sensitive Populations and Areas

12. Revise buffer zone language in existing statutes to <u>prevent</u> exposure of sensitive populations and environmental areas (e.g., health care facilities, residences, schools, wildlife management areas, parks, water supplies, etc). Buffers for aerial spraying of all toxic pesticides (not just "restricted-use" and "odoriferous" pesticides) should be at least one mile; ground-rig application at least 1/2 mile from any sensitive area (cf. Aud Gen Rpt ACAH pp. 27-32).

13. Revise Pesticide Management Area (PMA) language so that PMAs are established automatically by the state Department of Agriculture wherever there is a history of citizen complaints about drift and wherever else the Department knows that drift exposes people against their will.

14. Allow PMAs to be established upon request of 10% or any ten residents/owners of an area (rather than the high percentage of residents required at present).

15. Prohibit use of carcinogenic, teratogenic, mutagenic and immunotoxic pesticides in PMAs.

16. Revise air quality rules and statutes so that pesticide drift is regulated by ADEQ as an air toxics violation, and require that air sampling be done in pesticide spray areas.

17. Require pre-notification of residents in PMAs at least 24 hours before aerial pesticide applications.

18. Require posting of public areas (schools, playgrounds, parks, restaurants, hotels, etc.) at least 24 hours before and 48 hours after pesticide treatments. Signs should be conspicuously sized and placed and include information on the time of treatment, kinds of pesticide used, potential health effects, precautions to be taken, symptoms of exposure, emergency procedures and names and phone numbers for further information.

Improved reporting

19. Expand reporting base to include all sales (not just agricultural, as now) of 5 gals or 25#/mo.(Aud. Gen Rpt Programwide, p.14; ACAH, p.52; etc.)

20. Require all private applicators and structural applicators to report applications just as commercial applicators are now required to do (cf. Aud Gen Rpt Programwide, pp.21-22).

Container Disposal

21. Require (1) use and return of returnable containers, when possible; (2) that pesticide manufacturers and sellers accept return of pesticide containers; (3) deposits on all returnable pesticide containers (cf. Aud. Gen ACAH Rpt, p.38).

22. Establish university "programs aimed at developing economically viable alternatives to agricultural pesticides" and fund the program by (1) increasing pesticide registration fees; and (2) taxing sale of pesticides (cf. Aud Gen Rpt ACAH, p.47).

Groundwater Protection

23. As noted by reviewers contacted by the Auditor General (Aud Gen Rpt ADEQ, p.10), the State's Pesticide Contamination Prevention Program is reactive, not preventative; in order to make it preventative, the law should be revised so that pesticides that fail the numeric criteria can no longer be registered in the State (rather than being banned only after they are found in the groundwater, as at present).

24. Mandate ADEQ to require use of pest management alternatives that have least risk of polluting water in order to prevent further contamination in areas where groundwater contamination from pesticides has already occurred (cf. Aud Gen Rpt ADEQ, pp. 6-7).

25. Replace current discretionary clause of statute with mandate for ADEQ to require the same data for other toxic ingredients in pesticides as for so-called "active" ingredients.

26. Do not follow the Auditor General's recommendation (Aud Gen Rpt ADEQ, p.9-11) that the Legislature allow ADEQ "more flexibility" so that not as many pesticides are placed on the Groundwater Protection List; the Department has no sound scientific reasons for wanting the list shortened, only administrative reasons. Instead of increasing the risk of groundwater contamination, the Legislature should increase funding so ADEQ can implement the monitoring required by statute and other aspects of the Department's pesticide program (cf. Aud Gen Rpt ADEQ, pp. 13-20, 26).

Worker Safety

27. The Department of Agriculture should be required to adopt stricter worker protection rules than those previously adopted by the ICA, especially in regard to reentry intervals and washing and decontamination facilities; in both cases, the minimum standards should be at least as strict as those of Texas or California (cf. Aud Gen Rpt ICA, pp. 13-14).

28. The Legislature should require that ICA publish and make available to growers, applicators and pest control advisors, "lists of products with applicable reentry intervals and posting requirements" (Aud Gen Rpt ICA, p.14), and should require that employers guarantee their availability to farmworkers.

Enforcement

29. Require Department of Agriculture to stiffen penalties and enforcement, and include a list of serious violations in the statute (Aud Gen Rpt ACAH pp.16, 26, 58).

30. As recommended by EPA, ADEQ should be given "authority to impose administrative penalties on RCRA violators" (Aud Gen Rpt ADEQ, p.26).

31. Fund ADEQ and the Department of Agriculture so they can expand their investigation programs to include real-time monitoring of applications while they are being made; inspections after the fact are notoriously ineffective in discovering and preventing problems.

Recommendations for Incorporating Integrated Pest Management and Right-to-Know Provisions in the Structural Pest Control Commission Rules (1991)

Michael Gregory, presented to Association of Structural Pest Control Regulatory Officials 30th Annual Meeting, Scottsdale, Arizona (30 September 1991)

The following recommendations are made for improving the rules proposed on 10 June 1991 by the Structural Pest Control Commission.

Although the format and some provisions of these proposals are a great improvement over the existing rules, they are highly inadequate in two respects: (1) they do not require adequate notification and disclosure to the public and to the customer (i.e., they do not respond adequately to the public's right-to-know), and (2) they do not provide for rigorous implementation of Integrated Pest Management methods.

The following comments suggest some specific changes to address the first issue, but the second issue will require addition to the rules of a general policy statement requiring qualifying parties, advisors and applicators to take a systems approach to pest management, not just automatically jump into spraying poisons. Indeed, as noted in the first specific comment below, neither the existing or proposed rules give any encouragement to non-pesticide treatment, not even acknowledging that *pest management* is a more appropriate way to approach the problem than *pest control*.

In order to avoid unnecessary risks to human health and the environment, the rules should require training in and implementation of IPM methods, and should require use of available least-toxic methods whenever they are technologically and economically feasible.

In addition to the following comments, which indicate places where the above issues and others should be addressed, the rules should provide for reporting of all sales of structural use pesticides so that the state, coupling these reports with those received from agricultural sales, would have a more accurate record of how much or which chemicals are being used where.

The rules should clearly prohibit use of any chemicals that are known or may reasonably be anticipated to be carcinogenic, mutagenic, teratogenic, neurotoxic, immunotoxic or have other genetic or chronic effects, especially in schools and day-care facilities and in other public placess where children and other sensitive populations may be exposed to them.

The industry has for too long been concerned primarily with acute toxicity which, though important, is not the only problem. The long-term effects of neurotoxins on our children, leading to learning disabilities and other sometimes subtle effects, are particularly to be prevented.

1. In general, the term "control" should be changed throughout the rules to the word "management". "Control" implies eradication, and eradication is generally not a viable goal.

2. The term "applicator" should generally be replaced by the term "pest manager" or "pest management specialist" so it is clear that pesticides are not the only method of treatment (cf. R4-29-203). Similarly, the title "pest management advisor" should replace "pest control advisor" (cf. R4-29-204).

3. Alternatives to pesticides be included as a major topic in the general standards exam [R4-29-203(D)(1)] and in the category exams [R4-29-203 (D)(3) for commercial certification, as well

as the core [R4-29-204(D)(1)] and category [R4-29-204(D)(2) exams for qualifying party qualification and advisor licenses.

4. The "General Pest Control" category should be replaced by an "Integrated Pest Management" category.

5. Continuing education credit should not be given for simply attending Commission meetings [as proposed in R4-29-212(D)] or for taking a business management course [as [proposed in R4-29-212(E)].

6. No one should be allowed to apply pesticides commercially who is not certified (cf. proposed R4-29-303), especially not restricted use pesticides (R4-29-308), or those known to cause cancer, or other adverse reproductive, genetic or chronic effects.

7. Notification should be made to the Commission not only of "confirmed illness," but of *exposure* [R4-29-304(F)].

8. R4-29-305 should be strengthened by requiring (1) pre-notification to the person requesting treatment not only of the information listed, but a description of alternative treatments available, and the potential adverse health and environmental impacts of all alternatives, including the no action and preferred alternatives (similar to the treatment proposal information required under R4-29-416); (2) conspicuous pre- and post-treatment posting of property to provide adequate warning to the public of what pesticide is being used, when, what the potential adverse effects are, what the symptoms of exposure are, how to handle an emergency, and where to call for more information. Signs should be left posted at least 48 hours after treatment, but in no case less than any re-entry period that may be established for agricultural use of the chemical.

9. R4-29-306 should be strengthened by (1) giving the Commission request information about treatments planned for more than 24 hours in advance; and (2) *requiring* pre-notification to the Commission of intent to apply pesticides by any applicator who has been cited for an infraction of the rules in the past 24 months.

10. The records kept pursuant to R4-29-307 and R4-29-308 should include the alternatives considered for each treatment performed and statement as to why the preferred alternative was chosen over the others.

11. In the event of an emergency as described in R4-29-307(C), records should also be made available to medical or other emergency response personnel on request.

12. The posting requirements for fumigation treatments (R4-29-313) should be made more specific so that size, color, shape etc. of signs are standardized and conform to internationally recognized symbols.

13. The requirements for service vehicles (R4-29-315) should include use of standard DOT warning placards (e.g., POISON, POISON GAS, etc.).

14. The requirements for chemical application listed in R4-29-402 should include a requirement that applicators use the available treatment method that is least toxic and will still do the job.

15. The minimum standards (R4-29-405) should include a requirement that post-treatment chemical residues on surfaces or in the air shall not exceed levels that are known or may be

reasonably anticipated to cause or contribute to adverse acute or chronic health effects. This standard should not apply just to wood-destroying organisms (Article 4), but to all structural applications (Article 3).

16. The posting requirement of R4-29-407(D) should be strengthened by (1) making posting mandatory (i.e., changing the word *or* to the word *and*, so that the record is posted and left with the property agent

17. The records required by R4-29-408(B) should include chemical as well as trade name.

18. The information required in a structural treatment proposal [R4-29-416(C)] should include potential adverse health and environmental effects of the treatment, and description of symptoms of and treatment for exposure.

On the USDA-APHIS Medfly Cooperative Eradication Program Draft Environmental Impact Statement (1993)

Michael Gregory and Nancy Rucci, for Arizona Toxics Information and the Sierra Club National Hazardous Materials Committee (18 June 1993)

Contents

Overview

APHIS proposes to establish a program that would allow the agency, on as little as 24-hr notice, to aerially apply malathion-laced bait throughout nine of the ten states (New Mexico being the lone exception) that span the southern border of the US from Florida to California—i.e., those states where various species of fruit fly (especially medfly) may most likely be imported on agricultural products from Hawaii or other areas where it is established. The DEIS does not address the apparent discrepancy between its focus on medfly when the agency's applications for emergency quarantine exemptions in Florida (EPA-OPP 1991) and California (EPA-OPP 1992) both refer to a variety of non-indigenous fruit flies, not just the medfly.

More specifically, the EIS tries to justify what APHIS calls "emergency eradication": this is an unfortunate terminology, too easily confused with the commonsense meaning of *eradication* (e.g., as in the worldwide eradication of smallpox). Rather, what APHIS proposes is simply a continuation and expansion of its existing *chemical suppression* program to keep medfly from becoming established in the coterminous United States. In effect, the DEIS "preferred alternative" would legitimate a kind of perpetual crisis management which would allow the agency to react to an "infestation" (which the DEIS implies may consist of no more than a "find" of a single gravid fly) with (typically, the DEIS says: it may be more) 2-4 aerial applications of malathion in a 9 sq. mile area around the infestation site—which (since medflies presumably show up primarily from imported produce) is likely to be an urban area (DEIS 26-28, 162).

The main argument of the DEIS is that without such emergency eradication 1) medfly will become established in the continental US; (2) causing economic devastation to the agricultural industry; and that 3) without the government program, uncontrolled pesticide use by farmers as well as homeowners and gardeners will result in worse consequences than the proposed government program.

There are more than a couple of problems with the APHIS argument. For example, respected scientific opinion has suggested that the medfly is *already* established, its appearance in the US being the natural extension of its long-term cyclical range fluctuation, and that attempts to

eliminate it are bound to fail. Also, APHIS admits not knowing if, what or how much pesticides homeowners or farmers will use to control the medfly—with or without the APHIS program—and, consequently, can't determine with any certainty how the risk of such use might compare to the risk of the proposed program. Conversely, the DEIS does note that one of the greatest risks of its proposed action would be the interaction of malathion with the pesticides already being used in and around homes (DEIS 165).

Furthermore, the DEIS does not establish that there is a need for the program except, perhaps, to provide job security for APHIS employees (DEIS 18). Instead of providing economic and biological documentation for the claims that medfly = agricultural ruin, the agency merely asserts its belief.

In addition, the DEIS provides no evidence that chemical spraying is any more than a stopgap measure. The very fact that the agency is now proposing to spray again after the massive LA program two years ago, indicates that there is something amiss. The public is certainly justified in objecting to expending huge sums of money for a program that presents serious risks to human and environmental health, but provides short-term benefits at best. The DEIS offers no clear benchmarks to determine success or failure of the program, nor any measures to provide long-term solutions, but contemplates, instead, an endless series of "different programs in successive years" (DEIS 166) with no endpoint. Alternatives which may offer viable long-term control while providing maximum protection of human health and the environment (e.g., Integrated Pest Management emphasizing effective biological controls with use of chemicals only as a last resort) are dismissed without serious analysis.

One of the most serious problems with the DEIS, and one that is barely mentioned is the inevitable, unmitigatible, inequitable distribution of risks and benefits from the program. As the DEIS says, "the potential inequity of the program is unavoidable" (DEIS 163). In effect, in order to protect a particular economic sector (the agricultural industry), large numbers of other sectors of society (especially urban residents and, even more particularly, high risk subpopulations including the young, the aged, the infirm, the homeless and the low-income groups) are subjected (largely against their will, as witnessed by the public outcry against the LA sprayings) to toxic chemicals. The violations against civil and human (and non-human) rights implicit in the APHIS proposal are perhaps most apparent in the inadequacy of the measures proposed for preventing exposure of the chemically sensitive (the absurdly ineffective notification procedures, for instance), but they are equally abusive of others. The failure of the DEIS to address this issue adequately is by itself sufficient reason for the agency to withdraw the document and start over.

Objectives and Alternatives

Nominally, the DEIS considers three objectives (No Action, Emergency Eradication and Suppression) and four alternatives (No Action, Chemical Controls, Nonchemical Controls, and Combined Controls). In fact, the only objective discussed in detail is Suppression (which, as noted above, the agency confusingly calls Eradication). The only alternative looked at in detail is Chemical Control, which includes "soil drenching" of infestation hot spots with one or another of the organophosphates chlorpyrifos, diazinon, fenthion; fumigation of commercial shipments with methyl bromide; or aerial application of malathion baits.

Non-Chemical Controls listed include 1) release of sterile male flies; 2) Physical Controls like host elimination or fruit stripping; 3) Cultural Controls like clean culture, crop rotation, trap cropping, resistant varieties, etc.; 4) Male Annihilation through trapping, lures, etc.; 5) Biological Control with parasites, pathogens and predators; and 6) Biotechnological Control through genetic manipulation of the host crops, the flies or both.

In practice the agency would continue to use most or all of these chemical and non-chemical techniques, but for purposes of promoting the proposed program, the DEIS dismisses the non-chemical methods on the ground that they do not show "immediate results"; are "ineffective" on low pest populations like the medfly; are labor intensive; require careful and extensive pre-planning; or otherwise are found by the agency to be better suited for long-term management than short-term "emergency eradication."

Non-chemical eradication, for instance, is dismissed with the cursory explanation (DEIS 16) that the one attempt at non-chemical eradication with sterile males (DEIS 32) the agency made (20 years ago) didn't work. Cold Treatment or Vapor Heat Treatment alternatives to Methyl Bromide fumigation are dismissed because they would require specialized facilities (i.e., specialized for something other than the existing specialized fumigation facilities) in treatment areas (DEIS 43). Biological controls in general are dismissed because of the logistical difficulty in maintaining large numbers of biocontrol agents on hand (DEIS 37). And, as noted below under Management Alternatives, the DEIS does not take sufficient account of several significant new developments in non-chemical methods.

APHIS argues that if we don't take drastic action (i.e., launch massive chemical response more or less immediately upon finding each infestation) we will end up with an established, expanded and devastating resident population (or populations) that will require more (and therefore, more risky) pesticide use—mostly "uncoordinated" use by homeowners and agriculturalists (DEIS vii, 14, 19).

Although the agency couches it in biological terms (i.e., more flies), this is essentially an economic argument for which the DEIS provides no documentation or quantification. For instance, in rejecting the No Action and Suppression alternatives, the DEIS asserts but does not prove that both would be doomed to failure and would lead to more total pesticide use. Despite presentation of a detailed chart of estimated increases in non-governmental use (DEIS 20) and an assertion that governmental use would certainly be less (DEIS 19), the DEIS admits (DEIS 19) that the agency does not really know whether or not homeowners and growers will use more pesticides if the APHIS program isn't implemented, or if they were to use more, how much of which ones. In other words, since the amount of annual pesticide use for eradication cannot be predicted with accuracy or compared to the amounts predicted for non-program use (DEIS 19), the agency has no basis for its claim of more pesticide use under the No Action or Suppression alternatives.

In claiming automatic increases in private use to compensate for loss of the APHIS program, the agency's argument does not take into account the medfly control already provided by existing pesticide use of farmers and homeowners to control other pests.

Not only is the claim that the absence of an APHIS eradication program will lead to "uncontrolled use of pesticides" (DEIS 181) unsubstantiated; it also implies, remarkably, that APHIS recognizes that there is widespread use of pesticides not in accordance with pesticide labels or that they are unsafe even when used according to label instructions.

Procedural deficiencies

Although the DEIS says that it is prepared "in accordance with" the *National Environmental Policy Act* (NEPA) and Council on Environmental Quality (CEQ) Regulations (DEIS 181), in fact it fails to comply with NEPA in several ways, including the following:

1) ***Inadequate scoping process***: scoping meetings were held over two years ago, failed to involve or inform the affected public, especially of results of the 1989-1990 LA sprayings. In Arizona, e.g., only one poorly advertised public meeting was held; fewer than ten people attended.

2) ***Inadequate notification***: As explained in our 20 May 1993 letter to Secretary Espy (incorporated by reference), very few potentially affected people were made aware of the availability of the DEIS in a timely fashion. Many still aren't aware of the existence of the DEIS. Consequently, and contrary to NEPA, many people have not been able to participate fully in this process, including many, like ourselves, who have been involved with APHIS programs or who are clearly active in pesticide-related issues in their states.

3) ***Inadequate comment period***: the original 45-day comment period was far too short, especially in light of the lag time between agency publication of document availability, citizen request for document, citizen receipt of document and time it takes comments after written to reach the agency. At a minimum, the actual comment period gets narrowed to about 30 days, even shorter when the agency doesn't send the document promptly on request, as happened in many cases. Too short in any case for review of a highly technical document that the agency took several years to prepare, and the 30-day extension doesn't adequately answer that problem.

4) ***Inadequate presentation of evidence***: The agency must also provide evidence used to come up with the proposed action (1502.1), but in order to understand the DEIS, the public must go outside the DEIS to other documents because the agency has not provided in the DEIS sufficient description of the assumptions, calculations and processes behind its risk figures.

The agency bases a great deal of its argument, for instance, on the history of medfly infestations, treatments and regulation, yet the discussion of this history is scant (and correspondingly unconvincing). Another example: the DEIS proposal cannot be adequately understood without an understanding of the basis upon which the DEIS conclusions about risk are derived; yet the reader must go to documents outside the DEIS (e.g., the Syracuse risk assessment—Syracuse 1991; Syracuse 1992) for a clear discussion of the steps in risk process. The agency should provide a clear synopsis of program history (such as EPA presents in its Action Memorandum for the APHIS 1991 Florida Quarantine Exemption, e.g., EPA-OPP 1991, 3-16) and provide more detailed synopses of its risk assessments and Plant Protection and Quarantine Manual and Emergency Programs Manual.

5) ***Inadequate presentation of alternatives***: NEPA requires that the DEIS present a rigorous, fair and balanced evaluation of a range of reasonable alternative actions so the public has a means for choosing among them (1502.1, 1502.14), but the DEIS does an inadequate job of describing both the preferred and the non-preferred alternatives. The alternatives the agency doesn't prefer are dismissed with scant analysis and the DEIS, contrary to NEPA, is little more than an attempt to justify or rationalize choices the agency has already made (1502.5).

Even the preferred alternative suffers from inadequate description. The DEIS does not adequately explain many of the most basic components of the proposed action. For instance, there is no clear definition of what constitutes an "infestation" (as compared, say, to a "find"). It contains no explanation of what levels of response are triggered under what conditions, (the DEIS implies, for instance, that the finding of a single gravid female may trigger a full-scale eradication effort including aerial applications over urban areas). It does not describe the decision-making process (are cooperators responsible for deciding what and where to spray?) and does not even mention key decision-making points like the Technical Advisory Committee.

6) ***Inadequate specificity of mitigation measures***: Furthermore, NEPA requires that the DEIS spell out specific means to mitigate adverse environmental impacts (1502.16), but the DEIS presents only a very generalized statement of what mitigation areas need to be addressed (Table VI-2), not a description of the mitigation measures themselves. The programmatic nature of the DEIS does not relieve the agency from the duty of presenting such specific information as is not dependent on site-specific conditions.

7) ***Inadequate economic analysis***: NEPA requires that the DEIS contain a clear analysis of the economics (1502.23), but the DEIS has no economic analysis at all, only a generalized assumption of disaster if medflies were to become established.

Economics

The APHIS program is predicated on the assumption of devastating losses to the agricultural industry from medfly, but the DEIS (contrary to NEPA) does not document or quantify this dire prediction. Again, the reader is referred to another document incorporated by reference—the Draft Economic Analysis of medfly Program (DEIS 163) and, consequently, the public is given no basis for evaluation. In order to substantiate such claims, the DEIS (not just its cited sources) needs to supply specific data on the economic losses from medfly if left untreated or if treated by suppression (i.e., if non-preferred alternatives were to be followed). The DEIS should address at least three main areas of economic concern: cost/benefit, economic thresholds, and funding.

1. ***Cost/Benefit Analysis*** Before disrupting people's lives and exposing them and the environment to toxics, APHIS must establish that the benefit outweighs the impact to society and the environment. The DEIS fails to meet this responsibility. The DEIS should also supply specific data on the potential/real economic losses from potential human health-related affects of spraying (including days of work lost), effects on nontarget species, and cumulative effects on the overall environment. In other words, the estimated costs of each alternative in relation to the costs/benefits to the affected populations/environments. Contrary to NEPA, no data is provided on the projected cost of the preferred alternative, or on the supposed benefit gained by such a program. There is no cost/benefit analysis to account for the costs of administering or implementing the program, nor for the potential costs incurred from human exposure to pesticides, loss of non target species, pollution to water supplies and other damage that may occur.

It is not that APHIS does not have such data. In support of its application for quarantine exemption in Florida (EPA-OPP 1991, 3), for instance, USDA has provided very striking figures to EPA ($821-$831 million annual losses incurred by the industry if medfly were to become established in the coterminous US), and the University of California has projected equally striking figures for costs in California alone ($700 million to over $1 billion annually; see EPA-OPP 1992, 6). We certainly do not suggest that such projections are accurate, but the agency has chosen not to submit any such figures to public scrutiny in the DEIS.

The agency is well aware that one of the weakest parts of its proposal is the notification procedure. It is also an area where non-dollar costs to the public are readily seen. Improvement of the notification process would presumably involve considerable costs in time and personnel to make personal contact with citizens in targeted area. It has been suggested (with some plausibility) that one of the reasons the notification procedures have not been effective is that the increased cost of effectiveness (like the increased costs of labor intensive, non-chemical suppression methods), if weighed against the proclaimed benefits of the program, might show

that the presumed costs of the program are not as great as thought.

2. ***Economic Thresholds*** In a truly heroic approach to the problem, APHIS promotes an attitude of "the only good medfly is a dead medfly." Recognition of necessary tradeoffs between costs and benefits suggests that a more reasonable approach would be for the industry to identify acceptable levels of medfly damage and manage populations to keep losses below the acceptable threshold. The DEIS says that determining such an economically acceptable level of infestation" would be a necessary task if the Suppression (including chemicals) objective were adopted, and that under the Suppression (no chemicals) alternative "APHIS and its cooperators would need to decide what constitutes an appropriate economic threshold and then suppress or control medfly populations accordingly" (DEIS 19).

We strongly recommend that this be done now, with full public participation (which the DEIS does not mention). Determination of viable economically acceptable thresholds is a basic step in any Integrated Pest Management program and should become an integral part of all APHIS programs.

3. ***Funding*** The DEIS does not explain how the program will be paid for. Funding for the medfly program is supposed to be a "cooperative" program, which usually means that states are supposed to share the costs with USDA. Usually this means drawing money from a state's emergency or contingency funds, something most states cannot afford to do without, endangering funds needed to address real emergencies like forest fires, floods, etc. The DEIS gives no details at all about how the proposed program would be paid for. In regard to the ability of states to draw on contingency and emergency funds for the medfly program, a significant question arises about whether or not a recurring, preventable emergency really is an emergency. In the case of similar APHIS programs (the rangeland grasshopper program, for example) at least one state (Arizona) has in the past decided that the term "emergency" does not apply.

Consequences

The DEIS notes that "chemical control methods have the greatest potential for adverse environmental consequences," that "soil drench chemicals have the greatest potential for adverse human health effects," and that "malathion aerial bait applications were determined to have the greatest potential for adverse nontarget species effects," and "non-chemical control methods offer little, if any, potential for adverse environmental consequences" (DEIS 181). Beyond this fairly obvious summation, the risk assessments of the DEIS are subject to the uncertainties intrinsic to all RAs as well as to some peculiar to the agency's particular assessments.

Risk assessments are notoriously uncertain (especially when extrapolated from experiments with small numbers of animals to programs involving millions of human beings) and dependent on the assumptions and variables fed into the modeling. None of these inputs is discussed in the DEIS in enough detail to allow the public the legally-required opportunity to review and judge the validity of the conclusions presented in the document.

Another problem with the RA: the DEIS says that the risk is about the same from aerial or groundrig spraying, but a few lines later contradicts this by saying that exposure is greater from aerial application—as though increased exposure does not indicate increased risk (DEIS 88).

The DEIS also just flat ignores some significant health information. E.g., it states of all the organophosphates (OPs) that "the mode of toxic action is primarily through AChE inhibition"; this may be true but doesn't relate the equally significant information that they also have toxic

effects in other areas (see comments below on effects of isomalathion on the liver enzyme carboxyesterase).

When the agency's risk assessments do show cause for concern, the DEIS says that the risk will be minimized to acceptable levels by the notification process—as though notification can be effective enough to reach all the potentially harmed individuals and as if notification were the same as actual prevention. Protocols for notification of health effects of malathion aerial bait spraying for the LA program have been strongly criticized as effective and needing radical improvement (MPHEAC 1992, 23). The DEIS does not satisfy this need.

Even if notification does reach people, the kind of notification APHIS proposes generally leads only to advice to stay indoors, which may expose people to greater risks than ambient concentrations. The argument that people can reduce their risk by staying inside during spraying is not valid, especially in many of the hotter areas targeted for spraying. Note the case in Tucson where the air conditioners of a school pulled air from outside that had been contaminated with malathion by a homeowner a few doors down the street who was hand-spraying just four plants in his yard (Revere and Rigg 1987). This incident resulted in 296 students being rushed to hospitals, all but 10 of whom were treated for respiratory problems, headaches, vomiting and other systemic disorders.

Notifications to stay indoors are particularly ineffective when the source of the notification is also saying that there is "no hazard to health" and when people are likely to want to be outside (which is generally the case in hot spray seasons in the southern and southwestern states covered by the proposed program).

Furthermore, the inputs to the model are missing some significant data. E.g., the model apparently is figured on ambient outdoor air concentrations, but in the real environment outside the risk assessment model, ambient concentrations are likely to be far lower than actual exposure levels (Wallace 1987, 92). Breath levels of people indoors (where the DEIS mitigation procedures tell them to go to avoid the helicopter spraying) can contain significantly higher concentrations of malathion than levels derived from outdoor air (Wallace 1987, 92).

1. ***Chemical Sensitivity*** As mentioned above, the DEIS needs to more effectively address the issue of disproportionate risk. The risk to populations such as the chemically sensitive, the homeless and those (usually with low incomes) who have protein deficient diets is far greater than the risk to the "general population" from which risk figures have been derived. The risk for the very young and very old is greater than for the general population, and the risk for children playing outdoors, on open areas and surfaces, is especially great.(Brown 1993).

The DEIS admits that even with all the precautions built into its risk assessments and operating procedures, there may well be disproportionate risk to low-income and sensitive populations (DEIS 112), but says that issue will have to be dealt with in the site specific reviews and environmental assessments (EAs) to be done later in individual states. This is unacceptable. Chemical sensitivity (what the DEIS calls "hypersensitivity") is a generic issue that must be addressed in the DEIS as well as in site specific analyses. At a minimum, the DEIS must spell out standard notification and mitigation measures that would be used to prevent exposure of sensitive individuals, and indicate how the program will comply with the Americans with Disabilities Act. The DEIS outline of mitigation procedures says merely that every effort will be made to notify people who are on "the list"—in reference, presumably, to some register of chemically sensitive individuals. There is no such register in Arizona nor in most of the other target states.

2. ***Data Gaps*** Risk assessments are notoriously flexible and must be supplemented and validated by actual monitoring. Unfortunately, despite the long history of medfly eradication programs (since 1929), data is extremely limited. Throughout the discussions of risk in the DEIS, the preferred alternative is justified with phrases like "based upon the limited evidence, program use of [a given pesticide] should not pose an unacceptable risk" (cf. discussion of diazinon, DEIS 96). That is, in the face of ignorance, the agency proposes to plow ahead as though lack of data equals lack of risk.

APHIS has known about the lack of sound data for a long time, and has had plenty of time to prepare valid studies. Before the LA spraying, for instance, the California Department of Health Services (CDHS) issued a "Risk Assessment of Aerial Application of Malathion-Bait" (CDHS 1991a), which concluded that there were huge data gaps in the database for malathion and that in light of the results of the CDHS risk assessment, the aerial application of malathion should be "reconsidered" (CDHS 1991, 8-46). A 24 April 1991 memo from the EPA's Health Effects Division concurred, states that "the evaluation of the use of malathion over a large human population (as in urban areas) would require a more extensive database than that which is currently available, given the need to suitably evaluate the exposure and to assure the protection of the general population" (EPA-HED 1991a, 1).

The HED memo, one of a series of EPA memos reviewing the CDHS assessment document, included several specific comments on the toxicology and exposure components of CDHS' conclusions, noting (among other points) that a) "there were no actual human monitoring data with respect to post-application exposure"; b) "under certain high exposure scenarios, there was little or no margin of exposure (margin of safety, as used in the document) for skin irritation and 20% inhibition of acetylcholinesterase activity"; c) "although these [model-derived exposure] estimates may provide a fair characterization of the risk because of conservative exposure estimates, this characterization still abounds with uncertainties"; d) "additional chronic studies on these compounds [malathion and malaoxon] are needed to research the endocrine pathology and the mechanisms of the genotoxicity"; e) "CDHS requires at least two positive studies before a chemical is considered carcinogenic [whereas EPA] may determine that a chemical has carcinogenic properties based on one positive study," and although "because of the lack of adequate evidence of carcinogenicity CDHS does not classify malathion or malaoxon as a carcinogen," EPA's "HED continues to have a concern for the carcinogenic potential" of the chemicals; f) "HED has concerns for the potential damage to the eye from exposure to malathion"; g) "To reduce the number of assumptions required for a risk assessment of the aerial application of the malathion-bait. . . .at a minimum, data from an acute testing battery should be available for a health assessment"; h) also, to reduce the number of assessments for a risk assessment, additional exposure data would be useful"; and i) "HED's most current DRES analysis based on anticipated residue and crop treatment data shows that exposure from consumption of treated crops is estimated to be approximately 120% of the RfD. For non-nursing infants and children up through age twelve, the dietary exposure ranges between 175% and 250% of the RfD" (EPA 1991a, 1-3).

A few days before the HED headquarters memo, a memo from HED's Occupational and Residential Exposure Branch (OREB) in reviewing the "Exposure Estimation" section of the CDHS assessment, agreed with the CDHS statements that "the level of uncertainty in estimating exposure doses is probably large, but not quantifiable," and that "the environmental monitoring was not designed to be 'representative' nor was it designed to look at specific issues addressed by these calculations."

In regard to lack of actual monitoring data in the CDHS assessment, the OREB memo goes on to note that although "these remarks are in no way to be construed as disparaging. . . .if this information had been submitted in support of an application for reregistration, it would not be acceptable" (EPA-OREB 1991, 2).

After the LA spraying, California's Department of Health Services' Malathion Public Health Effects Advisory Committee (MPHEAC) issued a final report (1992) recommending that before the health effects of malathion in general or the spray program in particular could be known, and before large scale aerial spraying of malathion over urban areas resumes, a great many additional studies would have to be done—including studies on neurotoxicity, ocular effects, immunotoxic affects, reproductive and developmental effects, genotoxicity and carcinogenicity.

These recommendations are particularly interesting in light of CDHS' failure to conduct such studies during and after the LA spraying. Not only did the agency conduct very few studies when presented with the opportunity, those they did conduct "did not contain adequate exposure data to fulfill EPA's standard guidelines for reregistration studies" (EPA-OREB 1992, 3). Post-LA studies carried out by the California Department of Food and Agriculture are referenced in the DEIS (DEIS 79) only in regard to malaoxon concentrations in swimming pools.

In October 1991, EPA responded to APHIS' request for a quarantine emergency exemption in Florida by saying in part that:

> the database for malathion is inadequate to assess the risks from aerial bait-spray applications over densely populated areas. Significant toxicology data gaps exist in the areas of chronic toxicity, carcinogenicity, ocular toxicity, and neurotoxicity. Data to adequately assess exposure of the population to malathion as a result of this use are also unavailable (EPA 1991b, 16).

EPA's litany echoes the MPHEAC Final Report reiteration of incomplete data on neurotoxicity, ocular effects, immunotoxic effects, reproductive and developmental effects, genotoxicity and carcinogenicity. In response to such a great lack of data, the MPHEAC concurred with CDHS in recommending that "the use of aerial malathion-bait applications in urban areas for agricultural pest eradication be reconsidered carefully and used only when all other safer, less intrusive alternatives have been exhausted" (MPHEAC 1992, 19).

In concurring with the CDHS and MPHEAC recommendation, we note that although EPA has required registrants to submit studies on these gaps, many of the studies are still not completed, so the basic concern remains.

Besides cancer studies, for instance, other missing information includes studies on acute dermal toxicity, acute inhalation, primary dermal irritation and dermal sensitization and health effects to workers and bystanders; EPA is requiring data on all of these for reregistration of malathion (though the state of California has petitioned EPA to waive the data call-in requirement for most or all of the acute studies except for the last two)(EPA-OPP 1992, 14).

A similar lack of information affects the APHIS risk assessment. The Human Risk Assessment, for instance, points out that location analyses were, in fact, not done for Arizona and several other of the states included in the program (Syracuse 1992, 3-6); lack of these studies should preclude implementation of the plan in those states.

3. ***Interactions and Breakdown Products*** "Accurate human exposure assessment during

malathion spraying must consider environmental transformations" (Brown 1993, 388). Such consideration must include degradation products, impurities in technical products, bioaccumulation, and a wide range of interactive or synergistic effects like potentiation. The main danger from the proposed program is not malathion itself (though it has some problems), but its impurities and degradation products.

For instance, malathion degrades to malaoxon. A report submitted to EPA in 1987 found malaoxon to be 10,000 times more toxic than malathion itself as an AChE inhibitor (Dobroski 1987, V-2); the DEIS notes that it is 68 times more toxic, without specifying the kind of toxicity (DEIS 92).

During aerial application of malathion-bait at one site in LA, it was found that the "combined air concentrations of the four malathion impurities were actually *greater* [sic] than that of malathion" itself (Brown 1993, 396). After application, samples at the test site found that "concentration of malaoxon in outdoor air was greater than that of malathion" (Brown 1993, 390). In addition, the study (which is not referred to in the DEIS) showed a remarkable increase in malaoxon concentrations in surface depositions—as much as a 45 times higher than were contained in the malathion tanks before release (Brown 1993, 396).

It is significant to note that this study's calculations make "no corrections for collection efficiency. . .for any of the data for either air or surface sampling, and thus they represent minimum values" (Brown 1993, 392). The minimum values of malaoxon found on surfaces 9 days after the spraying were as high as 315ug/ft^2 (Brown 1993, 388).

Technical malathion also contains a significant impurity known as isomalathion which APHIS notes is 95 times more toxic than malathion (DEIS 92). In 1976, an incident in Pakistan resulted in 2800 accidental poisonings of applicators, including 5 deaths, which occurred mainly as a result of isomalathion interaction with technical grade malathion (Brown 1993, 389; Cohen 1984, 316).

More information is needed on the interaction of malathion with various environmental factors, including the presence of metal ions and impurities in the mixture itself (MPHEAC 1992, 92). In addition, more studies are needed to follow malathion's degradation and breakdown products after application (MPHEAC 1992, 7).

4. ***Potentiation*** Organophosphates exhibit a wide range of interactions with other chemicals, including other organophosphates and prescription drugs—the toxicities of which are increased in the individual who has taken them (Cohen 1985). This potential for interaction is may be especially significant in agricultural-area cities like Phoenix whose "normal" air already contains high ambient levels of organophosphate pesticides. The DEIS mentions this problem in its section on physical environment, but offers no mitigating measures to deal with it (DEIS 60).

Malaoxon is "detoxified" in the human body by the liver enzyme carboxyesterase, but certain impurities in the malathion mixture (especially isomalathion) effectively inhibit the detoxification action of this enzyme in the human liver, thereby increasing the toxicity of the mixture (Brown 1993, 388).

5. *Human Health Impacts* Malathion is mutagenic, immunotoxic, neurotoxic and possibly carcinogenic as well as having several acute effects.

Immunotoxicity: Low doses of malathion have been shown to cause immunotoxic response in

rats (Rodgers 1992). Impurities, at higher doses, were also shown to cause suppression of immune responses in rats, weight loss and death occurring up to 3 weeks after exposure (Brown 1993, 389).

Genotoxicity: Although the DEIS says that "most" studies do not support a finding of genotoxicity (DEIS 91), the MPHEAC found that the amount of chromosomal damage from malathion was significant enough to make carcinogenicity probable (MPHEAC 1992, 15; cf. Reuber 1985; IARC 1983). Malathion is currently undergoing EPA special review in the reregistration process, with studies on its carcinogenicity potential (required by EPA) supposed to be completed in 1994—though "the registrant has requested a time extension for this study until September, 1995" (EPA-OPP 1992, 9).

Neurotoxicity: The DEIS says malathion does not cause delayed peripheral neuropathy (DEIS 91), but studies by the US Army and others (US Army 1976; Bushnell 1991) contradict the APHIS assertion.

Acute Toxicity: Impurities have been reported to markedly influence the acute toxicity of malathion (MPHEAC 1992, 10).

Ocular damage: A great deal of toxicological and legal discussion has been raised by the case of a 15-year-old boy who reportedly looked upward outside his home in the Los Angeles area as a helicopter flew overhead spraying malathion. According to report completed by a UCSC School of Medicine ophthalmologist, Dr. Sadun, the boy suffered permanent loss of vision to the point of "legal blindness" (Sadun 1990). After Dr. Sadun's case report was submitted to the EPA-OPP consultant, Dr. Wagner, Wagner concluded that the patient's condition was probably a condition secondary to malathion exposure (Wagner 1990). The case has become very controversial. Although EPA's Health Effects Division (HED) has concluded that Dr. Sadun's and Dr. Wagner's opinions do not establish malathion as the cause of blindness, and that "due to the nature of the incident, it may be impossible to determine the extent, if any, to which malathion was responsible for these effects" (EPA-OPP 1992, 8), the Division's RfD/Peer Review Committee has concluded that "the combined toxicological data from epidemiology studies and from bioassays demonstrate the potential for organophosphates to produce a wide range of ophthalmological effects" (EPA-OPP 1992, 13). A consensus statement by the MPHEAC concluded that, "while acute and chronic exposure to malathion can lead to visual impairment, such impairment is unlikely to result from the exposures encountered in the medfly eradication program" (EPA-OPP 1992, 8). Results of ocular toxicity testing required pursuant to EPA's reregistration process are not due at the agency until June 1994.

Environmental Impacts

Climate: The scope of the DEIS is far too generalized. It targets Cochise County, Arizona, for instance, despite the fact that climate in all but a few square miles of that county are cold enough in winter to prevent establishment of the medfly. Again, the EIS needs to be more specific.

Air: Aerial spraying of malathion will affect air quality. Effects on air quality must be considered in the State Implementation Plans under the federal *Clean Air Act*, especially if the site of spraying is a non-attainment area for ozone (e.g., Phoenix).

Water: Malathion is water soluble and highly mobile in loam soils and although it may adsorb to organic matter, it is a threat to groundwater especially in western states where soils are typically devoid of organic matter (DEIS 59, 78). Malathion and diazinon are both on the

Arizona Groundwater Protection List for pesticides that pose a high threat to groundwater. The DEIS does not discuss how the agency will address these potential impacts to groundwater.

Biological Resources: Malathion also poses a threat to many aquatic non-target species (NCAMP, 6-88). Despite the language on the label which says "Do not apply directly to water, to areas where surface water is present" (EPA-OPP 1992, 17), the DEIS accurately notes that "smaller ponds and riparian zones usually are sprayed or receive drift" (DEIS 167). This should be absolutely avoided, especially in water-scarce states like Arizona where all water is a precious resource for humans and wildlife.

As the DEIS says, APHIS is consulting with the US Fish and Wildlife Service (FWS) and will comply with whatever the FWS recommends for protection of federally threatened and endangered species. Although the DEIS identifies a great many nontarget non T&S species that might be adversely affected by the proposed program (DEIS 59-69), it gives almost no particulars about how those species will be protected from exposure. Of particular concern among species not given sufficient attention in the DEIS are nontarget invertebrates, including economically important but non-commercial pollinators of commercial and subsistence food plants (including both human and wildlife foods), as well as other kinds of plants which may or may not have economic value to humans (e.g., the host-specific saguaro moth in Arizona).

As for vertebrates, diazinon is recognized by the DEIS as being notoriously dangerous to birds and malathion is especially deadly to aquatic species, but again the DEIS does not give the public enough detail about how these species will be protected. All of the chemicals are dangerous to predators in the upper reaches of the food chain that ultimately depend on insects like medflies for their sustenance.

Mitigation

Human Health The DEIS says that the "principal focus of the mitigative procedures for the protection of human health is the notification to residents [which is tell] residents when and what to expect, how it might affect them and what they can do to protect themselves" (DEIS 170); but Table VI-2, the "Recommended Program Mitigative Measures," is exceedingly vague about what specific information and advice residents will be given.

Where the table is specific, it makes clear that the measures are likely to be extremely burdensome and/or ineffective. In regard to "hypersensitive" individuals, for instance, the table provides for personal notification only of those who might be on some state registry, and specifies that the advice they are given on "what they can do to protect themselves" is nothing more than contacting their physician for advice. Not only are registries nonexistent in most states in the program area, and most physicians admittedly ignorant of pesticide symptoms and care, but asking all affected individuals to contact the limited number of physicians within twenty-four hours of spraying is a patently clumsy way of communicating emergency information. It would appear to be little more than passing the buck. Instead, the needed advice should be communicated at the time of initial contact. Furthermore, it should be spelled out in the EIS in the table of recommended mitigative measures.

The mitigation plan calls for re-entry intervals for farmworkers, but provides nothing comparable for the public (DEIS 173).

Nontarget Species The DEIS defers many essential planning steps to the site specific review stage of planning. but such planning should be done at the programmatic level when possible,

leaving for local site-specific analysis only those issues which are not generic. As with human health issues, many of these site specific steps should be spelled out in the mitigation plan. In particular, the DEIS needs to do a great deal more regarding plans to mitigate effects on non-target species rather than just listing the issues in a general form (DEIS App. VI-B).

The DEIS says that the proposed action will result in "some reductions of exposed terrestrial and aquatic invertebrate populations, and some alterations in soil micro-organism structure" (DEIS 181), and that "measures to protect" nontarget species will be employed (DEIS 170), but does not specify what or what kind of measures they are, so the public has no way of judging their possible efficacy or practicability. Again, the table of "Recommended Program Mitigative Measures" is no help; it says only that "operations will be conducted with appropriate concern for potential impact on nontarget organisms" (DEIS 174), that "the program will take appropriate action to ensure that [sensitive areas] are not adversely affected" (DEIS 175), and that "managers will coordinate with other programs to reduce potential cumulative impacts" (DEIS 175). This is all smoke and mirrors: what does "appropriate" mean, what are the "potential cumulative impacts" and how will they be reduced, etc.? Similarly, the DEIS at 181 says that chemical control "may result in some short-term cumulative effects" and that "to the maximum extent possible, program managers will coordinate with other programs to reduce potential for cumulative impacts," but doesn't describe them (or explain the apparent contradiction between the adjectives).

Significantly, the DEIS does indicate in at least one spot that APHIS is perfectly capable of being specific. The vague statement that the agency will "take appropriate action," five pages earlier is rendered as a concrete "avoid sensitive areas" (DEIS 170).

The programmatic nature of the DEIS does not excuse the agency from the NEPA responsibility of presenting enough specific details, guidelines and examples to allow the public to understand and comment on potential consequences. This table, especially, should be as detailed and specific as possible since it deals with procedures that, though they will necessarily be shaped by site-specific conditions are, nonetheless, to a great extent generic.

One of the most important improvement that should be made in the EIS is the expanding of the monitoring and mitigation plans from the overly-generalized lists of potential adverse effects to a detailed outline of procedures to be followed, including a) the specific steps that APHIS plans to take to reduce exposure in each community; b) detailed health and environmental monitoring before and after applications—including personal inhalation as well as ambient levels.

Monitoring Plan

The DEIS says that "APHIS has developed a generic Environmental Monitoring Plan" (DEIS 177), but instead of including the plan for public review, the document has only more assertions and generalizations. The DEIS discussion of what it calls "efficacy monitoring" is, in fact, only concerned with efficiency of application. Neither in this section nor in the immediately preceding section on "environmental monitoring" is there a discussion of or plan for monitoring actual efficacy of the program itself. Without some clear definition of success or failure, the program becomes almost automatically perpetual, able to claim success every year but returning to repeat the regimen year after year.

One statement about the monitoring plan is particularly disturbing. "Because of methyl bromide's volatility and pattern of use, methyl bromide residues would not be expected to remain in environmental components" (DEIS 177). If they aren't in the environment, where are they? As the DEIS also states (DEIS 165-166), methyl bromide is an ozone-depleter, and the DEIS should

quantify its potential stratospheric effect.

The DEIS states (DEIS 177) that "specific environmental components may also be taken" if the agency receives complaints; this kind of monitoring should be done whether or not there are complaints.

Management Alternatives

One of the main problems with the DEIS is its refusal to promote long-term solutions. Available and effective biological, cultural and integrated methods are slighted by the agency simply because they may not be "immediately effective"—a criterion generally necessary only in a crisis management, but not as important in the kind of long-term solutions the agency should be moving toward by recognizing, for starters, that management, not eradication, is the proper goal. The difference is more than merely semantic: it requires a switch in mindset from the outmoded mentality of the-only-good-medfly-is-a-dead-medfly to more realistic goals of identifying economically acceptable levels of medfly and developing sustainable agricultural practices that keep the medfly at or below those levels.

The DEIS does not take into account several significant new developments in non-chemical control. For instance, it does not mention research by its sister USDA agency, the Agricultural Research Service, reported in the Feb 1993 issue of *Agricultural Research*, indicating that application of relatively harmless Gibberellic Acid to citrus crops was an effective deterrent to medfly damage.

Biological Controls Effective biological alternatives are available, many of them mentioned within the DEIS; yet the agency has dismissed them for being "unproven efficacy and lack of immediate results for large scale emergency medfly eradication programs" (DEIS 36). However, the DEIS refers (albeit obliquely and with little apparent enthusiasm) to USDA-ARS studies in Hawaii that "could contribute to ultimate eradication of these pests in Hawaii, thereby reducing risk of spread to the conterminous [sic] United States" (DEIS 37). It does not mention that biological control of soil medfly larvae with nematodes in the Hawaiian studies have demonstrated an 89-95% success rate (*American Fruit Grower* 1990).

Other biological controls (parasitic wasps) are being used successfully to control medfly in Chiapas, Mexico where it is an established pest. Organic agriculture advisors of California were brought in to assist the Mexican organic coffee farmers who developed a low cost, effective management (i.e., non-eradication) program combining release of medfly natural enemies, enemy conservation techniques, sterile male releases and baiting with pheromone traps containing botanical insecticides (PANNA 1992, 13; JPR 1993, 30). This method deserves wider application and APHIS should incorporate it into their program to cut down sharply on the use of chemical pesticides.

As noted above, the agency intends to use a combination of chemical and non-chemical methods. The DEIS is not at all clear about how the Combined Controls program would work, but the DEIS briefly discusses the combined approach under three headings: Eradication including chemicals (the preferred alternative); Regulatory Controls (primarily Methyl Bromide fumigation); and Integrated Pest Management (IPM).

The main difference between the preferred alternative and IPM is that under IPM "the program would vary its use of control methods to protect human health, nontarget species. . .sensitive areas, and other components of the environment. Program managers also would utilize specific

protection measures and/or mitigations. . .to maximize efficacy and minimize environmental risk" (DEIS 43-44). This doesn't sound too bad. In fact, it sounds very close to exactly what APHIS should be doing.

References

American Fruit Grower. March 1990.

Brown, Mark A. et al. 1993. Monitoring of Malathion and Its Impurities and Environmental Transformation Products on Surfaces and on Air Following an Aerial Application. *Environmental Science and Technology* 27(2): 388-397.

Bushnell, M. [1992]. *Journal of Pharmacology and Experimental Therapeutics*; cited in, Tina Adler 1992, Pesticides' Long-term Effects Get a Closer Look from EPA, *American Psychological Society Newsletter* (December, 1992), p. 44.

CDHS 1991. California Department of Health Services, Health Risk Assessment of Aerial Application of Malathion-Bait. California Department of Health Services (February 1991).

Cohen, Steven D.1984. Mechanisms of Toxicological Interactions Involving Organophosphate Insecticides. *Fundamentals of Applied Toxicology* 4:315-324.

Dementi, Brian.1991. Ocular Effects of OPs. EPA Office of Hazard Evaluation Division (27 March 1991).

Dobroski, Charles J. et al 1987. Malathion: A Profile of Its Behavior in the Environment. Submitted to USDA-APHIS-PPQ under Contract No. 53-6395-1-1151.

EPA-HED 1991a. Review of the Health Risk Assessment of Aerial Application of Malathion-Bait submitted by California Department of Health Services. Memorandum from Penelope A. Fenner-Crisp, Director Health Effects Division to Anne E. Lindsay, Director Registration Division, dated 24 April 1991.

EPA-OPP 1991b. Section 18 - USDA Quarantine Exemptions for Use of Malathion and Diazinon to Eradicate Exotic Fruit Fly Species in Florida—ACTION MEMORANDUM. Memorandum from Anne E. Lindsay, Director, Registration Programs to Douglas D. Campt, Director, Office of Pesticide Programs.

EPA-OPP 1992. Section 18 - Quarantine Exemption for the Use of Malathion to Eradicate Exotic Fruit Flies in California (EE#93-CA-02) —Action Memorandum from Lawrence E. Culleen, Acting Director, Registration Division to Douglas E. Campt, Director, Office of Pesticide Programs dated 14 December 1992.

EPA-OREB 1991a. "Exposure Estimation" in: California Department of Health Services' "Health Risk Assessment of Aerial Application of Malathion-Bait." Memorandum from Mark I. Dow, Special Review and Registration Section, Occupational and Residential Exposure Branch to Penelope Fenner-Crisp, Director Health Effects Division, dated 18 April 1991.

EPA-OREB 1992. OREB Response to Questions from OMB Regarding the Malathion Data Call-n (DCI). Memorandum from Jeff Evans, Reregistration Section to L. Rossi, Branch Chief, Reregistration Branch, Special Review and Reregistration Division.

EPA-TB I 1991a. California Health Risk Assessment of Aerial Application of Malathion-Bait. Memorandum from Brian Dementi, Review Section III, Toxicology Branch I to Flora Chow, Chemical Manager, Reregistration Section, Science Analysis & Coordination Branch, Health Effects Division, dated 19 April 1991.

IARC 1983. World Health Organization, International Agency for Research on Cancer, IARC Monographs on the Carcinogenic Risk of Chemicals in Humans—Miscellaneous Pesticides (vol. 30).

JPR 1993. Biological Control of the Mediterranean Fruit Fly. *Journal of Pesticide Reform* 13(1): 30.

MPHEAC 1992. Malathion Public Health Effects Advisory Committee Final Report: Charges and Recommendations. California Office of Environmental Health Hazard Assessment, Pesticide and Environmental Toxicology Section (February 1992).

PANNA 1992. Indigenous Cooperative Blocks Malathion Spray Program. Pesticide Action Network North American Regional Center *Global Pesticide Campaigner* 2(4): 13.

Pesticide Action Network. *Global Pesticide Campaigner* 2(4):93.

Reuber, Melvin D. 1985. Carcinogenicity and Toxicity of Malathion and Malaoxon. *Environmental Research* 37:119-153.

Revere, C.T. and Melissa Rigg 1987. Spray Enters Coolers at Homer Davis Elementary. *Arizona Daily Star* (25 April 1987), p. B-1.

Rodgers, Kathleen, et al 1992. Mechanisms of the Modulation of Purine Peritoneal Cell Function and Mast Cell Degranulation by Low Doses of Malathion. *Agent Action* 35:57-63.

Sadun, Alfredo, M.D. 1990. Letter to Brian Dementi, USEPA, Wash. DC, 1 Aug. 1990.

Syracuse 1992. Human Health Risk Assessment: APHIS Fruit Fly Programs. Syracuse Environmental Research Associates (November 1992).

Syracuse 1993. Nontarget Risk Assessment for the MEDFLY Cooperative Eradication Program. Syracuse Environmental Research Associates (February 1993).

U.S. Army 1976. Study #51-051-73/76.

Wagner, Sheldon 1990. Letter to Frank Davido, OPP Pesticide Incident Response Officer (24 August 1990).

Wallace, Lance A. 1987. The Total Exposure Assessment Methodology (TEAM) Study: Summary and Analysis: Volume I. EPA/600/6-87/002A (June 1987).

Medfly Eradication and Public Health: a Fruitless Effort? (1994)

Michael Gregory and Nancy Rucci, pre-publication draft published, with minor revisions, in *New Solutions* 4(4):9-20 (1994).

In August 1989, a single Mediterranean Fruit Fly (medfly) was found near Dodger Stadium in Los Angeles, California, triggering a state-federal cooperative eradication project which, by the time the California Department of Food and Agriculture (CDFA) declared the project a success, had led to aerial application of over half a million pounds of the organophosphate insecticide malathion on 595 square miles of four southern California counties (CDHS 1991, 2-10; Segawa 1991,4). Despite widespread public outcry and public health concerns, between August 1989 and July 1990, the California Department of Agriculture carried out 153 aerial sprayings over southern California communities with a combined population of over one and a half million people.

Malathion-baits were again distributed widely in the Los Angeles area in 1992, followed by release of 7.5 billion sterile flies from December of that year through the following May (CDHS 1993). Nonetheless, by the end of July 1993, at least 51 adult medflies had been discovered in the northern San Fernando Valley (Hawkins 1993), and by the end of October, 350 flies had been trapped; in response, CDFA routinely increased the number of groundrig sprayings from two to three sprayings per site before the release of sterile flies (Otten 1993).

Although the extent and the size of the directly affected population of the recent California projects are unusual, the failure to achieve control is not. In 1980, for instance, California spent $100 million for its "successful" malathion-based medfly eradication project and followed it with similar projects in 1981, 1982, 1987, 1988, 1989 and, as noted, 1990 (Dolan and Dunn 1990).

Despite decades of expensive eradication programs in agriculturally-rich states like California and Florida, the medfly and other closely-related fruitflies[1] continue to plague the US Department of Agriculture's Animal and Plant Health Inspection Service (APHIS). That agency's determination to eradicate medfly from the coterminous United States has been heroic; but the seemingly endless succession of spray projects has led to a heated public debate about the health and environmental effects, and about the obvious failure to produce long-term results. By 1990, even scientists working as advisors to the California eradication program began to express pessimism about the possibility of ever eradicating the medfly from the southern California area.[2]

Nonetheless, in November 1993, five months after the close of a public comment period during which more than 200 commentors overwhelmingly opposed continuation of the eradication

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[1]In Florida, for instance, the Caribbean Fruit Fly (Caribfly) has been the object of eradication efforts. As used in this paper, the terms *medfly* and *eradication* include these related species.

[2]The assumption that the medfly can be eradicated is contrary to respected scientific opinion which suggests that the medfly is already established, its appearance in the US being the natural extension of its long-term cyclical range fluctuation, and that attempts to eliminate it are bound to fail. See, Carey 1991; for a more popular account, see Wheeler 1993.

program, APHIS issued a final programmatic environmental impact statement (EIS)[3] calling for more of the same, potentially much more—-this time targeting nine of the ten U.S. states spanning our southern border. As before, the agency's main argument is that an "emergency eradication" with broadscale application of chemical pesticides is necessary to prevent establishment of medfly in the continental United States.[4] Shortly after publication of the EIS, in February 1994, after discovery of one pregnant medfly, CDFA began biweekly spraying of an 18-square mile area of southern California, including the communities of Corona and Norco.

Eradication and Public Health Policy

Several significant public health policy issues are raised by the eradication programs in general, and the medfly programs in particular, including the degree to which people have a right not to be exposed against their will to toxic pesticides; the right to full disclosure about what they are being exposed to and its hazards; and the economic justification and effectiveness of such programs, as well as the need for them in the first place.

Given the insect's voraciousness and rapid reproductive capabilities,[5] few would disagree that some agricultural damage is almost bound to result from a medfly infestation, although the amount and inevitability of damage is disputed. The USDA has estimated that if medfly were to become established in the coterminous U.S., annual losses to the agricultural industry would be in the range of $821-$831 million (EPA-OPP 1991, 3). The University of California has projected costs of $700 million to over $1 billion annually in that state alone (EPA-OPP 1992, 6). While the wide range between these figures suggests that they cannot be accepted uncritically, they do indicate the magnitude of the problem perceived by the agricultural industry. The EIS does not demonstrate, however, that agricultural ruin is a necessary consequence of individual infestations or of medfly existence, *per se*; nor does it provide evidence that chemical spraying is more than a stopgap measure. Furthermore, the APHIS eradication program, like previously discredited (and, therefore, abandoned) eradication efforts by the US Forest Service, offers no clear benchmarks to determine success or failure of the

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[3]The final EIS was issued while this paper was in preparation; publication deadlines have precluded detailed examination of the final text which, while substantially similar to (and for the most part a verbatim reproduction of) the draft issued in April 1993, may contain changes which are not reflected in the present commentary.

[4]Given the repetitive and fairly predictable nature of medfly episodes, both words in the agency's preferred alternative, "emergency eradication," are questionable as descriptors. As used by APHIS, the term "eradication" is easily confused with the commonsense meaning of the word (e.g., as in the worldwide eradication of smallpox), but is used to mean simply a continuation and expansion of the existing chemical *suppression* program. Presumably, since the cooperative programs are funded to some extent with state emergency funds, the programs should address legitimate emergencies.

[5]As it goes through its 30-60 day life span of egg-laying and fruit-devouring, the medfly can pose substantial problems for agriculture. By laying its fertilized eggs just under the surfaces of fruits and vegetables (medfly affects over 250 varieties), the female medfly scars the host fruit superficially. Within twelve days, the eggs hatch into larvae, which then feed upon the fleshy interior of the host, leaving the produce insect-contaminated and rotted. The life-cycle changes continue after about 7-10 days, when the mature larvae leave the fruit, often going into the soil as the fruit drops prematurely. In the soil, the larvae develop into pupae and, within 8-14 days, adult medflies emerge to begin the reproductive cycle once again.

proposed action, nor any measures to provide long-term solutions.[6] Instead, it contemplates an endless series of "different programs in successive years" (DEIS 166) with no apparent endpoint.

In light of past failures at actual eradication, the agencies' arguments for repeating and enlarging their program are not compelling, and recent proposals have met with widespread and vocal opposition. Predictably, opposition has been especially strong from citizens and organizations who objected to the 1990 Los Angeles project and continue to object to expending large sums of money for ongoing programs that expose millions of people to toxic pesticides particularly if, as critics argue, the projects provide only short-term benefits at best and are essentially unnecessary due to availability of effective, less-toxic alternatives, including biological controls and other sustainable agriculture practices which replace reactionary chemical methods with diversified production systems that recognize acceptable economic thresholds of pest populations.[7]

Using the APHIS EIS as its primary text, this paper examines some of the policy issues raised by chemical eradication programs, and presents some of the elements of an alternative approach increasingly called for by the public, an approach that stresses prevention rather than reaction, management rather than eradication, and reduced rather than increased pesticide use.

The APHIS Model

The agencies' preferred alternative (the only alternative discussed in detail in the EIS) includes aerial application of malathion baits, fumigation of commercial produce shipments with the ozone-depleting chemical methyl bromide, and "soil drenching" of infestation hot spots with the highly toxic organophosphates chlorpyrifos, diazinon, and fenthion. The mainstay of the program is malathion, one of the most widely used organophosphate insecticides in the United States and throughout the world. Malathion has been "shown to be mutagenic, possibly carcinogenic, implicated in vision loss, causing myriad negative health effects in human and animal studies, damaging to nontarget organisms, and containing highly toxic impurities" (Brenner 1992). Studies have also shown that low doses of malathion can cause an immunotoxic response in rats (Rodgers 1992), and that in the presence of impurities at higher doses, can cause suppression of immune responses in rats, weight loss and death occurring up to three weeks after exposure (Brown 1993, 389). Impurities also have been reported to markedly influence the acute neurotoxicity of malathion (MPHEAC 1992, 10).

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[6]Decades-long attempts by APHIS' sister agency to eradicate western spruce budworm similarly were characterized by repeated aerial spraying of thousands of square miles (with DDT, carbaryl and other pesticides), with claims of success after each project, and treatment protocols that included no methodology for measuring long-term success. As with the medfly programs, the term *eradication* in practice meant *perpetual suppression*. Protests by citizens and eventual lawsuits eventually led the Forest Service to drop eradication goals and adopt, instead, successful non-chemical management methods, including setting of realistic acceptable damage thresholds and benchmarks for determining success or failure of the management programs. See IPMWG 1986).

[7]During recent spray programs in the Los Angeles area, citizens groups, many of which were formed in direct response to the spraying of their neighborhoods, organized numerous demonstrations, set up citizen information hot-lines and attended California Dept. of Health Services meetings in force. Since 1990, members of many of these groups have been active under the umbrella of Action Now, which has taken a leading role in calling for alternatives to chemical eradication. Among national organizations opposing the APHIS proposal are the National Coalition Against the Misuse of Pesticides and the Sierra Club.

In defense of its chemical approach, APHIS says that without its cooperative federal-state eradication programs, greater environmental and health consequences would result due to "uncontrolled use of pesticides" by farmers, homeowners and gardeners (DEIS 181). While this is a remarkable official recognition that private use of pesticides not in compliance with pesticide labels is widespread, or that use is unsafe even when done according to label instructions, or both, the agency concedes that since the amount of annual pesticide used in eradication programs cannot be predicted with accuracy or compared to the amounts predicted for non-program use (a figure which is perhaps even more uncertain since record-keeping by private applicators is not required), there is, in fact, no data to substantiate the claim that greater environmental and health damage will occur without its program.

Risk Assessment and Right-to-Know

In lieu of mandatory prevention measures, US environmental law typically provides for worker and public right-to-know about the risks that it may be subjected to. This fundamental element of democratic process is embodied, for instance, in the *National Environmental Policy Act* (NEPA), which requires federal agencies to disclose the potential impacts of their proposed actions and viable alternatives. APHIS relies heavily on quantitative risk assessments, the details of which are contained not in the EIS but in two separate documents (Syracuse 1992; 1993) not generally available to the public during the comment period.

As a measurement tool, quantitative risk assessment is a notoriously uncertain procedure (perhaps especially so when results of experiments with small numbers of animals are extrapolated to programs exposing millions of human beings) and dependent on the assumptions and variables fed into the modeling. When used as the basis for public policy decisions, quantitative risk assessment is an even less certain tool. The APHIS assessment, while subject to the generic uncertainties, has also been strongly criticized both on technical and policy grounds for a) assuming that some additional risk is acceptable; b) underestimating exposure; c) underestimating low dose effects of primary and secondary ingredients; d) overestimating project effectiveness; e) overestimating mitigation effectiveness; f) miscalculating cost-benefit by inflating estimated costs to industry, discounting costs to the public and benefits of alternatives; and g) nearly totally ignoring non-human effects (Sierra Club 1993; Action Now 1993; ACLPI 1993). The basis of many of these criticisms lies in the agency's selective use of data, which frequently ignores or discounts data that does not support the agency's preferred alternative, and similarly discounts the significance of data missing due to absence of studies.

- *Selective Data*

Quantitative risk assessments typically consider only one chemical at a time in isolation from other environmental contaminants. In the case of pesticides, for instance, usually only the so-called "active ingredient" is examined and exposure estimates are typically based only on the amounts of active ingredient released by the project being assessed; additive, potentiating or other cumulative effects from exposure to extraneous sources of the same chemical, or chemicals presenting substantially similar modes of toxicity, or other ingredients (impurities, inerts, degradants) within the pesticide formulation, are not ordinarily considered. But current science alerts us to the probable significance of low dose and multiple exposures from multiple sources, acting through relatively unstudied pathways and mechanisms of toxicity (cf. NRC 1991; Birnbaum 1993; Davis 1993; Lucier 1993). Traditional dose-effect models (such as those the APHIS risk assessment is based on) do not show the whole picture but must be evaluated in light of new findings on biochemical individuality and molecular biology which increasingly are discovering specific susceptibility of individual genomes to certain chemicals, suggesting that, in

addition to biological and chemical markers, we must also consider markers for genotoxicity (cf. Lioy 1993; Waldman 1992; Wegman 1992). APHIS gives scant consideration to such issues.

For instance, the agency does not address the wide range of interactions that organophosphates exhibit with chemicals not associated with the pesticide mixture, including the presence of metal ions and other organophosphates occurring in the environment (MPHEAC 1992, 92), nor the interactions with some prescription drugs—the toxicities of which are increased in the individual exposed to organophosphate pesticides (Cohen 1985). The potentials for interaction are especially significant in urban-agricultural interface areas like Phoenix (one of the potential "target" cities), the "normal" air of which already contains high ambient levels of organophosphate pesticides.

The main danger from eradication programs using aerially applied malathion may be not malathion itself, but its impurities and degradation products, some of which are more toxic than the parent chemical. In an exposure study done to measure levels of malathion's breakdown products after the 1990 aerial sprayings in Los Angeles, for instance, researchers found that due to rapid oxidation of malathion to malaoxon, "two days after spraying at one measurement site, the concentration of malaoxon in outdoor air was greater than that of malathion" (Brown 1993, 390). The study also showed a remarkable increase in malaoxon concentrations in surface depositions—as much as 45 times higher than were contained in the malathion tanks before release (Brown 1993, 396), and concluded that "accurate human exposure assessment during malathion spraying must consider environmental transformations" (Brown 1993, 388). The APHIS program does not take such data into account, but assumes that a rapid degradation of malathion itself is equivalent to a rapid lowering of risk.

Significantly, this study's calculations make "no corrections for collection efficiency. . .for any of the data for either air or surface sampling, and thus they represent minimum values" (Brown 1993, 392). The minimum values of malaoxon found on some surfaces nine days after the spraying were as high as 315$\mu g/ft^2$, up from 7$\mu g/ft^2$ after initial deposition (Brown 1993, 388). Actual levels may be significantly higher.

Unexpectedly high exposure levels have also been shown in a more recent study which tested symptomatic residents of a household that had been sprayed with diazinon (one of the other organophosphates proposed for use by the EIS). Normally, testing for exposure would depend solely on measuring levels of blood cholinesterase, the most immediate effect of organophosphates. In this case, despite blood cholinesterase levels measuring within "normal" ranges, urinalysis showed diazinon's metabolite, diethyl phosphate (DEP) four and a half months after the spraying took place (Richter, E.D. 93). Risk assessments for cholinesterase inhibition as discussed in the EIS are based only on projections of exposure as measured by blood analysis and do not consider increased levels that might be determined through other analytical methods.

APHIS notes that "chemical control methods have the greatest potential for adverse environmental consequences"; that "soil drench chemicals have the greatest potential for adverse human health effects"; that "malathion aerial bait applications were determined to have the greatest potential for adverse nontarget species effects"; and that "non-chemical control methods offer little, if any, potential for adverse environmental consequences" (DEIS 181).

Beyond this relatively obvious risk comparison of chemical alternatives, the EIS tends to omit significant health effects information. For example, the risk assessment model used by APHIS apparently is figured on ambient outdoor air concentrations of malathion, but, as noted above in the discussion of malaoxon and DEP residues, in the real environment outside the model, actual exposure levels are likely to be far higher than ambient concentrations; and, conversely,

malathion breath levels of people indoors (where the EIS mitigation procedures tell them to go to avoid exposure from helicopter spraying) can contain significantly higher concentrations than levels derived from outdoor air (Wallace 1987, 92).

The agency's discussion of malathion's effects on enzyme function are also highly selective. While noting that "the mode of toxic action [of organophosphates] is primarily through acetyl-cholinesterase (AChe) inhibition," the agency omits the equally relevant (and less well-known) information that organophosphates are also known to cause other acute and chronic health effects, including but not limited to immunotoxic, reproductive and developmental effects which may be as or more significant than cholinesterase inhibition (Greenpeace 1991).

Furthermore, technical-grade malathion, the mixture generally used in government spray programs, contains a peculiar impurity known as isomalathion which APHIS notes is 95 times more toxic than malathion itself (DEIS 92). Similarly, malathion degrades to a substance known as malaoxon, which according to some studies is 10,000 times more toxic than malathion itself as an AChE inhibitor (Dobroski 1987, V-2), though the agency notes only a 68-fold increased toxicity of unspecified kind (DEIS 92). The agency fails to mention that while malaoxon is eventually "detoxified" in the human body by the liver enzyme carboxyesterase, certain impurities in the malathion mixture (especially isomalathion) effectively inhibit the detoxification action of this enzyme, thereby increasing the toxic effects of the mixture (Brown 1993, 388). In 1976, an incident in Pakistan resulted in 2800 accidental poisonings of applicators, including 5 deaths, which occurred mainly as a result of isomalathion interaction with technical grade malathion (Brown 1993, 389; Cohen 1984, 316).

The effect of selective data can also be seen in the assertion that "most" studies do not support a finding of genotoxicity (DEIS, 91), a statement that seems at best disingenuous in light of a 1992 report completed for the California Department of Health Services after the Los Angeles sprayings found that the amount of chromosomal damage from malathion is significant enough to make carcinogenicity probable (MPHEAC 1992, 15; cf. Reuber 1985; IARC 1983). Malathion is currently undergoing EPA special review in the reregistration process, with studies on its carcinogenicity potential (required by EPA) expected to be completed in 1994—-though "the registrant has requested a time extension for this study until September, 1995" (EPA-OPP 1992, 9).

Similarly, the APHIS assertion that malathion does not cause delayed peripheral neuropathy (DEIS 91), is apparently in direct contradiction to the results of studies by the US Army and others (US Army 1976; Bushnell 1991).

In regard to malathion's potential for causing ophthalmological damage, a great deal of toxicological and legal discussion has focused on the case of a 15-year old boy who reportedly looked upward outside his home in the Los Angeles area as a helicopter flew overhead spraying malathion. According to a report completed by USC School of Medicine ophthalmologist Dr. Sadun, the boy suffered permanent loss of vision to the point of "legal blindness" (Sadun 1990). An EPA consultant reviewing Dr. Sadun's report concluded that the patient's condition was probably a condition secondary to malathion exposure (Wagner 1990). Meanwhile, results of ocular toxicity testing required pursuant to EPA's reregistration process for malathion are not due at the agency until June 1994.

- *Lack of Health and Exposure Studies*

Computer estimates generated by risk assessments are particularly uncertain when not supplemented and validated by actual monitoring, but despite the many opportunities for study

afforded by the long history of medfly eradication projects since 1929, epidemiological data remains extremely limited. In effect equating lack of data with lack of significant risk, the EIS (cf. DEIS 96), contains a plethora of such phrases as "based upon the limited evidence, program use of [a given pesticide] should not pose an unacceptable risk." When coupled with selective use of data, the high number of data gaps concerning degradation products, residues and exposure, tend to skew the agency's assessments against high risk estimates.

Such judgment calls reject advice from EPA, the California Department of Health Services (CDHS), and the blue ribbon Malathion Public Health Effects Advisory Committee (MPHEAC) convened by the state of California to examine the risk question. In a risk assessment begun before the 1989-1990 Los Angeles project and completed following it, the CDHS, while stopping short of a recommendation to halt the spraying, warned that in light of numerous significant gaps in the database for malathion, the proposed aerial application project should be "reconsidered" (CDHS 1991, 8-46).

After the project, the MPHEAC concurred, noting that before the health effects of malathion in general or the spray program in particular could be known, a great many additional studies would have to be done—including studies on neurotoxicity, ocular effects, immunotoxic affects, reproductive and developmental effects, genotoxicity and carcinogenicity. The MPHEAC report recommended that "the use of aerial malathion-bait applications in urban areas for agricultural pest eradication be. . .used only when all other safer, less intrusive alternatives have been exhausted" (MPHEAC 1992, 19).

As early as April 1991, EPA's Health Effects Division notified California that "the evaluation of the use of malathion over a large human population (as in urban areas) would require a more extensive database than that which is currently available, given the need to suitably evaluate the exposure and to assure the protection of the general population"[8] (EPA-HED 1991a, 1).

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[8] The HED memo, one of a series of EPA memos reviewing the CDHS assessment document, includes several specific critical comments on the toxicology and exposure components of CDHS' conclusions, noting (among other points) that 1) "there were no actual human monitoring data with respect to post-application exposure"; 2) "under certain high exposure scenarios, there was little or no margin of exposure (margin of safety, as used in the document) for skin irritation and 20% inhibition of acetylcholinesterase activity"; 3) "although these [model-derived exposure] estimates may provide a fair characterization of the risk because of conservative exposure estimates, this characterization still abounds with uncertainties"; 4) "additional chronic studies on these compounds [malathion and malaoxon] are needed to research the endocrine pathology and the mechanisms of the genotoxicity"; 5) "CDHS requires at least two positive studies before a chemical is considered carcinogenic [whereas EPA] may determine that a chemical has carcinogenic properties based on one positive study," and although "because of the lack of adequate evidence of carcinogenicity CDHS does not classify malathion or malaoxon as a carcinogen," EPA's "HED continues to have a concern for the carcinogenic potential" of the chemicals; 6) "HED has concerns for the potential damage to the eye from exposure to malathion"; 7) "To reduce the number of assumptions required for a risk assessment of the aerial application of the malathion-bait. . . .at a minimum, data from an acute testing battery should be available for a health assessment"; 8) also, to reduce the number of assessments for a risk assessment, additional exposure data would be useful"; and 9) "HED's most current DRES analysis based on anticipated residue and crop treatment data shows that exposure from consumption of treated crops is estimated to be approximately 120% of the RfD. For non-nursing infants and children up through age twelve, the dietary exposure ranges between 175% and 250% of the RfD" (EPA 1991a, 1-3).

In October 1991, EPA's Office of Pesticide Programs (OPP) responded to APHIS' request for a quarantine emergency exemption in Florida by stating that:

> the database for malathion is inadequate to assess the risks from aerial bait-spray applications over densely populated areas. Significant toxicology data gaps exist in the areas of chronic toxicity, carcinogenicity, ocular toxicity, and neurotoxicity. Data to adequately assess exposure of the population to malathion as a result of this use are also unavailable (EPA-OPP 1991, 16).

For the most part the agencies still have not had those studies done. What few studies the state did conduct, "did not," as EPA noted later, "contain adequate exposure data to fulfill EPA's standard guidelines for reregistration studies" (EPA-OREB 1992, 3), a criticism which strongly echoes EPA's earlier conclusion that "the level of uncertainty [in the February 1991 CDHS risk assessment] in estimating exposure doses is probably large, but not quantifiable," that "the environmental monitoring was not designed to be `representative' nor was it designed to look at specific issues addressed by these calculations," and that "if [the limited data included in CDHS assessment] "had been submitted in support of an application for reregistration, it would not be acceptable" (EPA-OREB 1991a, 2).[9]

Los Angeles is not the only target area lacking basic health and ecological studies. As the APHIS Human Risk Assessment document notes, for example, location analyses were not done for Arizona and several other of the potential program states (Syracuse 1992, 3-6). Nonetheless, the APHIS proposal contemplates Los Angeles-style spraying in those areas.

EPA is currently requiring malathion registrants to fill some of the data gaps during that agency's reregistration process, and some studies are underway. Besides cancer studies, EPA has issued data call-ins on acute dermal toxicity, acute inhalation, primary dermal irritation and dermal sensitization, and health effects to workers and bystanders. The state of California, however, in an action of particular significance to the public's right-to-know, has petitioned EPA to waive the data call-in requirement for most or all of the acute studies except for the last two (EPA-OPP 1992, 14).

Risk Management: Notification as Mitigation

The issue of how risks and benefits are distributed over society remains one of the most distressing aspects of chemical eradication programs. The risk to populations such as the chemically sensitive, the homeless and those (usually with low incomes) who have protein deficient diets is far greater than the risk to the "general population" from which the agency derives its risk figures. The risk to the very young (NAS 1993) and very old is greater than for the general population, and the risk for children playing outdoors, on open areas and surfaces, is especially great (Brown 1993). Thus, in attempting to protect a particular economic sector (the agricultural industry), eradication programs subject large populations of other sectors of society (especially urban residents) to toxic chemical exposures.

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[9] Post-project studies carried out by the California Department of Food and Agriculture are referenced in the DEIS (p.79) only in regard to malaoxon concentrations in swimming pools.

The potential transgressions against civil and human rights implicit in these spray programs[10] are perhaps most apparent in the inadequacy of the measures they propose for preventing exposure of the chemically sensitive, but they are equally abusive of others. APHIS admits that even with all the precautions built into its risk assessments and operating procedures, there may well be disproportionate risk to low-income and sensitive populations (DEIS 112), but defers the issue for consideration in site specific reviews and environmental assessments to be done later in individual states. The EIS outline of mitigation procedures says merely that efforts will be made to notify people who are on "the list"—in reference, presumably, to some register of chemically sensitive individuals. Most target states have no such register.

Critics have argued that chemical sensitivity is a generic issue which must be addressed in the EIS as well as in site-specific analyses. While insisting that preventing exposure is the only realistic way of protecting the chemically sensitive, they argue that the EIS must at a minimum spell out standard notification and mitigation measures. Critics have also argued that such measures are required by the Americans with Disabilities Act, which includes the chemically sensitive under its protections.

APHIS, however, insists that risk will be minimized to acceptable levels by the notification process, an assumption based on the inter-related beliefs that 1) notification can be effective enough to reach most of the most-at-risk individuals; 2) reaching "most" such individuals provides an "acceptable" level of protection; and 3) notification is equivalent to actual prevention or mitigation of harm. Assuming that notification were to reach citizens, the kind of notification APHIS proposes and is distributed by the CDHS (CDHS 1993) contains only advice to seek more information from family physicians and to stay indoors, the latter of which may expose people to greater risks than ambient concentrations since, as noted above, indoor concentrations of pesticide may be greater than outdoor ambient concentrations (Brown 1993). The notification protocol has been strongly criticized by California's experts panel as ineffective and in need of radical improvement (MPHEAC 1992, 23).

The dangers of seeking refuge indoors are also illustrated by an incident in Tucson where the air conditioners of an elementary school pulled in air from outside that had been contaminated with malathion by a homeowner a few doors down the street who was hand-spraying four rose bushes in his yard (Revere and Rigg 1987). As a result, 296 students were rushed to hospitals, all but 10 of whom were treated for respiratory problems, headaches, vomiting and other systemic disorders.

Furthermore, notifications to stay indoors are particularly ineffective when the agency giving the notification is also saying that there is little or no hazard to health, or when people are likely to want to be outside (as they typically do during hot spray season months in the southern and southwestern states covered by the proposed program).

APHIS concedes that one of the weakest parts of its proposal is the notification procedure. It is also an area where non-dollar costs to the public are readily seen. Improvement of the notification process would presumably involve considerable costs in time and personnel to make personal contact with citizens in targeted areas. One of the reasons the notification procedures

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[10]And others. Besides its plant and animal quarantine programs, APHIS is also responsible for broadscale chemical programs against Bollworm and Boll Weevil, Rangeland Grasshoppers and Mormon Crickets, Gypsy Moth and other invertebrates, as well as the controversial Animal Damage Control program that targets such birds and mammals as blackbirds, ravens, coyotes, bears, wildcats, mountain lions and other predators.

have not been effective may be that the increased cost of effectiveness (like the increased costs of labor intensive, non-chemical suppression methods), if weighed against the proclaimed benefits of the program, might show that the presumed costs of the program are not as great as thought.

But fine-tuning the procedure with economic analyses will not address the main concern, which is that there is no way to effectively notify or prevent exposure to millions of people in an urban spray program. The only fully effective means to prevent exposure is not to spray. Given this obvious fact, and the multiplicity of data gaps concerning exposure and health effects, it becomes apparent that the APHIS proposal rests on undisclosed cost-benefit assumptions, flawed risk assessments and, ultimately, on unilateral judgments about what constitutes "acceptable risk" not only to sensitive populations, but to all exposed individuals and the environment.

Management vs. Eradication

Continuing to spray millions of people with toxic pesticides is not a viable solution to the medfly problem. Just as a rational program requires clear criteria by which to measure success or failure, it also requires reasonable goals. Eradication does not meet this criterion. The EIS contains no cost-benefit analysis, but insofar as tradeoffs between costs and benefits are necessary, critics argue that a more reasonable approach would be for the industry to identify acceptable levels of medfly damage and manage populations to keep losses below the acceptable threshold. Such determination of viable economically acceptable thresholds is a basic step in any Integrated Pest Management program and has been successfully employed in medfly programs outside the continental United States.

In Chiapas, Mexico, for instance, where medfly is established, an organic farming cooperative, afraid of losing its organic registration, blocked the government spraying of malathion and began successfully controlling medfly with biological alternatives, including release of parasitic wasps. Organic agriculture advisors from California assisted Mexican organic coffee farmers who developed a low cost, effective management program combining release of medfly natural enemies, predator conservation techniques, sterile male releases and baiting with pheromone traps containing botanical insecticides. The Chiapas program, which stresses management rather than eradication, combines biological and physical controls with education measures, and through recognizing a certain level of medfly infestation as economically acceptable, has allowed farmers to cut down sharply on the use of chemical pesticides while retaining economic viability (PANNA 1992, 13; JPR 1993, 30).

While APHIS recognizes that setting an "economically acceptable level of infestation" would be necessary if anything other than eradication using chemicals were the chosen objective, the agency does not consider such an option under its current policy.

Despite APHIS' longstanding assertion that biological controls are ineffective, two months after releasing its DEIS, APHIS was working in cooperation with Florida's Department of Agriculture to release 1.5 million parasitic wasps in citrus-growing areas of that state to combat the Caribfly. As explained by the administrator of Florida's Division of Plant Industry, the biological alternative was chosen after more Caribflies had been detected than ever, despite the ten year history of the state's chemical program (Shuchman, 1993). The successful use of parasitic wasps in the Chiapas program and elsewhere (Tumlinson, 1993), presents a strong argument that this method deserves wider attention and application than it has been given in past and present APHIS programs.

Similarly, APHIS refers only obliquely and with little apparent enthusiasm to a medfly management program in Hawaii that "could contribute to ultimate eradication of these pests in Hawaii, thereby reducing risk of spread to the conterminous [sic] United States" (DEIS 37). The EIS does not mention that the Hawaiian studies being conducted by APHIS' sister agency, USDA's Agricultural Research Service (ARS), are showing that biological control of soil medfly larvae with nematodes have demonstrated a success rate up to 97% (Associated Press 1991).

Effective biological and other non-chemical alternatives are available, many of them mentioned in the EIS, including release of sterile male flies; physical controls like host elimination or fruit stripping; cultural controls like clean culture, crop rotation, trap cropping, resistant varieties, etc.; male annihilation through trapping, lures, etc.; biological control with parasites, pathogens and predators; and biotechnological control through genetic manipulation of the host crops, the flies or both.

For a variety of reasons, APHIS also dismisses or ignores other less toxic alternatives to chemical control. Cold Treatment or Vapor Heat Treatment alternatives to methyl bromide fumigation, for instance, are dismissed (DEIS 43) because they would require specialized facilities (i.e., specialized for something other than the existing specialized process), a particularly shortsighted position considering methyl bromide's high toxicity and poisoning rates (CAN 1992; O'Brien 1992) and the EPA's plan to phaseout use of the pesticide by the year 2000 as a Class I ozone depleter under the Montreal Protocol (EPA-OAP 1993).

The EIS does not mention other ARS research indicating that application of relatively harmless Gibberellic Acid to citrus crops was an effective deterrent to medfly damage (Silva 1993). Nor does the EIS mention another commercially available biological control measure—an extract derived from the Neem tree which grows in Thai rainforests. This product has reached U.S. markets, acts against more than 200 types of insects including medfly (Stix 1992), and has been approved for use in Los Angeles County.

The agency does not attempt to demonstrate that such alterative methods are infeasible, and admits that in practice its programs will continue to use most or all of the chemical and non-chemical techniques mentioned in the EIS (DEIS 1), but nonetheless dismisses non-chemical alternatives on the grounds that they do not show "immediate results"; are "ineffective" on low pest populations like the medfly; are labor intensive; require careful and extensive pre-planning; show "unproven efficacy and lack of immediate results for large scale emergency medfly eradication programs" (DEIS 36); present logistical difficulties in maintaining large numbers of biocontrol agents on hand (DEIS 37); or otherwise are considered better suited for long-term management than short-term "emergency eradication." Non-chemical methods in general are dismissed because the agency's one attempt 20 years ago to achieve eradication through use of sterile male flies didn't work (DEIS 16, 32).

However, the "immediate effectiveness" criterion is generally necessary only in crisis, not long-term management. Eradication, as practiced by APHIS and its cooperating agencies, is unrelentingly short-term. The difference between short-term "eradication" and long-term "management" is more than merely semantic: it requires a switch in mindset from the outmoded mentality of "the-only-good-medfly-is-a-dead-medfly" to the more realistic goals of identifying economically acceptable levels of medfly and developing sustainable agricultural practices that keep damage at or below those levels.

According to the APHIS, such a program is not impossible, the main difference between the preferred alternative and an Integrated Pest Management (IPM) approach being that under IPM "the program would vary its use of control methods to protect human health, nontarget species. .

.sensitive areas, and other components of the environment. Program managers also would utilize specific protection measures and/or mitigations. . .to maximize efficacy and minimize environmental risk" (DEIS 43-44). This doesn't sound too bad. In fact, it sounds very close to exactly what APHIS should be doing in the short term, rather than continuing ineffective eradication programs that expose millions of people to toxic pesticides.

In the long term, however, critics of chemical programs point out the need to go beyond IPM and similar partial approaches. What is needed instead, they argue, are programs to foster development of viable agricultural systems that are not dependent on high inputs of expensive petrochemicals, but which instead can be sustained in the long term in co-existence with pests. Such systems require *cultural* methods (crop diversification, use of species and varieties that are resistant or bear at times when they are less susceptible, etc), and the acceptance of certain economic thresholds for crop damage. The goal, in short, is sustainable agriculture, which, given sufficient incentives by the Clinton administration through a comprehensive, adequately funded R & D program at USDA, could go a long way toward replacing outmoded, ineffective eradication programs.

References

Action Now 1993. Comments on Draft Programmatic Environmental Impact Report: The Exotic Fruit Fly Eradication Program Using Aerial Application of Malathion and Bait (June 1993).

ACLPI 1993. Arizona Center for Law in the Public Interest. Medfly Eradication Program - Draft EIS (May 21, 1993).

Associated Press 1991. Worm Seen as Weapon Against Fruit Fly. *New York Times* (December 27, 1991), p. A13.

Birnbaum, Linda S. 1993. Advances in Estimating and Predicting Health Effects from Exposure to Environmental Toxicants. Paper presented to the USPHS-ATSDR International Congress on the Health Effects of Hazardous Waste, May 3-6, 1993, Atlanta, Georgia.

Brenner, Loretta 1992. Malathion. *Journal of Pesticide Reform* 12(4):29.

Brown, Mark A., et al. 1993. Monitoring of Malathion and Its Impurities and Environmental Transformation Products on Surfaces and in Air Following an Aerial Application. *Environmental Science and Technology* 27(2): 388-397.

Bushnell, M. [1992]. *Journal of Pharmacology and Experimental Therapeutics*; cited in, Tina Adler 1992, Pesticides' Long-term Effects Get a Closer Look from EPA, *American Psychological Society Newsletter* (December, 1992), p. 44.

CAN 1992. California Action Network et al. Into the Sunlight: Exposing Methyl Bromide's Threat to the Ozone Layer (November, 1992).

Carey 1991. Carey, J.R. Establishment of the Mediterranean Fruit Fly in California. *Science* 253: 1369-1373.

CDHS 1991. California Department of Health Services. Health Risk Assessment of Aerial Application of Malathion-Bait. California Department of Health Services (February 1991).

CDHS 1993. California Department of Health Services. Answers to Health Questions about

Aerial Application of Malathion (July, 1993).

Cohen, Steven D. 1984. Mechanisms of Toxicological Interactions Involving Organophosphate Insecticides. *Fundamentals of Applied Toxicology* 4:315-324.

Davis, Devra 1993. Overview of Environmental Epidemiology: Establishing Causal Links between Exposure to Hazardous Waste and Human Disease. Paper presented to the USPHS-ATSDR International Congress on the Health Effects of Hazardous Waste, May 3-6, 1993, Atlanta, Georgia.

Dementi, Brian. 1991. Ocular Effects of OPs. EPA Office of Hazard Evaluation Division (27 March 1991).

Dolan, Maura and Dunn, Ashley. "Growers Express Fears and Anxiety Over Medfly War", *Los Angeles Times*, (January 12, 1990), p. B-8.

Dobroski, Charles J. et al 1987. Malathion: A Profile of Its Behavior in the Environment. Submitted to USDA-APHIS-PPQ under Contract No. 53-6395-1-1151.

EPA-HED 1991a. Review of the Health Risk Assessment of Aerial Application of Malathion-Bait submitted by California Department of Health Services. Memorandum from Penelope A. Fenner-Crisp, Director Health Effects Division to Anne E. Lindsay, Director Registration Division, dated 24 April 1991.

EPA-OPP 1991. Section 18 - USDA Quarantine Exemptions for Use of Malathion and Diazinon to Eradicate Exotic Fruit Fly Species in Florida—ACTION MEMORANDUM. Memorandum from Anne E. Lindsay, Director, Registration Programs to Douglas D. Campt, Director, Office of Pesticide Programs.

EPA-OAP 1993. 58 *Federal Register*, at 15014 (18 March 1993).

EPA-OPP 1992. Section 18 - Quarantine Exemption for the Use of Malathion to Eradicate Exotic Fruit Flies in California (EE#93-CA-02) —Action Memorandum from Lawrence E. Culleen, Acting Director, Registration Division to Douglas E. Campt, Director, Office of Pesticide Programs dated 14 December 1992.

EPA-OREB 1991a. "Exposure Estimation" in: California Department of Health Services' "Health Risk Assessment of Aerial Application of Malathion-Bait." Memorandum from Mark I. Dow, Special Review and Registration Section, Occupational and Residential Exposure Branch to Penelope Fenner-Crisp, Director Health Effects Division, dated 18 April 1991.

EPA-OREB 1992. OREB Response to Questions from OMB Regarding the Malathion Data Call-n (DCI). Memorandum from Jeff Evans, Reregistration Section to L. Rossi, Branch Chief, Reregistration Branch, Special Review and Reregistration Division.

EPA-TB I 1991a. California Health Risk Assessment of Aerial Application of Malathion-Bait. Memorandum from Brian Dementi, Review Section III, Toxicology Branch I to Flora Chow, Chemical Manager, Reregistration Section, Science Analysis & Coordination Branch, Health Effects Division, dated 19 April 1991.

Greenpeace 1991. The Use and Environmental Impact of Organophosphorus Compounds in the Mediterranean Region. Submitted by Greenpeace International to the Joint Meeting of the

Scientific and Technical Committee and the Socio-Economic Committee of the Mediterranean Action Plan. Athens, 6-10 May 1991.

Hawkins, Larry 1993. Medfly Cooperative Project. Personal communication, cited Action Now 1993, p.9.

IARC 1983. World Health Organization, International Agency for Research on Cancer, IARC Monographs on the Carcinogenic Risk of Chemicals in Humans—Miscellaneous Pesticides (vol. 30).

IPMWG 1986. Integrated Pest Management Working Group, The Path from Here: Integrated Forest Protection for the Future, ed. Dave Brown, et.al. Albuquerque, N.M.: USDA-Forest Service, Region 3.

JPR 1993. Anon. Biological Control of the Mediterranean Fruit Fly. *Journal of Pesticide Reform* 13(1): 30.

Lioy, Paul J. 1993. Frontiers of Exposure Assessment for Hazardous Waste Sites. Paper presented to the USPHS-ATSDR International Congress on the Health Effects of Hazardous Waste, May 3-6, 1993, Atlanta, Georgia.

Lucier, George W. 1993. Molecular-Epidemiologic Approaches to Assessing Public Health Impacts of Hazardous Waste. Paper presented to the USPHS-ATSDR International Congress on the Health Effects of Hazardous Waste, May 3-6, 1993, Atlanta, Georgia.

MPHEAC 1992. Malathion Public Health Effects Advisory Committee Final Report: Charges and Recommendations. California Office of Environmental Health Hazard Assessment, Pesticide and Environmental Toxicology Section (February 1992).

NAS 1993. National Research Council. Pesticides in the Diets of Infants and Children. Washington, D.C.: National Academy.

NRC 1993. National Research Council. *Environmental Epidemiology vol. 1: Public Health and Hazardous Wastes*. Washington, D.C.: National Academy.

NRDC et al, 1993. See, e.g., August 27, 1993 Memo to federal Interagency Working Group on Pesticides from Natural Resources Defense Council, Public Citizen, World Wildlife Fund, Pesticide Action Network, Public Voice and Environmental Working Group .

O'Brien, Mary. 1992. Methyl Bromide: Time to Stop the Killing. *Global Pesticide Campaigner* 2(3): 1, 4-5, 12.

Otten, Noel, 1993. Action Now. Personal Communication (October 27, 1993).

PANNA 1992. Indigenous Cooperative Blocks Malathion Spray Program. Pesticide Action Network North American Regional Center *Global Pesticide Campaigner* 2(4): 13.

Reuber, Melvin D. 1985. Carcinogenicity and Toxicity of Malathion and Malaoxon. *Environmental Research* 37:119-153.

Revere, C.T. and Melissa Rigg 1987. Spray Enters Coolers at Homer Davis Elementary. *Arizona Daily Star* (25 April 1987), p. B-1.

Richter, E.D., et al, 1992. Illness and Excretion of Organophosphate Metabolites Four Months after Household Pest Extermination. *Archives of Environmental Health* (March/April 1992 [Vol. 47, No.2]).

Rodgers, Kathleen, et al, 1992. Mechanisms of the Modulation of Purine Peritoneal Cell Function and Mast Cell Degranulation by Low Doses of Malathion. *Agent Action* 35:57-63.

Sadun, Alfredo, M.D. 1990. Letter to Brian Dementi, USEPA, Wash. DC, 1 Aug. 1990.

Segawa, R.T. et al. Calif. Dept. of Food and Agriculture. Environmental Monitoring and Pest Management, "Environmental Monitoring of Malathion Aerial Applications used to Eradicate Mediterranean Fruit Flies in Southern California, 1990", EH 91-3, (3/91), p.4

Shuchman, Lisa, 1993. Florida Fights Fruit Flies with Wasps. *San Francisco Chronicle* (July 14, 1993).

Sierra Club and Arizona Toxics Information 1993. Comments on the USDA-APHIS Medfly Cooperative Eradication Program Draft Environmental Impact Statement—1993. Bisbee, Arizona, June 18, 1993.

Silva 1993. J. Silva. Tougher Peel Repels Fruit Flies. *Agricultural Research* 41(2): 14-18.

Stix, Gary, 1992. Village Pharmacy: The Neem Tree Yields Products from Pesticides to Soap. *Scientific American* (May 1992) p. 132.

Syracuse 1992. Human Health Risk Assessment: APHIS Fruit Fly Programs. Syracuse Environmental Research Associates (November 1992).

Syracuse 1993. Nontarget Risk Assessment for the MEDFLY Cooperative Eradication Program. Syracuse Environmental Research Associates (February 1993).

Tumlinson, James, et al, 1993. How Parasitic Wasps Find Their Hosts. *Scientific American* (March 1993) p. 100-106.

U.S. Army 1976. Study #51-051-73/76.

Wagner, Sheldon 1990. Letter to Frank Davido, OPP Pesticide Incident Response Officer (24 August 1990).

Waldman, Jed 1993. A Framework for Exposure-Dose Modeling and Data Needs for Hazardous Waste Sites. Paper presented to the NIEHS Joint United States-Mexico Conference on "Fate, Transport and Interactions of Metals," April 13-16, 1993, Tucson, Arizona.

Wallace, Lance A. 1987. The Total Exposure Assessment Methodology (TEAM) Study: Summary and Analysis: Volume I. EPA/600/6-87/002A (June 1987).

Wegman, Patricia Ostrosky 1993. Human Biomarkers in Exposed Populations. Paper presented to the NIEHS Joint United States-Mexico Conference on "Fate, Transport and Interactions of Metals," April 13-16, 1993, Tucson, Arizona.

Wheeler 1993. Wheeler, Mark. Fly Wars. *Discover Magazine* (February 1993), pp. 42-53.

Pesticide-Use Reduction: The Core Element in IPM (1993)

Michael Gregory, remarks to Arizona Clean and Beautiful, “Illegal Dumping Forum III,” Phoenix, Arizona (5 November 1993)

Environmentalists and farmers, farmworkers and the public have mutual concerns about pesticides in the water and air and about high cancer rates in our communities and on the farm. Recent studies have shown that a high percentage of Superfund sites contain pesticides and that over 20% of the volatile hydrocarbons in the ambient air of Maricopa County is from pesticides.

The National Academy of Sciences (NAS) estimated in 1989 that some 20,000 new cases of cancer occur each year in the United States from residues of just eight pesticides on raw produce. A growing number of studies by the National Cancer Institute and others indicate that farmers and farmworkers are at especially high risk, and a number of other recent scientific studies show that many pesticides, especially those like DDT that contain chlorine and act like estrogenic hormones in our bodies, are implicated in breast cancer.

But cancer may be the least of our worries. Studies of non-cancer effects of toxic chemicals are looking these days at things like the worldwide 50% drop in male fertility since 1938, nerve damage resulting in subtle behavioral deficiencies, immune-system damage and other long-term chronic problems. The NAS report released this past summer, for instance, is a scathing indictment of the failure of our traditional ways of managing pesticides to protect our children not just from cancer, but from a wide variety of toxic effects of pesticides.

The best current thinking about pollution—not just pesticides but all pollution, is that once it's out there you can't really control it: the one-chemical-at-a-time, command and control system just doesn't work; for one thing, it's based on the disproved "assimilative capacity" theory that nature and living organisms can absorb and detoxify our waste products as long as we put it out in limited amounts, but there are just too many people and too many unnatural synthetic chemicals for the theory to work. Instead of detoxification we get contaminated wells, polluted air, holes in the ozone layer, birth defects and cancer. The little-bit-here, little-bit-there system is in fact nickel-and-diming us to death.

The alternative to the assimilative capacity model is the precautionary principle which recognizes that once persistent and bioaccumulative chemicals are produced there's no way to keep them out of our water, food and internal organs; which assumes that the stuff is bad until proved otherwise; and which prompts us to take action to prevent its spread wherever possible rather than putting it out and then trying to regulate at the end of the pipe. The way to deal with pesticides is not through regulation, but through elimination and reduction. That was the original purpose of IPM, and I'm glad to see that after many perversions of that basic meaning, we're finally returning to the original sense of the term: IPM means pesticide use reduction, and the heart of use-reduction is diversification.

That's the approach taken in several European countries and it works. Farmers in Sweden, for instance, cut pesticide use by 50% between 1985 and 1990, and have established a second round reduction goal of another 50% by 1997. The Netherlands. the second largest exporter of agricultural produce after the U.S., has implemented a plan to cut pesticide use 30% by 1995 and an additional 50% by 2000. In 1991, eighteen Mediterranean area countries signed the Barcelona Convention, committing themselves to phase out use of all organophosphate pesticides "hazardous to human health and the environment" by the year 2005.

If they can do it in Europe, and they are, without economic hardship on farmers, then we can too. The question, is how to get there from here. I see five essential steps, based on the successes of farmers in other countries as well as those who have already made the switch towards sustainable agriculture here in the U.S.

(1) First, to respond to the immediate danger, we have to ban pesticides known to cause cancer, birth defects, immune-system disease and other genetic poisoning. A good place to start would be by strengthening the Delaney Clause of the Federal Food Drug and Cosmetic Act, but banning residues is not enough; keeping in mind the precautionary principle, we also have to ban the use, manufacture and sale (including export) of those worst offenders. Where we already have alternatives (which we do in a great many cases), we should implement an immediate ban. Where we don't have alternatives yet, and where we absolutely *need* the chemicals, we should put them on a drop-dead phaseout schedule and at the same time put the government and industry on a crash R&D program to provide farmers with alternatives before the chemical is sunsetted.

(2) And by alternatives I don't mean just substituting another chemical. It's time to get off the chemical treadmill. And that's the second part of the "how to get there" answer. For too long. IPM has meant integrated pesticide management rather than *pest* management; but now we're beginning to see that what we really need is something broader than that, what we might call integrated *farm* management, which means returning farming to where it belongs, in the hands of farmers, and using government to give farmers the tools they need to raise food and fiber without toxic chemicals.

To do that, USDA and EPA will need to work together (something they've never been very good at) to aggressively fund R&D and technology transfer programs for sustainable agriculture: programs like USDA's SARE (Sustainable Agriculture Research and Education) and SATDTP (Sustainable Agriculture Technology Development and Transfer); and EPA's Agriculture in Concert with the Environment (ACE) program; and the programs mandated by the Organic Foods Production Act. Although the funding for many of these programs was appropriated by Congress, the previous administrations never fully implemented them, so many farmers are no closer to sustainable farming now than they were twelve years ago.

Not only do we need to implement these existing programs, we need to create and adequately fund new programs for on-farm participatory research, education and implementation of environmental and conservation practices. EPA, for instance, could spend less time on chemical management and more on coordinating various programs in water quality, IPM, wildlife protection, and air quality with sustainable agriculture initiatives—with an emphasis on source reduction and pollution prevention. It's time to overhaul the failed commodity/price support program based on crop production and acreage, and replace it with conservation-based supply management programs.

Once that's in place, then IPM will follow as a natural approach to sustainable agriculture.

(3) The third step in getting there involves our right to know: we need to overhaul our pesticide reporting system in several ways so that the public, farmers and farmworkers know what pesticides are being used where, and what their effects are. This means that:

(a) We should thoroughly train all growers and applicators in IPM as part of their licensing and certification, something that can be done easily during the Department of Agriculture's rulemaking.

(b) Next, we need to revise our Form 1080's so that all pesticide use is reported by all growers—including use of non-restricted pesticides by private applicators. California has already required full reporting without causing unreasonable burden on farmers, and other states can do the same.

(c) The forms should also include IPM information, not just pesticide information. For instance, applicators should have to include on their 1080's not only what they sprayed, but what less-toxic methods were considered and why they weren't chosen, what *levels* of pests were present, what natural predators were around, and so forth.

(d) Pesticide labels should be revised to disclose not only the active ingredients, but the so-called inerts, many of which are toxic in their own right, some even more toxic than the active ingredient. And the information should be in Spanish as well as English.

(e) Food products, raw and processed, should be labeled to let consumers know

(i) where they were grown,

(ii) what pesticide residues they contain and in what amounts, and

(iii) what pesticides were used in their production.

(4) The fourth step is money. In order to pay for our the state's crash program in technology transfer to facilitate the conversion to sustainable agriculture, we should sharply raise fees for pesticide registrations and for applicator licensing and certification. Even more important, we should sharply raise penalties for misuse of pesticides. The Department's existing and proposed violation and penalty schedules, for improper disposal, for instance, are a joke.

(5) And finally, farmers should stop the practice of individually disposing of pesticide containers by burning or burying them. This is just another version of the little-bit-there/little-bit-there problem. Instead of being disposed in the more or less random way they are now (which, in the case of burning, can produce more dangerous substances than the pesticide residue itself), containers should be disposed of like other hazardous waste.

Pesticide Regulation and Use: The Public Perspective (1994)

Michael Gregory, for the Sierra Club Grand Canyon Chapter, Draft Comments presented to the University of California, Riverside Desert Agriculture Institute Conference "Pesticide Regulation and Use: Conflict Resolution" Holtville, California, 29 April 1994

I'd like to start by expressing my thanks for the opportunity to speak to you today. It's a pleasure to be back in California, and especially in a valley where it rains and doesn't just blow like it's been doing for the past two months in my valley in Arizona.

It's also a pleasure to be able to add my encouragement to the Desert Agriculture Institute. The Institute provides a great opportunity for a balanced forum to find solutions to some of our problems. We need a space like that for growers to get together with the other constituencies, and the Institute could be that place.

But I want to note at the beginning, that I'm very uncomfortable with the role I've been assigned here today, supposedly representing the views not only of environmentalists (as if we all agreed with each other), but of consumers and labor and public and occupational health advocates too. Obviously I can't do that. In a sense, or course, as we've heard, we're all environmentalists, and we're certainly all consumers, but hopefully in the future the Institute will provide a truly balanced forum with equal time for specialists in each of those areas to present their special perspectives.

I also hope the Institute would take the lead in working not just for "economic growth," but for sustainability. As people all over the world have learned since the Earth Summit in Rio, sustainable development is a much more feasible goal than economic growth and that long-term sustained growth is, in fact, an impossibility, based on an outmoded economic philosophy; what we need is not unlimited growth, but sustainability.

In some ways it's nice to be the last one on a panel, because it gives you a chance to comment on the what the previous speakers said, and in that regard I want to emphasize that, as Jim Wells said, there is a great deal of disagreement about risk assessment. I don't want to take much time on that, but just to say that study after study has shown that risk assessment almost always underestimates the risk, and that whatever the science may be, when risk assessment becomes a tool of public policy, when it starts talking about acceptable risk, it basically gets down to saying that some of us are expendable.

There is a basic misunderstanding a lot of people have about risk assessment: when we say that the assessment shows there is, say, a one-in-a-million risk, that doesn't mean there is a one-in-a-million chance that somebody will die; it means there is a certainty that one person out of a million *will* die. And while that may be acceptable to some. if I'm that one it certainly isn't acceptable to me. I'll try to come back to that if there's time. And by the way, I've never heard anyone in the environmental field, or public health, or the other constituencies I work with, say that they wanted a risk-free world. Everybody knows you can't do that. What we do want is to get rid of unnecessary and avoidable risks, and that we can do.

As you know, in pesticide regulation as in other things, California leads the world. What happens here provides a model for the rest of us. California has some of the best pesticide regulations in the world, and hopefully will keep them. Other states and other countries depend on California to show us how to do it.

I'm told for instance, that there is a bill in your state legislature that would gut the state's *Birth Defect Prevention Act* by harmonizing standards down to the federal level. I hope not. Arizona's *Birth Defect Prevention Act* is modeled closely on yours, and I would hate to lose that important law in Arizona. One of the reasons the Sierra Club opposed NAFTA was because both the Bush and Clinton administrations wanted to harmonize pesticide standards to match international standards, which meant harmonizing downwards. It's very hard to harmonize upwards, and I'm afraid if you play that game with EPA, California and the rest of us will lose.

While I'm getting started, I should also mention that the Sierra Club has a long history of involvement in pesticide issues, which I can indicate simply by noting that Rachel Carson was the Club's first pesticide issues chair.

I'm not a farmer, but I come from farmers and I am a grower. For the past 20 years I've been raising a couple of acres of fruit trees and greenhouses in the high desert of southeast Arizona. I've seen the devastating effects of flood and drought and pests, know what it means to have the floods come in and drag the fences across the orchard pulling the trees up by the roots. I know what it means to have the pump break down run dry in the driest hottest part of the year and be too broke to get it fixed. And I've watched the grasshoppers come in and take not just the leaves and fruit but the bark and branches.

But I've also seen, as I'm sure most of you have, loved ones suffer and die of cancer. The National Cancer Institute statistics show that one out of every three people in this country these days comes down with one form of cancer or another, and one out of every four of us dies of it. And I suspect that everybody in this room somewhere senses that just isn't right, isn't anywhere near natural and has just got to stop.

And I've been on the other side of it too, picking peaches and apples, bending down all day in the sun to pick blackberries and currants, bending lower to pick strawberries and pull onions. And I've seen workers washing in pesticide-poisoned water, and drinking that water, and cooking with it, and their kids playing in it, and everybody in the field being doused with chemical when the planes come over—and that has got to stop too.

And though I believe very deeply in democracy, I have some serious doubts about majority rule, especially when that majority is a bunch of urbanites and suburbanites who think food comes from supermarkets and wouldn't know an udder or seed drill if they saw one. But no matter what we may think about one man/one vote or one woman/one vote, the political reality is that most people, most of the customers for agricultural products, do live in cities. And as you know, they are the ones who are demanding food safety for their kids and themselves, food without toxic pesticides, and water without toxic pesticides, and air without toxic pesticides. And those are the people who are going to drive the political process.

The result, as you know, is a changing regulatory environment in Washington and Sacramento, one in which the needs of the farmer are not usually given the same priority as the demands of the public. What I'd like to do in the next few minutes is suggest some ways that the demands of the public and the needs of the farmer can both be met.

But first note that I'm talking about the needs of the *farmer*, not the needs of *agriculture*, because those are not always the same and in some cases they're directly contrary to each other. And in many ways, it is the focus on *agriculture*, rather than on farms and farmers that has gotten us into the problems we face today.

I'll come back to that point, but first let's spend a couple of minutes looking at the pesticide

problem (from the perspective of at least this one environmentalist-consumer) and at the kinds of political response that is going to come out of Washington in the next few months.

The Problem

The problem, of course, is many problems. We can lump some of them under the headings of environment, human health and agriculture. I think we are all aware of these, so I don't want to dwell on them, but a quick review is probably useful.

Environment

- Water

  • high consumptive use
  • polluted run-off (cf. New River): surface water and groundwater, contaminated wells

- Noise (irrigation pumps)

- Air

  • As you know from the example of Methyl bromide, most pesticides contain high levels of volatile organic compounds (VOCs) that destroy the ozone layer or contribute to global warming

  • But a lesser known problem of air pollution is re-entrainment as pesticides that settle on the ground are put back into the air with dust, a particularly important problem in the desert where thermal uplifts and twisters can carry pesticide chemicals hundreds of miles from the place where they were applied

- Soil

  • sterilization
  • dermal absorption (animals, humans)

- Wildlife/Vegetation

  • including threatened and endangered species

- Food residues

  • Residue testing by FDA etc. is a joke

  • Market basket surveys consistently show high levels of pesticides, even though pesticide application is presumably done according to label instructions

  • Even if residues are within limits, the standards are too weak to offer protection (as pointed out, for instance, by the recent National Academy of Sciences report on risks to children)

Agriculture

- Cost of energy-intensive off-farm inputs

- Resistance (cf. whitefly)

Human Health

First and foremost, pesticides are a health issue, and while health *care* is important, it is an end of the pipe approach. Pesticide reform means disease (and pollution) prevention. We want to protect our kids and ourselves and our environment from toxic chemicals that are just too hazardous to allow in our food and, in many cases, too hazardous to use at all.

- Life-cycle analysis: manufacturers, growers, workers (mixer/loaders, applicators), public

- Cancer is on the increase, especially incidence of those kinds that are associated with environmental contamination: breast cancer, ovarian cancer, prostate cancer, testicular cancer, bladder cancer, kidney cancer, non-Hodgkins Lymphoma

- And some occupational groups are more prone to cancer than others—and farmers have some of the highest rates of some kinds of cancer, again, those kinds that are associated with man-made contamination.

- Cancer may be the least of our worries: transgenerational reproductive disease of other kinds is showing alarming increases in industrialized countries in the past few decades: hermaphroditism, low fertility, etc

- Persistence and bio-accumulation: current science is showing a number of new findings that indicate why pesticides are so dangerous, including findings on the mechanisms of toxicity and the significance of low-dose exposures. For example, we now know that in some cases, the reason low doses seem to have a disproportionately heavy effect, is that synthetic persistent chemicals and those that bioaccumulate, because they remain in the tissue, repeat their effect over and over as long as they remain, so the dose cannot be calculated on the one-hit model but must be seen as a magnified, repeated or continual exposure. But our standards for pesticides generally don't take that kind of effect into account.

- Which is one of the reasons the old "innocent until proved guilty" approach to chemical regulation just won't work anymore. We need to prevent exposure, not wait and see what happens or, as risk assessment does, try to see how much we can get away with.

The Program: Proposals in Congress

At the present moment, there are three bills kicking their way through Congress that are going to change the way you do business. Or actually, there is one bill and two packages that haven't been introduced as bills yet but will be in the near future.

The one that has been introduced is Rep. Waxman's House bill H4091, the Pesticide Food Safety Act of 1994, which deals with pesticide residues on food and will amend the *Federal Food, Drug and Cosmetic Act* (FFDCA).

The second is a *Pesticide Use Reduction Act* proposal by the National Campaign for Pesticide Policy Reform (NCPPR) which would amend FIFRA by creating regional farmer-based

programs for identifying transfer of best reduction methods from farmer to farmer.

The third is the package announced by the Clinton administration on Monday, which they are calling the Pesticide and Food Safety Reform Proposal, which is a kind of weaker version of the other two that would amend both the Food and Drug Act, and the *Federal Insecticide, Fungicide and Rodenticide Act* (FIFRA).

The Program: Phase-Out of Unacceptably Toxic Pesticides

Both the Waxman bill and the Administration proposal contain provisions for phasing out pesticides that present unacceptably high hazards to human health and the environment. In general, the Administration proposal is a weaker compromise, and it's not clear at this point how much their proposal is just rhetoric rather than being able to actually get done what they say it will. But I haven't seen the actual language of the Administration proposal yet, only their press releases, so what I'll do is give you a summary of the main points of the Waxman bill and note what we do know about how the Administration addresses those points.

- The Waxman bill would direct EPA to phase out tolerances on both raw and processed foods for Class A & B carcinogens (i.e., "known and probable human carcinogens") and other "high hazard pesticides," including potent neurotoxins (basically, current TOX I pesticides), reproductive and developmental toxins, endocrine-disruptors, persistent and bioaccumulative pesticides, and pesticides that present special risks to children, infants, embryos and other sensitive subpopulations. Under the Waxman bill, the EPA listing would be based on existing definitions and lists.

The Administration would use a weaker standard for determining which pesticides, if any, get phased out, including a complicated and questionable risk assessment procedure. The phase-outs would occur within five years under Waxman, in approximately seven years under the Administration proposal, with extensions possible under both (three years under Waxman, five years for the Administration) in extraordinary circumstances—for instance, if banning a particular chemical would cause a severe drop in food supply on the national market.)

- Both bills, to varying degrees, would put the burden of proof on registrants to prove that a pesticide shouldn't be phased out, rather than leaving the burden where it is on, on the public and the environment

- Under the Waxman bill, pesticides would be phased out if either active and so-called "inert" ingredients present the high hazard properties. The summary of the Administration proposal I've seen doesn't mention inerts, which are often more dangerous than the active ingredients.

- Under both proposals, EPA would be given a date certain by which to develop phase-out lists and testing procedures.

- Both proposals would require that food tolerances for pesticide residues comply with the recommendations of the National Academy of Science report for protecting children and infants (e.g., figuring an additional 10-fold safety factor into risk assessments when human effects are known, or a 100-fold factor above the NOEL if the assessment is based only on animal data).

- In tolerance setting for residues, both Waxman and the Administration would require EPA to take into account the cumulative effects of multiple exposure from multiple sources of the

same pesticide (whether on the same or different foods, or from other sources (water, etc). I'm not clear at this point if the Administration would give the same weight to these factors as the Waxman bill.

- The Waxman bill also requires that EPA take into account cumulative effect of multiple sources of exposure to other chemicals with the same or essentially similar pharmacological effects as the pesticide chemicals. I don't know how or if the Administration proposal addresses this issue.

- In the Waxman bill, these provisions for setting tolerance would apply to raw as well as processed foods.

- In regard to Class C carcinogens (those that are "potential human carcinogens"); the Waxman bill gives registrants a couple of years to demonstrate that these chemicals should not be classified instead as A or B carcinogens. The strength of this is that it will no longer allow registrants to keep potential carcinogens on the market just because they haven't done the tests yet.

In cases where the tests have been done but the data are still equivocal (for instance, when cancer is caused in one test animal species but not another), the Waxman bill would allow residues in foods, but would require that they be kept below levels that would cause no more than one person out of a million to get cancer, and would require EPA to publish a list of those chemicals within one year, and to "inform the public of its exposure to" those pesticides. The Administration doesn't address the public's right-to-know about this exposure.

- In addition to these actions under FFDCA, both the Administration and the Pesticide Reform Campaign proposals would give EPA authority under FIFRA to streamline the procedure for banning dangerous pesticides and getting them off the market without the interminable legal delays registrants can cause under the current law.

All of which adds up to fewer pesticides available under either proposal. I think there is little disagreement that is the direction we are going. The handwriting is on the wall. The question is, how do we do that without hurting the farmer?

The Program: Pesticide-Use Reduction

Unfortunately, it doesn't look like the Administration proposal will do that. It focuses on gathering more data, on teaching IPM and basically providing little or no incentive except the big stick of banning some pesticides and substituting others.

But what we need is not just a change in chemicals, but a change in agricultural systems. The Administration bill lays great stress on IPM, on making it a mandatory part of applicator training, for example, but the focus should not be on pest or pest management, but on sustainable agricultural systems. The dependence of farmers on pesticides is part and parcel of dependence on high-energy off-farm inputs or various kinds—including high inputs of capital. What we need is not just integrated *pest* management, but integrated *farm* management, and we need government programs that will reward farmers who have already made the switch to sustainable farming, and provide incentives to those who are ready to make the transition.

If we do that, least-toxic pest management to a great extent will naturally follow as part of the package.

While the Administration proposal would "authorize regional ecosystem-based reduced use pilot projects," it is not clear how these projects would be developed. The danger is that they would be unrealistic top-down programs that do not take advantage of on-the-ground farmer know-how or provide needed incentives on the farm.

The Reform Coalition proposal, on the other hand, is very specific in calling for pesticide-use reduction programs based on identification of model farms in every agricultural region, farms that have already made the transition to reduced use methods on a crop-specific basis, providing means for those farmers to demonstrate and transfer their techniques to others in the region, and providing incentives for other farmers to adapt the techniques and implement them on their own farms. As you know, many farms that have switched to sustainable practices or gone organic show higher yields and higher profits than chemically-dependent farms.

Some of the incentive program is already in place. under programs that were created or revised under the 1990 Farm Bill. But although Congress created those programs and allocated funds for them, the previous Administration never spent the money or spent only part of it, so most farmers still haven't had the opportunity and training to start the transition to sustainable agriculture. And although the current Administration has been a little better about this, the programs still aren't fully funded, and the Administration proposal doesn't call for much improvement in this area.

We need to fully fund and implement programs like USDA's Sustainable Agriculture Research and Education (SARE) and Sustainable Agriculture Technology Development and Transfer (SATDT) programs and EPA's Agriculture in Concert with the Environment (ACE) program. We need to accelerate implementation of the Organic Food Production Act. Why, for instance, hasn't President Clinton issued an executive order to require procurement of available organic foods for the school lunch programs and other federal food programs? That would certainly speed up non-chemical production.

What we need is an aggressive government program to significantly increase funding for on-farm participatory research and education, and to implement conservation practices. Instead of subsidizing commodity/price support programs which only encourage monoculture, overproduction and the attendant problems (including pest problems), we should be subsidizing conservation-based, diversified, integrated supply management programs.

Few of us would argue that environmental protection isn't necessary. We've all seen too many contaminated wells, sick animals and sick people. It's time to start thinking ahead to a different kind of vision of agriculture, to go beyond the vision of the factory farm that came out of the technocratic fantasies of the 50s. What we need is a redirecting of commodity, credit, and conservation programs to give farmers the flexibility they need to develop diversified, integrated farming systems *within* our conservation and environmental protection programs.

Compromising Disease and Pollution Prevention: *The Food Quality Protection Act* of 1996 (1997)

Michael Gregory, presented to the Arizona Agricultural Aviation Association, Arizona Crop Protection Association "Second Annual Desert Agriculture Conference," Yuma, Arizona, (14 January 1997)

In terms of human and environmental health policy, the *Food Quality Protection Act* of 1996 (FQPA) —a PR name if there ever was one— is not a step forward but a step back. Although it was partly written in response to public demands for increased health protection, especially for children, and will probably get some of the most obviously dangerous chemicals off the market, to accomplish those ends it has seriously compromised public health by giving away a major principle of environmental protection, an action that in the long run will lead, in my opinion, to more disease and human suffering.

We've all heard of the three Rs; I'm an advocate of the four *Double Ps*: Public Participation, Pollution Prevention, Polluter Pays, the Precautionary Principle. In its rush towards political expediency before they all hit the campaign trail, in passing the FQPA the 104th Congress and the Clinton Administration agreed to dispense with or seriously weaken all four of those essential elements of health and environmental protection.

The main problem with the Food Quality Protection Act (FQPA), as I said, is weakened standards, most of which fall under section 408. The Act [§408(b)(2)] replaces the zero tolerance ("Delaney clause") standard for carcinogens in processed food with an undefined standard called "reasonable certainty of no harm" (also called "reduced risk," "negligible risk" or "no significant risk") that applies to raw and processed food and to non-cancer health effects. But one person's insignificant risk can be another person's cancer, or birth defects, or nerve damage, hormone disruption or immune system disease. What the FQPA does, in effect, is declare chemicals in our food and fields as "safe" for everyone by *non*-definition —not by science, but by Congressional decree based on party politics compromise.

Under the new law, what constitutes "reasonable certainty" is to be based on quantitative risk assessment, and risk assessment is a problem in several ways. First, it is not "science" (as it is often claimed to be), let alone good science, but a mathematical computer game—a variant of statistical analysis—the rules of which even the risk assessors themselves can't agree on. In its worst excesses, it is not even a game, but a kind of numbers racket run by unscrupulous corporations and consultants.

Basically, as former EPA Administrator Ruckelshaus said about risk assessment, if you torture the numbers enough, you can make them say anything you want. Risk assessment doesn't begin with the facts and then try to interpret them: it begins with the desired end product (i.e., "how much contamination or exposure or cancer can we get away with") and develops a model to prove the pre-conceived result. As the man said, there's lies, damned lies, and then there's statistics.

Risk assessment cannot deal at all adequately with problems of multiple exposures or low-dose exposures, especially with chemicals whose mechanisms of toxicity operate through several complex biological processes to effect organs and tissues at several removes from the initial point of exposure.

We've known since the Vietnam War, for instance, that dioxin, the most dangerous ingredient of

Agent Orange, can cause birth defects when fed to Rhesus monkeys in doses as low as 5 parts per trillion. That's like a teaspoonful in a swimming pool. But only in the past year or so have scientists started to figure out how dioxin works —and the answers are not comforting. We now know, for instance, that people and wildlife in most parts of the industrialized nations already carry dioxin in our bodies at levels known to cause health effects in laboratory animals.

We also know now that the toxicity of chemicals can be greatly increased when they are in combination —and we are all exposed daily to toxic chemicals from a variety of sources. Recent studies of pesticides, for instance, have shown that exposure to some active ingredients that were apparently relatively harmless by themselves, in combination with other chemicals increases the toxicity by several magnitudes. And the chemicals don't need to all be pesticides —a fact which should make us think about the so-called "inert" ingredients in pesticides.

Similarly, the most recent studies of Gulf War Syndrome indicate that it is the low dose exposure to a *combination* of chemicals that has been making our vets sick. And the kind of sickness is not necessarily flashy stuff like cancer and gross birth defects and gender reversal (though those may show up later); instead, it's subtle stuff like nervousness, lack of sexual response, sleeplessness, reduced learning capability in our kids, runny noses and flu or asthma symptoms, abnormally low immunity to infection —exactly the kinds of symptoms farmers and farmworkers and their families often suffer from.

While the FQPA does require EPA to consider the cumulative effects of single chemicals, it requires consideration of *mechanisms of toxicity*, of *cumulative effects* from *multiple exposures*, and of special risks to infants and children only when information is already "available", but doesn't provide any funding to generate the required data [cf. §408(b)(2).

And of course it doesn't address non-human effects at all. Wildlife and organisms low in the food chain are often susceptible to much lower doses of chemicals than people, but ecological risk assessment is even less exact than human health assessments and that whole topic is left out the law.

Given these facts, it just doesn't make sense to most people to keep on exposing ourselves to more chemicals, putting more in our environment, especially those that haven't been fully tested (which is true of over 90% of all chemicals in commerce, including pesticide chemicals). Instead, we need to be looking at ways to get off the pesticide treadmill, to get serious about disease and pollution prevention. And to start applying the Precautionary Principle, which simply says that if you don't know what the effects of a chemical are going to be, don't put it in our air, water, or foodchain.

The FQPA does not follow this basic public health principle, but assumes that chemicals are innocent until proved guilty and allows their use or continued use until after the fact of "harm" [cf. §408(b)(2)(C)].

Risk assessment is not a way of getting to pollution or disease prevention, or of taking precaution: it always assumes that a certain amount of disease or exposure is ok, or "acceptable". So however much it may be a useful, practical tool in the field, as a policy instrument, it is a way of enshrining in law that basically undemocratic concept (undemocratic because, among other reasons, its esoteric mumbo-jumbo process precludes informed public consent (and, therefore, of effective Public Participation —that fourth Double P), and because in our competitive society the risk of getting cancer or other diseases under risk-based policies falls disproportionately on the poor, on the old, the young and the disabled, and on the ethnic minorities who for a number of reasons (e.g., poor diet, increased exposure) are most susceptible to the adverse effects of

pesticides and other pollutants.

Because quantitative risk assessment is driven by statistical methodology, policies and regulation based on it routinely put individuals and groups or communities with special problems at greater risk than the statistical "normal" population, but the FQPA goes even further by specifically excluding from its calculations those people most exposed to pesticides through their occupation: farmworkers, farmers, applicators, pest control operators and advisors, chemical manufacturers, and transportation workers [§408(b)(2)(A)]—even in the face of an increasing number of studies showing elevated levels of cancer and birth defects in some of those groups.

For instance, I just received in the mail a copy of a new report showing elevated levels of birth defects for pesticide applicators in the farm country of western Minnesota, as well as increased levels for the general population in those communities compared to non-farming areas [Garry, Schreinemachers, et al, Pesticide Appliers, Biocides, and Birth Defects in Rural Minnesota, *Environmental Health Perspectives* 104(4): 394-399, April 1996].

In closing, I'd like to point out a few other specific problems with the FQPA. Besides continuing the absurd policy of regulating pesticides one chemical at a time, on a case-by-case basis (a policy that guarantees we won't have reliable health data on most chemicals until they're already off the market for any number of other reasons), besides that, the law:

- prohibits states and local jurisdictions from adopting more protective residue standards than the federal government except under certain "compelling local conditions" or when EPA has allowed a tolerance that even the agency itself admits isn't "safe"]—which it is allowed to do under the new law [§408(n)]

- in a move in just the opposite direction from this trashing of states rights, in the name of Free Trade, requires EPA to go through several extra and difficult hoops to set a standard more protective than international standards set by the Codex Alimentarius, a panel notorious for its lack of opportunities for public participation [§408(b)(4)]

- allows EPA, under poorly-defined "emergency" circumstances, to set residue tolerances without public notice allowing pesticides to be used on food crops that have never been approved for use on food crops, or even have been specifically not approved [§408(l)(6)]

- allows EPA to set tolerances for pesticides that have been banned, presumably to deal with unavoidable traces of persistent chemicals like DDT that will be in the general environment for many more decades, but may also allow more widespread illegal use of those chemicals in places like Arizona where chemicals banned in the US may be easily purchased across the line in Mexico and brought back in [§408(l)(4)]

- requires EPA to publish an annual statement on risk of certain pesticides on foods, and grocery stores to post that information, but does not require that information to be put on food labels where it would be most easily accessible to people [§408(o)]

- allows the EPA to weaken health and safety testing requirements and provides extraordinary exemptions from other requirements for so-called "minor use" pesticides (a category that in 1987 included 80% of the crops in California, 75% of those in Florida and 46% of those in Arizona), and further provides federal subsidies of about $10 million for registration of those pesticides; but provides no funding for research to develop effective non-chemical alternatives to those pesticides [cf. §408(c-e)].

EPA recently issued, for instance, a statement saying that "to the extent possible, EPA will waive data requirements or grant tolerance exemptions for minor uses" and will give "expedited review" to minor use tolerance data, which is Washington code for cutting corners on health protection.

And that brings me to a good place to close. During the ten-year long debates on what has become the FQPA, a broad coalition of public interest organizations, sustainable agriculture groups, environmentalists and other concerned parties insisted repeatedly that in order to adequately protect human health and the environment in the long run while at the same time not creating unacceptable economic hardship on farmers, changes to the Federal Food Drug and Cosmetic Act would have to be part of a package along with sweeping reform of the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA)—especially guaranteed funding and other incentives for toxics use reduction to assist farmers in phasing out toxic chemicals (instead of subsidizing them), including expedited research to develop effective alternative pest management tools (not just alternative pesticides), and a farmer-to-farmer training program that would pay farmers to teach and learn from each other how to make the alternatives work in the field.

In their wisdom, Congress and the Administration chose not to give us the whole package, but only a deformed portion—the *Food Quality Protection Act* of 1996.

Bisbee Vegetation Management Committee Majority Report (2000)

Michael Gregory, for the Majority of the Committee (Janeen Crockett, Colleen Crowlie, Michael Gregory, Emily Noble, Luis Ruiz, Jill Thomas), presented to the Mayor and City Council, Bisbee, Arizona (18 April 2000) [exhibits excluded]

I. Summary

Following heavy vegetation growth after the 1999 summer rainy season, Bisbee City Councilmember Davis Cartun raised concerns about what he termed excessive undesirable vegetation in City properties and a probability of even heavier vegetation growth in the spring of the year 2000 due to seed production of the 1999 crop. At a City Council meeting in October, he proposed that the City allow use of herbicide on City properties, which had been banned by the Council in 1983. Following publicity in the local media about the controversial proposal, Mr Cartun proposed that a "Weed Control Committee" be formed to study and make recommendations on the issue. After hearing testimony on the controversial herbicide-use issue from several citizens at its meeting of October 19, 1999, the City Council voted to establish the committee.

The twelve-member Committee met nine times from November 4, 1999 through February 10, 2000. At its third meeting, the Committee changed its name to "Bisbee Vegetation Management Committee," in order to more accurately reflect the approach members considered more appropriate, and adopted the following Mission Statement:

> To examine the existing vegetation management operation by the City of Bisbee and to recommend effective, economical and environmentally safe techniques to manage this vegetation.

At its fifth meeting, Mr Cartun presented the Committee with a list and map of 72 sites of concern. After visits to and assessment of several of the sites, and review of pertinent issues and options, the majority of the Committee agreed that most of the concerns, sites of concern and plants of concern presented by Mr Cartun were listed principally for aesthetic reasons, and did not require urgent attention and resources, or any change in current City policy. Instead, the majority agreed that, although the City currently does not allocate appropriate funds, most of the concerns could best be addressed through a more comprehensive and systematic management program of site-specific preventative maintenance without undue additional expense and without the added risk of recourse to chemical herbicides.

The majority agreed, for instance, even bearing in mind that brush fires and encounters with wildlife are more likely at heavily vegetated areas, that the relatively unlandscaped vegetation along roadways was generally acceptable and, for some, preferable to more rimmed or barren roadscapes. Similarly, some felt strongly that certain species (e.g., Tree of Heaven, Desert Broom, Carelessweed) should be targeted as alien invaders and eradicated or, at least, rigorously controlled; the Committee did not reach consensus that any particular plant species was undesirable (although there was general agreement that certain "sticker"-bearing plants were more or less a nuisance.

The Committee did find that four areas of concern warranted more attention:

- infrastructure damage resulting from roots of woody plants
- fire hazards from heavy plant growth near flammable structures

- health problems (e.g., asthma, allergies) related to pollination
- general deterioration of the City's thirteen parks and various landscape areas.

The Committee did not find consensus on several other identified issues. For instance, although the Committee did agree that non-toxic vegetation management methods were preferable, and a majority of members understood that to mean that the Committee's principal effort should be exploration of manual, mechanical and biological alternatives, which are more or less obviously non-toxic, a minority felt that chemical methods should also be considered.

Although most members of the Committee agreed that in theory there may be non-toxic chemical products available, finding them proved difficult, especially since the majority considered that neither manufacturers' claims nor government approval of sale and use could serve as satisfactory guarantees that the product would not cause unacceptable problems down the road. Given the long history o chemical products being sold as "safe", then later being withdrawn from the market after being found to damage human health or the environment, the majority agreed that rather than taking a chance, it was clearly better public policy to use only relatively benign manual, mechanical and biological alternatives, as long as they were effective and not too expensive, even when the monetary costs of labor or equipment might be greater than the outlay for chemicals. The Committee recognized that the apparently lower short-term cost of using herbicides needs to be weighed against potential long-term health and environmental consequences.

The topic often shifted from such economic issues, usually turning on questions of short-term vs. long-term values. While some members urged that immediate attention to current conditions was needed, the majority was n ot convinced of the urgency and saw no compelling need for a switch back to chemical methods, but agreed that if the decision were to be based on economics, then the analysis must take full account of non-monetary as well as monetary values; and that the values of future generations must be budgeted in.

If the City cannot find resources to do that kind of thorough, open analysis, the majority agreed, it should act on the side of caution and valor by not taking a chance on the public's long-term health but, instead, keeping the 1983 ban on pesticide-use intact. Why take the unnecessary risk, the majority asked, when there is no need—no need because there is no agreed-upon problem of import, and no need because there are far less risky alternatives easily available. To do so would be at the very least poor public policy, and might lead to unnecessary increases in liability.

Besides economics, the chemical/no-chemical debate the most often on the question, "how do you know it's safe?" The Committee found this a difficult question to answer, well beyond its capabilities. Clear information is not easily available, and not easily interpreted once found.

Committee discussions indicated that the question involves not only toxicological questions, themselves subject to heated scientific controversy, but significant issues of public policy. A majority of the members felt, for instance, that chemicals should not be considered innocent until proved guilty, but that prudent public policy requires that those who propose to sell or use the product should bear the burden of proof that it's harmless before they're allowed to put it into thr environment. To continue searching for an herbicide that can pass the "no harm" test may not be a bad ideas, the majority felt, but to deliberately release in public places toxic chemicals that we don't know enough about, is clearly not good public policy.

Finally, the Committee found that its own work, although of some immediate and practical use, should be considered as preliminary to further research and to development of a comprehensive, integrated, non-toxic vegetation management program. The principal needs identified for such a

program included 1) Adequate budget, 2) Comprehensive plan and schedule, 3) Staff trained in Integrated Pest Management, 4) Timed, prioritzed and consistent management activities, 5) Widely-disseminated public information about the program goals and practices, and 6) Public participation in all stages of planning and implementation.

II. Recommendations

At its final meeting on February 9, 2000, attended by 8 of the10 voting members of the Bisbee Vegetation Management Committee, the following recommendations were adopted by consensus, except for Recommendation A.1., which was approved by a 6-2 majority vote.

A. General Recommendations

A.1. The existing ban on pesticide use should be maintained.

A.2. In all vegetation management activities, the City should follow Best Management Practices such as those suggested in section IV.E of the Report upon which these Recommendations are based.

A.3. The City should consider regulating allergenic plants.

B. Recommendations for Program Administration

B.1. The City should develop and implement a non-toxic Vegetation Management Plan, setting clear short- and long-term goals and objectives for the City in general and for each of the five major types of management areas in the City: Parks, Infrastructure, Landscape Areas, Roadways, and Highway Shoulders.

B.2. City staff should develop and implement a schedule for remediation and maintenance based on a prioritized incentory of sites, Calendars, maintenance plan, and site map should be part of each remediation plan.

B.3. The City should provide an adequate budget, through reallocation of funds and acquisition of grants, to allow for remediation and maintenance needs identified in the Vegetation Management Plan.

B.4. Funds should be allocated for purchase or lease of appropriate equipment (e.g., brush hog, tractor, seed vacuum, pulling tools, steamers, flamethrowers, ultraviolet devices).

B.5. City staff should be provide training in Integrated Pest Management (IPM).

B.6. The Parks and Recreation Groundskeeper should be provided with a year-round full time assistant a well as a seasonal assistant during the growing season.

B.7. The City should cooperate with the Rural Development Grant Coordinator of the USDA Coronado Resources Conservation and Development Program to obtain funds for the City's vegetation management program, including funding for a coordinator of volunteer activities.

B.8. The City should participate in the JTPA Summer Youth Employment and the Americorps programs, and actively recruit other volunteer and semi-volunteer help during the growing season.

B.9. The City should actively seek volunteer assistance from the public in managing targeted sites adjacent to their businesses and residences in accord with Best Management Practices such as those suggested in section IV.E of the Report upon which these Recommendations are based.

B.10. Time should be budgeted for vegetation management staff to work with the City Librarian and other sources on a regular basis at least quarterly to locate documents on non-toxic methods of practical use in managing the City's vegetation.

B.11. The City should invite outside vendors to present information on their alternative or non-toxic vegetation control products and to provide training to staff in usage of those products if procured.

C. Recommendations for Infrastructure

C.1. Staff should develop a prioritized inventory of and schedule for addressing infrastructure problems.

C.2. Seedlings of plants that are likely to cause an infrastructure problem should be pulled or have crowns dug out before damaging root structures develop.

C.3. The City should investigate alternative non-toxic stump-removal methods such as slashing/solarization which cause the stump to rot.

C.4. The City should develop an agreement with utility companies to reclaim or plant with desirable species the sites that are disturbed by utility work, in order to minimize the chance of unwanted species taking root at the site.

C.5. The Bisbee Fire Department should enforce the combustible vegetation section of the Uniform Fire Code in order to abate high fire hazard conditions caused by vegetation growth. Bisbee at no charge to the City.

C.7. Information regarding practices for fire protection from combustible vegetation should be widely disseminated n the City.

C.6. The City should accept the offer of the Sierra Vista Ranger Disrtict office of the U.S. Foest Service to conduct a Brush Fire Audit of

D. Recommendations for Parks

D.1. The City should obtain grant funding to hire a Volunteer Coordinator to improve the Adopt-a-Park program.

D.2. The City should cooperate with the USDA Resource Conservation and Development program to form volunteer groups to help rehabilitate and maintain the parks.

D.3. The City should cooperate with the Arizona State Land Department, Division of Forestry, to help develop an urban forestry plan for the City.

D.4. Turf areas should be rehabilitated through use of soil conditioning techniques such as tilling, aeration, mulching and organic fertilization, and all drip irrigation systems upgraded.

D.5. A flexible maintenance schedule should be followed to provide for pulling, digging out

crowns or vacuuming of undesired species before seeds mature.

D.6. Fire-susceptible, high-maintenance and high water-use plants should be replaced as needed with fire-resistant, low-maintenance, low water-use plants.

D.7. Trimmings should be collected and converted ti mulch in accordance with the Best Management Practices as suggested in Section IV.E. of this Report.

D.8. Raised beds should be constructed in order to improve soil drainage of ornamental plantings. Chemically-treated wood should not be used.

E. Recommendations for Landscape Areas

E.1. The Adopt-a-Park Program should be expanded to involve volunteers in rehabilitation and maintenance of landscape areas.

E.2. The City should cooperate with the Coronado Resource Conservation and Development Program, the JTPA summer youth employment program, Americorps, or others, to provide volunteers for helping in maintenance of landscape areas.

E.3. High-maintenance areas should be redesigned and restructured with more appropriate lower-maintenance landscaping.

E.4. Fire-susceptible, high-maintenance and high water-use plants should be replaced as needed with more appropriate fire-resistant, low-maintenance and low water-use plants.

E.5. Raised beds should be constructed in order to improve soil drainage of ornamental plantings. Chemically-treated wood should not be used.

F. Recommendations for Roadways

F.1. Cutting of brush along roadsides should be limited to the minimum needed to meet legal requirements of the State and to provide a reasonable degree of safety for pedestrians, motorists, wildlife and property. Use a chipper to make mulch of the brush.

F.2. The City should plant roadsides to a hardy mix of native wildflowers, short- to mid-level grasses and nitrogen-fixing legumes that will blend in with the existing vegetation. Mulch and a water truck should be used to ensure the seeds will germinate and the seedlings will become well established.

F.3. The City should coordinate cutting of vegetation with the growth cycle of the plants at each site as to minimize dispersal of seeds from unwanted plants.

F.4. The City should increase use of manure and volunteer labor to manage highway shoulder vegetation.

G. Recommendations for Highway Shoulders

G.1. Cutting of brush on highway shoulders should be limited to the minimum needed to meet legal requirements of the State and to provide a reasonable degree of safety for pedestrians, motorists, wildlife and property. Use a chipper to make mulch of the brush.

G.2. he City should assure that Arizona Department of Transportation does not use chemical herbicides where highways pass through City limits.

G.3. The City should coordinate cutting of vegetation with the growth cycle of the plants at each site as to minimize dispersal of seeds from unwanted plants.

G.4. The City should plant highway shoulders to a hardy mix of native wildflowers, short- to mid-level grasses and nitrogen-fixing legumes that will blend in with the existing vegetation. Mulch and a water truck should be used to ensure the seeds will germinate and the seedlings will become well established. The City should solicit support from the Arizona Department of Transportation for this.

G.5.The City should increase use of manure and volunteer labor to manage highway shoulder vegetation.

G.6. The City should evaluate the use of goats or llamas for control of large, brushy areas such as Naco Highway.

III. The Vegetation Management Committee

A. Formation and Mission

Summer rains in 1999 were followed by abundant vegetation growth throughout the City of Bisbee. In October of that year, Bisbee City Councilmember David Cartun expressed concerns that undesirable vegetation in various locations throughout the city needed attention, ands proposed to the City Council meeting of October 5th that the City consider lifting the 1983 ban on use of pesticides on City property to herbicides could be used "to control weeds and unwanted vegetation." He proposed that if the motion weere approved, written procedures for use of the chemicals would be developed which could eventually be incorporated into the City Code. The proposal was tabled by the Council, but drew considerable attention from the public and the news media.

At the next Council meeting (October 19th), Mr Cartun moved to leave his previous motion tabled, and proposed instead that a "Weed Control Committee" be formed to study and make recommendations on the issue. After hearing testimony from several citizens, the City Council voted to establish the committee, with a sunset date of January 19, 2000.

Mr Cartun solicited volunteers in the following week, and on November 4, 1999, the first of nine meetings of the City of Bisbee Vegetation management Committee was held. Membership consisted of thirteen voting members and three advisory members. BY the end of the month, resignations had reduced the numbers to twelve and two, respectively.

After discussion of several proposals, at its third meeting (November 23, 1999) and without objection, the Committee adopted the following mission statement:

> To examine the existing vegetation management operation by the City of Bisbee and to recommend effective, economical and environmentally safe techniques to manage this vegetation.

B. Process

Initial meetings addressed timetables and other procedural matters. The Committee decided not to elect a chairperson or recording secretary, but to rely on volunteers at each meeting to provide facilitation and keep minutes. Rather than using a simple majority vote process, the Committee decided to seek consensus before making decisions.

At its third meeting (November 23, 1999), the Committee agreed that a quorum would consist of 2/3 of the 12-member committee (Exhibit A.1) and that although any member of the public would be e=welcome to attend and participate in meetings, no new members would be added to the Committee after that date. It was also decided that a member having three "unexcused" absences could be dropped from the Committee.

The Committee met nine times (four times in November, twice in December, once in January, and twice in February), the last meeting being held on February 10, 2000. Non-attendance was chronic, with most meetings after the first attended by the same core group of four to seven voting members and advisory members (one member, for instance, attended only one meeting).

C. Scope and Methodology

At the opening meeting, the Committee was charged by Mr Cartun with identifying "weed problems and solutions" for the City of Bisbee, with particular focus on engaging homeowners and businesses, and investigating mechanical, "natural" and chemical "controls".

At its early meetings, in trying ti define issues, the Committee found it necessary to also attempt definition of basic terms like *pesticide*, *herbicide*, *control*, *management*, *natural*, *native*, *noxious*, *invasive*, *weed*, etc.). Working definitions were agreed to or developed throughout the Committee's life, including the following:

> *Vegetation* and *management* were the terms of choice for the Committee's title and deliberations, since those terms were understood to better indicate the Committee's preference for less draconian approaches than those implied by the terms *weed*, *control* and *eradication*.
>
> *Pesticide* is a generic term including insecticides, herbicides, rodenticides, algicides, avicides, etc., As defined in federal and, consequently, state law, it include devices (e.g., traps) as well as substances.
>
> An *herbicide* is a kind of *pesticide* used to kill, defoliate or otherwise fatally alter growth of plants. In accordance with federal law, in legal usage the term refers to any substance or device used or intended for those purposes. In common usage, it usually refers to products composed of synthetic chemicals, as distinct from products that work by simple physical actions (e.g., dusts that smother plants), and biological organisms (e.g., predators and pathogens).
>
> The term *inert* as used in relation to pesticides does not indicate that the substance is biologically inactive or non-toxic (many "inerts" are both), but only that the government does not regulate them as a pesticide in a given formulation (though some are regulated as active ingredients in other products) and that they do not have to be listed on the product label (Exhibits C.4, C.6). Solvents, for example, many of which are highly toxic, are common "inert" ingredients in pesticides. The surfactant POEA, which is added to the herbicide Roundup©, is several times more toxic than Glyphosate and associated with health effects that Glyphosate is not (Exhibits D.1, D.1).

Impurities (*aka contaminants*) and *breakdown products* (*aka degradation products*) may also be in or form from pesticides. These are also not listed on the label, though they too may be biologically active or toxic.

Noxious weeds are plant species designated as such by state and federal governments; they are usually *non-native* (i.e. *exotic*) species, of concern due to their ability to put-compete other species, resulting in domination of some plant communities, especially grazing lands, and consequent reduction in biodiversity.

Natural and *organic* have no standard or legal definitions, so products labeled as such, or as being made from such ingredients, cannot be automatically considered environmentally or physiologically benign. *Natural* substances (in the sense of being found in nature) are also composed of chemicals, many of which (including many plants) are also highly toxic, and active ingredients of chemical herbicides are usually *organic* compounds (in the sense of being composed of carbon and hydrogen).

At its second meeting, the Committee established as its scope of work the identifying of vegetation management issues of the City and assessment of them in terms of four criteria (aesthetics, human health and safety, environmental health, and economics), with particular attention to sites identified by the City and, based upon findings, to make recommendations to the Council in terms of five management categories: Parks, Infrastructure, Landscape Areas, Roadways and Highway Shoulders. Overall administrative issues kept coming into discussion, so a Program Administration category was added to the recommendations, along with a category of General Recommendations applicable to all sites and program implementation.

research methods included literature and Internet searches, interviews by phone and in-person, and site visits. In addition, the Committee heard from several concerned citizens during Call to the Public portions of Committee meetings. These included Melvin Ray, an employee of the Bisbee Public Works Department; Bisbee Mayor Lyle Reddy; Donna Matthews from the USDA Resource Conservation and Development program; and private citizens who discussed the significant health problems they suffer when exposed to chemical pesticides (including herbicide spraying by the City of Sierra Vista and the Arizona Department of Transportation)., and who come to Bisbee specifically because of the City's no-pesticide policy.

Initially, site data was collected on a matrix developed by the Committee (Exhibit A.4). At the suggestion of Mr Cartun, the Committee agreed to remove chemical and biological methods from the site information form (on the grounds that neither method is currently used by the City), and to leave the Old Bisbee drainage ditch off the site list, since its management had already been set by the Council based on recommendations made by a citizen group a year ago. However, discussion of chemical and biological methods for the ditch and other sites continued throughout the Committee's proceedings.

A considerable amount of information on vegetation management practices used by other communities was gathered by a subcommittee phone survey (Exhibit A.5). The survey was limited to Arizona cities, though it was noted that techniques appropriate to Bisbee might also be used in non-Arizona cities and that innocative techniques might, in fact, be more likely to be found elsewhere.

D. Tasks and Deliverables

The Committee was not able to develop a coherent workplan, but set itself the following tasks, most of which were focused on information-gathering:

1. Identify the issues and concerns pertaining to vegetation growth and management, with particular attention to sites and concerns identified by the City

2. Identify management methods

3. Identify potential hazards of the herbicide Roundup©

4. Examine specific sites of concern

5. Characterize and evaluate the conditions at the identified sites

6. Identify appropriate management practices for the identified sites

7. Research the history of vegetation management in Bisbee

8. Investigate practices used by other cities and jurisdictions

9. Develop an Interim Report

10. Develop a Final Report with recommendations

After an initial set of site visits, the Committee decided that gathering such detailed information was too ambitious for the Committee, especially in light of time constraints, so field investigation and the data-collection form the Committee had developed were both abandoned in favor of less site-specific tasks.

Research of written literature and the Web were also severely limited, again due in large part to time constraints. Although a variety of written materials were distributed to Committee members, the search was not systematic or comprehensive. Some documents requested at early meetings were not provided until several meetings later, sometimes too late to be of much use, sometimes not presented at all.

The Interim Report, one of the tasks set by the City at the first meeting for delivery in early January, was not presented to the Committee for review until early February, two meetings after the Committee's initial sunset date, when it was decided to incorporate it into the final report rather than issue it separately.

In mid-January, shortly before the original sunset date for the Committee set by the Council, members agreed to extend the life of the Committee for an additional two weeks. At the first of these "extra-innings", at the end of January, it was agreed to extend the Committee for another additional week in order to compose this Final Report.

IV. Findings

A. Current Situation

At its first meeting on November 4, 1999, the Committee requested that the City provide a list of sites of concern so members could have a concrete idea of the kind and scope of issues to be addressed. At the fifth meeting on December 10th, Mr Cartun distributed a list (Exhibit A.2) and map (Exhibit A.3) of some 70 sites. He explained that the Old Bisbee drainage ditch was not included as a site of concern because the City had already in the previous year accepted

recommendations on the area that had been submitted to the City by a citizen task force.

He noted that many of the identified sites were highly visible (roadway edges in business areas, traffic islands, etc.) and are not maintained on a schedule coordinated with the growing cycle of plants, but irregularly, only as time and other resources allow. Consequently, he noted, some have become overgrown by aggressive "weeds" that pose concerns of safety (e.g., fire hazards), comfort (e.g., stickers and insects), health (e.g., allergies), or economics (e.g., sidewalk cracking). The most commonly listed concern was aesthetic: that the plants or plant growth were in one way or another "unsightly" and crowded out more visually "attractive" species. Parks were identified as priority sites, due in large part to migration of seeds into them from nearby private lawns.

City employees informed the Committee that at the present time, the City's vegetation management activities are implemented principally through the Community Development and Public Works Departments, the former of which has two employees with primary responsibility for maintenance iof the City parks. The D Department also contracts with Cochise County Association for the Handicapped (CCAH) for routine maintenance of turf, and contracts on an occasional basis with the Arizona Department of Corrections for inmate labor. The Public Works Department has responsibility for rights-of-way, including streets, sidewalks, utilities (including thr Old Bisbee ditch), the cemetery, and related infrastructure.

In addition to maintaining the City parks, the CD Department has responsibility for abating vegetation growth that constitutes a nuisance or hazard on private property.

Mr Cartun explained that one of the City's principal interests is in cutting costs. He presented figures indicating manual vegetation management costs of approximately $65,000 per year, mostly for watering, mowing, trimming, and raking, fuel, equipment and supplies, exclusive of the $25,000 contract with CCAH. Requested documentation for this figure was not presented.

B, History of Vegetation Management in Bisbee

Based on research and information presented, the Committee was able to compile the following short history of vegetation management in Bisbee. Much of this information was gathered from verbal accounts of long-time residents.

Traditionally, horses, llamas and goats were allowed to graze on City property and this tended to keep the vegetation in check. In the late 1800s a dirt-field golf course was kept free of unwanted vegetation by spraying motor oil on it (a practice later made illegal after it was found to pose unacceptable hazards to human health and the environment). For many years, the City retained a sexton to maintain the cemetery grounds.

During the Depression, CCC crews, who built swimming holes and retaining walls, brought in native plants to control erosion on the hillsides, and identified what were termed "unwanted growth" and "invasive species." Later in the 1930s, the City included burning and a "weed truck" in management methods.

From 1979-1988, a volunteer Beautification Committee engaged in a variety of vegetation management activities. These included landscaping the Mine Tour entrance, obtaining a CBDG grant to rehabilitate several parks, xeiscaping several traffic islands and medians with native plants, and planting iris bulbs throughout the city,

in early October, 1983, the City announced its decision to use chemical herbicides in the

cemetery, and also proposed using them in the drainage channel ("the Old Bisbee ditch") that runs through Tombstone Canyon to Mule Gulch. The proposal was vigorously opposed by a significant number of citizens concerned about potential pollution and health problems, including groundewater contamination and effects on wildlife. Subsequently, the City Council heard testimony on the issue at two Council meetings, including testimony from a representative of the manufacturer of the herbicide Roundup©. At the meeting of November 1, 1983, the Council passed a motion to "discontinue akk use of herbicides and pesticides in the City of Bisbee" (Exhibit B.1).

In December 1985, the City's volunteer Beautification Committee, which had been involved in a variety of vegetation management activities over the previous several years, submitted a set of recommendations on vegetation management for the ditch (Exhibit B.5).

In 1989, the Beautification Committee merged with the Parks and Recreation Committee (which is still in existence), and engaged in a number of vegetation management activities, including replanting trees in Vista Park, installing a drip irrigation system in the park, rewriting the City's Parks Ordinance, and developing a maintenance plan for the five city parks that were improved through the CBDG grant.

In 1993, the Arizona Legislature passed a bill, and the State Board of Education adopted rules, requiring public schools throughout the state to institute programs for prior notification to students, employees and the public of any pesticide use on school grounds. In 1994, in response to requests from parents opposed to pesticide use ini the schools, the Bisbee Unified School District adopted a no-pesticide policy. In 1996, the Bisbee District and the Naco School District participated in an EPA-funded *IPM in the Border Schools Project* administered by Arizona Toxics Information, a non-profit organization headquartered in Bisbee. The project complemented the Bisbee District's 1994 no-pesticide policy by training schools personnel in Integrated Pest Management and assisting them in developing no-pesticide pilot programs. Personnel from the City's principal vegetation management contractor, CCAH, also received the training.

In 1998, n response to the City's practice of clearing of the Old Bisbee ditch each year, a volunteer group known as the "Lovers of the Green" was formed. In cooperation with City officials, the group conducted a survey of citizens and found that many people valued the ditch habitat which supports a variety of flora and fauna. The group called for a change in management to a ore rational, non-toxic procedure for maintaining as natural a habitat as possible in the water channel. On December 3, 1998, the City Council accepted (without making a motion to follow) the recommendations fom the group (Exhibit B.6).

C. Methods of Vegetation Management

Research by the Committee found that there are six standard approaches to vegetation management generally recognized. The six methods include: No Action, Manual Methods, Mechanical Methods, Biological Methods, Chemical Methods, and Integrated Est Management. A survey by the Committee (Exhibit A.5) found that other Arizona towns employ all these in one form or another, except the last, and rely heavily on the use of city personnel or prison labor to remove or cut back unwanted vegetation with manual or mechanical methods.

C.1. No Action. In some cases, by preference or default, little or no vegetation management is done. In most instances, although the term "no action" is applied, some management actions are in fact undertaken, but they are done sporadically or unsystematically. This is the case, for instance, in cities that do not have official policies regarding unwanted vegetation and in which,

consequently, problems are addressed by private citizens on an *ad hoc* individual basis.

C.2. Manual Methods. Manual methods include such common practices as hand pulling, rimming and hoeing and employ simple hand tools such as grass whips, hoes, shovels, scrapers, digging bars and loppers. All cities surveyed use one or more methods of manual management.

C.3. Mechanical Methods. Mechanical methods are usually defined as those that employ electrical or gasoline-operated machines. All cities surveyed use some form of mechanical equipment to remove unwanted vegetation. Mechanical equipment includes, but is not limited to, weed eaters, lawn mowers, stump grinders, chippers, brush hogs, trenchers, and tractor mowers, as well as thermal equipment that applies hot water (Exhibit F.30, steam or lame, and recently-available devices that kill unwanted vegetation with ultra-violet (UV) light.

C.4. Biological Methods. Biological methods employ living organisms to control or inhibit unwanted and to enhance desired growth. Biological methods include use of vertebrate and invertebrate predators, growth regulators, plant pathogens, competitive plants, and plants that are in some ay or other resistant to otherwise unfavorable conditions (e.g., disease-resistant, drought-resistant, malnutrition-resistant, fire-tolerant, shade- or sun-tolerant). Goats, llamas and horses, for instance, were traditionally used in Bisbee, and the first two are currently used in San Francisco (Exhibit C.22), to control vegetation growth, and geese are a well-known method of controlling many unwanted species, especially Johnsongrass in cottonfields of the Southeast (where the technique is known as “cotton goosing”)

The only biological method reported by the cities surveyed was overseeding with desirable grasses, native plants and wildflowers to out-compete unwanted species.

C.5. Chemical Methods. Chemical methods for controlling unwanted vegetation include use of herbicides and fertilizers. Fewer than 50% of the surveyed cities used chemical herbicides. Of the five cities currently using them, three are re-evaluating their herbicide policies due to citizen complaints and concern for public and environmental health. The common names of the herbicides used by these five cities are Roundup©, Comfort©, Surflan©, and Simazine©.

C.6. Integrated Pest Management. Integrated Pest Management (IPM) is a site-specific systems approach which may employ any or all of the other five methods. Developed principally as a means of reducing chemical pesticides, IPM in general tries to address vegetation needs from a holistic perspective, considering such matters as community interests and concerns (e.g., the goals and purposes of management); timing of treatments based on vegetation life cycles (e.g., pollination and seed formation); concepts of plant, animal and human communities (e.g., compatibility of plants in landscape groupings, trampling and use patterns of parks); natural controls (e.g., predation, climate, soil types and condition, eater regime); long-term management costs (including costs of personnel, equipment and materials, potential health and legal expenses, etc.). Comprehensive planning, and systematic preventative maintenance are key practices in IPM. Although in theory IPM does not exclude use of chemical pesticides, in practice the usual goal is to use chemicals only as a last resort, and then as sparingly as practicable, after non-chemical methods have been tried and found unacceptable.

D. Issues and Concerns

The Committee heard, read and engaged in discussions on a wide range of issues and concerns related to vegetation management. Topics included, among others, exotic, invasive and noxious species; plant-induced respiratory problems; safety hazards related to mechanical management activities; health effects of chemicals; water contamination; effect of under-managed and

mismanaged growth on tourism and community self-respect; democratic process and public policy; effects of under-management and mismanagement on desired vegetation in parks and landscape areas; management costs; monetary vs. intangible values; short-term vs. long-term goals; perceptions vs. facts; equipment effectiveness; use of wild plants for medicine and food; damage to retaining walls, sidewalks and roads; soil retention and erosion control.

The Committee examined issues and concerns under five headings: Aesthetic, Human Health and Safety, Environmental Health, Economics, and Program Administration.

D.1. Aesthetics. Presentations by City officials and visits by Committee members to identified sites indicated that the principal vegetation management concern at identified sites was one of aesthetics. The Committee immediately found that assessment of vegetation from an aesthetic standpoint is purely subjective and tends to be controversial.

While plants, like water, are generally considered a blesing in the desert, the Committee found that vegetation which some consider ugly or unsightly is considered by others to be aesthetically pleasing, essential to the natural beauty of the area, or otherwise desirable; similarly, species which some consider unwelcome alien invaders, others consider lovely exotics.

Some Committee members felt, for instance, that removing vegetation from areas (e.g., along roadsides and at traffic circle) would improve the aesthetics of these areas. The benefits, they felt, wold be that the area would be more attractive for residents and visitors, and would appeal to residents' civic pride. One member said that he was embarrassed about these areas and felt that they reflected poorly on the City. Other members strongly disagreed. They expressed an enthusiasm for the variety of plants found around the City, and felt that encountering these plants was a very positive experience. These Committee members felt that to remove plants that weren't causing problems (like fire hazard or infrastructure problems) was a waste of money, destroyed sources of useful herbs, enhanced desertification, and worsened the aesthetics by making the areas more barren.

Plants specifically identified as being of aesthetic concern included, but were not limited to, Desert Broom, Tree of Heaven and Carelessweed. Each of these plants found defenders, either from a differing aesthetic perspective, or because the plant had other values (as food or medicinal plant, for instance, or in erosion control, or as wildlife habitat).

The Committee found that since the Bisbee community is characterized by so many divergent tastes, opinions and attitudes, as well as a diverse set if vegetation habitats, a management policy based on decisions about aesthetic values would be controversial t best.

D.2. Human Health and Safety

The issue of human health and safety as related to vegetation management produced much discussion and debate.

No plants were specifically listed by the City as posing health concerns, but several candidates were repeatedly suggested by some members of the Committee, including some said to cause hay fever or other allergic reactions (e.g., Desert Broom, Sneezeweed, Carelessweed, Chamiza, Rabbitbrush, Bermuda Grass). Desert Broom was frequently said to provoke asthma attacks, n but no evidence was presented in support of that contention. It was noted that some cities prohibit planting of certain "hay fever" plants (e.g., Russian Olive and Saltcedar).

While some are concerned with adverse health effects of plants, members were also provided

information about the positive health effects—dietary, medicinal and psychological—of some plants usually considered "just weeds." These included, for instance, medicinal use of Rue, Rabbitbrush and Valerian, and dietary use of Carelessweed, Fennel, Purslane, and Miner's Dock. The positive effects of greenery on psychological health are generally recognized, while the effects on psychological health of more or less managed landscapes are hard to separate from aesthetic judgments, and so are subject to some of the same disagreements.

It was generally agreed that tall brush which limits visibility on roadways poses a safety risk to drivers and pedestrians (as well as to wildlife), and that heavy growth of brush and grasses, especially near structures, can pose significant fire hazards.

The principal discussion centered around the health and safety hazards of chemical pesticides as a method to control vegetation. The Committee agreed that exposure to pesticides, especially for children, represents a potentially serious and unacceptable health risk. Several members and guest speakers provided numerous accounts of the dangers of pesticides, and stressed that the potential risk of any pesticide use far outweighs any possible benefit. A minority of the Committee felt that in certain limited and controlled applications, if non-chemical methods are proved to be inadequate, chemical alternatives warrant further research.

There were no specific pesticide application proposals to the Committee for which the possible chemical exposure to the population could be evaluated. Although the Committee decided that doing the kind of research and analysis required to determine safety of pesticide products in general or anything as specific as toxicity levels was well beyond its capability, the Committee did examine a variety of information indicating myriad health problems associated with herbicide use, particularly the potential for such chronic or developmental problems as cancer, birth defects, nerve damage, immune-system disruption and reproductive-system disorders.

Concerns included bio-magnification of toxic chemicals in the food chain, multiple exposures to the toxics from a variety of existing sources (e.g., residues on food, presence in treated buildings, air-borne farm chemicals,); potentially toxic interactions between pesticides and other chemicals in the environment we are commonly exposed to (e.g., car exhaust, industrial emissions); and the severity of adverse health effects that can result from extremely low exposures to some pesticide ingredients (Exhibits C.3, C.8, C.9, C.14, C.23, D *passim*).

A common reference was the "Silent Spring scenario," the well-documented potential of pesticides to spread from point of application to the environment at large. While some felt that limited use of herbicides might be acceptable as a last resort in a "balanced" program when solution of a problem is especially difficult by non-toxic means, the majority noted that such use had to be considered in the wider context if "limited" use by millions of people and from that perspective, "a little-bit-here/little-bit-there" adds up to a lot among the community at large.

Of particular concern to the Committee was the overwhelming evidence, including a report by the National Academy of Science (Exhibits C.20, C.25), that embryos, fetuses and growing children, not just because of their smaller size but because their bodies are developing rapidly, are far more susceptible that adults to toxic pesticides, and are inadequately protected from exposure by state and federal standards, which are based on adult physiology only.

The Committee was informed that some synthetic chemicals, including some pesticides, are virtually impossible to keep out of the general environment once they are manufactured, and toxic in such minute doses, that they are widely recognized as being unacceptable in any amount anywhere. In this regard, the Committee was informed of the current international treaty negotiations to end production, sale and use of Persistent Organic Pollutants (POPs), at present a

group of twelve highly toxic substances, all of which were once manufactured in the United States and have not become global pollutants. Nine of the twelves POPs are pesticides once sold and officially accepted as being what in common usage is called “safe”, the best-known being DDT (Exhibits C.10, C.11), which has been found at the North Pole and at toxic levels in the tissue of walruses and polar bears thousands of miles from where the substances were originally applied.

The majority noted that the term “safe” is notoriously subjective and relatively undefinable. It was also noted that, contrary to popular belief, besides that cause cancer, birth defects and other health problems are not prohibited by the EPA or other government agencies, and that most pesticides have not undergone sufficient testing to prove that they don’t cause adverse health effects. Consequently, the assumption of safety is usually based not upon laboratory tests but on the lack of them, not on information, but its absence, and the common statement of pesticide manufacturers that “there is no evidence” that a given chemical causes a particular health effect may mean only that the tests haven’t been done (Exhibits C.3, .8, C.14, C.19).

The Committee was also presented information noting that many pesticide substances once considered and promoted as safe by government and industry have been shown, after more study and experience, to be obviously unsafe (Exhibits C.3, C.19). DDT and 2,4,5-T (one of the active ingredients in Agent Orange) were given as examples of why so many people feel it is better not to take a chance on products even when EPA or pesticide manufacturers say there is no cause for alarm.

While some felt that EPA registration was sufficient evidence of probable safety (or “acceptable risk,” in governmentese), others considered EPA standards to be set not so much to protect human health and the environment as to satisfy political goals of an industry that supports some of the highest-paid lobbyists in the world—otherwise, critics say, the standards would not permit release to the environment of substances that are know to cause cancer, birth defects, hormonal disorders, nerve and immune-system damage, etc. While the Committee as a whole agreed that non-toxic methods of vegetation management were highly preferable, and a majority felt that non-toxic alternatives were the only ones acceptable, a minority felt that use of low-toxicity herbicides would be acceptable under some conditions. The majority was willing to concede that possibility, but the issues remained moot since the concept of “low-toxicity” proved as difficult to determine as “safety”, and the Committee did not have time or resources to investigate products that might meet that criterion.

D.3. Environmental Health

Environmental health concerns of vegetation management include, among other matters, takeover of diverse plant communities by highly-competitive species (e.g., “noxious weeds”), with resulting reduction in biodiversity; the value of plants to wildlife systems (food, habitat, pollination, etc.); the usefulness of fast-spreading plants as colonizers useful for stabilization of disturbed areas; the pollution of water, air, and wildlife food chains by pesticide use; and the role of plants ion filtering toxic substances from air and soil, maintaining atmospheric oxygen balance, and moderating climate extremes.

Vegetation is widely considered to be an indicator of environmental quality in general; when vegetation is unhealthy, people tend to think that something’s wrong with the environment. From this perspective, lush plant growth following heavy rains is positive rather than negative.

It was noted that while increased vegetation growth may be the result of increased temperatures and off-schedule heavy rains in a changing climate pattern, that same pattern of increasing

temperatures and drought may make any vegetation more welcome, not only for shade and aesthetic reasons, but for the essential roles plants play locally and globally as "the lungs of the earth." Vegetation management practices can exacerbate changes caused by climate change; for instance, clearing vegetation can contribute significantly to formation of "heat islands," an increasing problem in areas where moderate temperatures were previously enjoyed.

The Arizona Department of Agriculture list of Native Arizona Weeds (Exhibit E.1) was distributed, identifying plants, usually non-native (e.g., exotic) species, of state and national concern due to their domination of plant communities, especially grazing lands. None of the listed species was identified as an issue in Bisbee.

While some considered so-called "invasive" species (e.g. Desert Broom, Carelessweed, Mesquite, Tumblewed) as foreign invaders overwhelming more desirable, usually native, species, the majority found that many species so labeled are themselves native (e.g., Desert Broom and Mesquite), and that the "invasions" of which they're accused are recognized by some scientists as part of natural ebb and flow patterns that occur over long climate cycles. Often, it was noted, concerns expressed about "invasive" species are based more on aesthetics than ecological stability.

While there was general agreement that a large presence of competitive species may be an indicator of a system out of balance, it was brought o the Committee's attention that the colonizing of disturbed areas by highly competitive species, whether recently or historically introduced, is not an unnatural process, but one by which nature fills its ecological niches and vacuums, and that this process is often speeded up by modern human behaviors that overwhelm a relatively natural environment's ability to adjust to stressors, thereby rapidly altering once very stable, slowly evolving ecosystems. In this light, what some call "invaders" might better be thought of as "pioneer" or "colonizing" species that provide the important benefit of stabilizing disturbed grounds to control erosion, thereby beginning the process of re-conditioning and re-establishing micro-climates so "second-stage" plants can come back.

Information presented to the Committee indicated that some pesticide chemicals (both active ingredients and byproducts) can and eventually do find their way into groundwater, and that regulations to keep such chemicals out of the water or limit the amount allowed in it, have generally come only after contamination has occurred. Contamination, it was found, can occur not only from direct application to water, but from run-off after storms, from percolation through the ground, and from residues blown by the wind.

D.4. Economics

It is a well-known axiom of landscape management that groomed landscapes, unlike natural ones, are inherently unstable; the more groomed, the less stable and, therefore, the more intensive the management required to maintain them. The majority found that considerable savings could bresult from replanting some properties (e.g., highway shoulders) from high-maintenance lawn-like plants to low-maintenance mixtures of short- or mid-level grasses and herbaceous plants (including native wildflowers) that do not require mowing.

Similarly, in vegetation management as elsewhere, addressing causes rather than symptoms may be more cost-effective in the long run (Exhibit F.4). The Committee found, for instance, that in the long term it is more cost–effective to prevent woody plants from taking root than to remove the roots after the plants have become established, and it is less costly in the long term to maintain turf areas than to rehabilitate them after proper maintenance has een neglected as it has been, for instance, in Vista Park.

Actual figures pertaining to current costs of vegetation management (e.g., infrastructure damage, the cost of personnel and l equipment, and potential liability to the City) were not provided to the Committee, but the Committee's survey of other cities in the region indicated that the $65,000 Mr Cartun reported as Bisbee's annual figure and the approximately $50,000 allocated in the Parks and Recreation budget (Exhibit B.4) are considerably less that most other small Arizona cities spend in maintaining their public properties.

Even if figures had been available on which to base an economic analysis of current practices and management options study, which they were not, such an analysis was beyond the scope of the Committee; the Committee did find, however, that economics of vegetation management involve significant non-monetary values which must be figured into any reasonably complete cost-benefit analysis.

It was noted by some members, for instance, that there are significant factors involved in pesticide use beyond the purchase price of the chemicals (Exhibit C.21), among them the long-term costs associated with the syndrome cited in classroom and textbook as the "pesticide Treadmill" or "Pesticide Habit"—the problem of not being able to stop using the chemicals once you start because their vary use creates growing conditions that demand more of them over time. The analogy to better-known kinds of addiction is instructive. Other members noted, however, that it is also possible to use pesticides for a period and then stop, and that in some instances, depending on the economic criteria, pesticide use could reduced management costs.

D.4.a. Infrastructure Damage

Infrastructure damage was identified by the Committee as the top management priority for the City. The Committee was informed of a number of vegetation-related infrastructure problems, including cracked and buckled sidewalks and roadways, damaged retaining walls on hillside and in flood control channels, and clogged or broken sewer lines. It was noted that the drainage ditch in Old Bisbee is classified and maintained by the City as a utility, an infrastructural component, since it s principal function is as a stormwater conveyance.

The Committee found that prevention plays an important part in stump and root removal, as it does in other kinds of vegetation management, and that management that monitors and treats vegetation before seeds form and root systems take hold is the most economically sensible approach. Pulling or crown removal (i.e., cutting below the crown to prevent or retard resprouting of undesired woody plants while the plants are young) is generally easier (and cheaper) than removal of more mature plants (rule of thumb: can below the soil 5x the ground level diameter of the trunk). Future costs can also be significantly reduced by capping the disturbed area after removal with impermeable materials or competitive vegetation to reduce the likelihood of other woody plants taking root there. Cutting plants before seeds mature prevents their spread to undesired locations, Installing barriers below steps when building or repairing walkways inhibits plant and root growth beneath them which might otherwise lead to cracked pavement (Exhibit F.4).

The Committee found that mature trees already causing infrastructure damage should be systematically targeted for removal in a prioritized sequence, beginning as soon as practicable. It was noted that simply killing the tops and roots of such trees is not sufficient, since the damage may even worsen as roots rot and their place is taken by heavy soils or water. Some members noted that in most such instances, the expense of using herbicides first to kill the roots is unnecessary since it is no more expensive to remove living than dead roots. It was also noted, however, that there are instances where physically removing unwanted mature plants is not

practical; it wold in some cases, for instance, involve the unnecessary expense of destroying sidewalks, retaining walls and culverts in order to access these roots. A minority felt that in these rare cases, the use of some kind of stump killer should be considered, but only, they felt, if prior to such use, several safety factors were evaluated, including ,1) the safest effective product on the market, 2) what type of personal protection the person applying the product requires, 3) evaluation of the potential exposure routes for the population and the environment, 4) mitigation of the potential exposure routes to the fullest extent possible (e.g., signage, public notification, physical barriers, and encapsulation), 5) the extent that the remaining unmitigated exposure represents an insignificant risk, 6) a strictly enforced policy that this method only be used as a last resort in narrowly-defined instances such as cases where mature roots are causing or will cause infrastructure damage, and cannot practically be removed without damaging existing infrastructure.

The majority found that such an evaluation process was too cumbersome to be feasible , and, given the realities of employee turnover, unlikely to be maintained in the long term. Furthermore, the majority noted that non-chemical methods (such as stump grinders and biological stump-removers) were readily available, more practical, and less risky.

D.4.b. Personnel and Equipment

The Committee found that the City possesses very little mechanical equipment designed for efficient vegetation control, especially considering the large area covered by the municipality. It was agreed that weed eaters were inadequate for covering the areas targeted fir trimming, and that other equipment (e.g., mowers, seed vacuums) would likely be far more cost-effective in the long run.

For instance, the Committee heard from the Public Works Department that its employees may spend weeks weed-eating narrow strips of vegetation along the shoulders of Highway 92 from the traffic circle to Naco Highway, but was also informed that Ft. Huachuca had recently reduced its timeload from weeks to days at similar brushy shoulders sites by weed-eating thoroughly once and using a brush hog thereafter.

Presentations made to the Committee indicated that grant monies for capital expenditures, such as equipment, are more difficult to obtain but that assistance in grant seeking is available to rural community groups who are willing to research and prioritize their needs.

The Committee also found that too few employees are assigned to vegetation management. At present, the Community Development Department apparently has only two employees for that job, and Public Works has non assigned fulltime. The Committee found that proper equipment wold probably increase productivity of employees in both departments, and that the Parks and Recreation Groundskeeper's workload demanded that he be provided at least one fulltime assistant in addition to a seasonal or part-time assistant during the growing season.

The Committee found that alternative sources of labor, including inmate labor and volunteer labor, though in general very helpful, are sporadic and otherwise unreliable. Based upon agreement that preventative maintenance, timing, and coordination are keys to cost reduction, the Committee found that grant monies could be sought to provide for the hiring of a program coordinator for non-employee workers Such a coordinator's duties might include recruitment and organization of volunteer and other alternative labor forces, prioritizing and scheduling of management activities, site mapping and information collection, and researching appropriate methods. Grant-seeking assistance is available to the City through the USDA resource Conservation and Development Program office in Wilcox.

Presentations made to the Committee indicated that more reliable sources of volunteer help may be available through such programs as Americorps (Exhibit G.1) and JTPA. Other sources of labor or research assistance may be sought through the Master Gardener Program (which requires community service as part of the training), schools and clubs. The City should investigate opportunities as well as the possibility of grants to supplement the program budgets.

In addition, the Committee found that re-vitalizing the volunteer Adopt-a-Park program, and extending it to include landscape areas, could provide a significant benefit to the City's vegetation management program, as could a program to involve private property owners in management of the vegetation on adjacent City properties.

D.4.c. Liabilities

All management methods. including No Action, pose a variety of personal and property liabilities to the City. For instance, the Committee was told that the City has had several property liability cases resulting from stones thrown by weed eaters. Manual and mechanical methods in general present a range of physical hazards to employees (cuts, sprains, etc.).

The Committee was also informed that the potential for personal liability suits resulting from the use of chemical pesticides must be seriously considered. Because chronic health effects (cancer, birth defects, immune system damage, etc.) are associated with a wide variety of herbicides and other pesticides (Exhibits C.4, C.5, C.7, C.12, C.15-18, D.7), legal action may not be taken for many years after the chemical management activities at issue. Similarly, health effects in children, who are disproportionately susceptible to adverse effects of chemicals (Exhibits C.8, C.14), may not be diagnosed until years after exposure. Similarly, groundwater contamination may not occur or be discovered until years after chemical applications. In consideration of these possibilities, it was noted that the apparently lower cost of using herbicides may be merely a shortsighted "pennywise" expedience that needs to be weighed against potential long-term health and environmental costs.

The Committee agreed that non-toxic methods are preferable, but did not find any specific chemical products or method that met the non-toxic criterion; on the other hand, the Committee found that manual, mechanical and biological methods were relatively benign and to be preferred as long as they were comparably effective and not too expensive.

D.4.d. Full-Cost Accounting

While a minority spoke of economic factors principally in quick-turnaround, bottom-line terms (defined largely by the City's annual budget-setting process), a majority held that if economics were to be a determining factor it old have to be an economics that employs open, full-cost accounting; that is, one that takes full account of and gives honest weight to not only easily quantifiable costs and benefits like labor and materials and unbroken retaining walls, but the costs and benefits of relatively intangible things kke public and environmental health, peace of mind, civil contentment, etc., factors that partial-cost accounting practices typically ignore or undervalue.

Standard financial planning, for example, usually "discounts the future" in order to figure accounts on the basis of current and near-term cash values and avoid uncertainties of an unforeseeable future. A majority of the Committee found that ignoring or discounting or otherwise undervaluing such intangibles was not honest accounting, not compatible with

sustainable development, and no a valid basis for vegetation management decisions by the City.

On the other hand, in full-coast accounting , the cost of controlling a particular plant or species figures in not only the labor and material costs of physical control, but the public values affected pro or con by removal: the value of the site in aesthetic terms, for instance, or for parking, or erosion control, or wildlife habitat. Similarly, full-cost accounting requires that any cost-benefit analysis of chemical pesticide use figure in such potential long-term or deferred costs as cleaning up the water supply, or finding an alternative supply for the future, or responding to pesticide-caused illness.

Standard accounting normally treats non-monetary values as “externalities” and “variables” subject to “uncertainties” that resist being reduced to dollars and cents. But because many of the costs and benefits in vegetation management are not monetary or otherwise easily quantified, the accounting, and the decision-making that follows it, become judgment calls, weighing various monetary and non-monetary values against each other—in short, political rather than purely factual or financial.

D.5. Program Administration

The Committee found that the City has no comprehensive, coherent program for vegetation management. The City Ordinance on Parks and Recreation is silent on vegetation management, and relevant parts of the City Code and Uniform Fire Code refer only to hazard and nuisance abatement. Management is divided between the Public Works Department and the Parks and Recreation section of the Community Development Department, the former having responsibility principally for rights-of-way and general infrastructural upkeep (including cemetery and ditch maintenance), the latter for other areas.

Vegetation management is not broken out in the departmental budgets. The line items in the FY 1999 Parks and Recreation budget (Exhibit B.4) that include vegetation management as well as other P&R expenses (Maintenance and Repair, Other-Grounds, Agriculture and Horticulture, and Other-Events-Programs, Small Tools, etc.) total approximately $20,000. The division also pays salary of the Groundskeeper, has a $25,000/year contract to Cochise County Association for th Handicapped (primarily for mowing), and contracts with the Department of Corrections for occasional inmate labor.

The Public Works budget figures were not available by the time this report was being written. At the Committee’s first meeting, Mr Cartun reported that the vegetation management expenses in the FY 1999 PW budget were approximately $65,000/year.

The Bisbee Fire Department is responsible for enforcing the Combustible Vegetation section of the Uniform Fire Code (Exhibit B.3) and the Community Development Department is responsible for litter abatement on private property pursuant to Article 9.4 under the Health and Sanitation section of the City Code (Exhibit B.2). The Community Development Department also has abatement authority under the City’s Zoning Ordinance.

The City sets 6" as the height past which vegetation becomes subject to litter abatement under Article 9.4. Although the Department previously cited property owners for violation of the Code (a criminal misdemeanor), notifying them by mail that if they did not take care of their vegetation the City wold do it for them, that procedure was found to be ineffective and costly. More recently the Department notifies owners that if the overgrowth is not abated promptly, the matter will be turned over to the Magistrate Court as a zoning violation; this procedure so far has proved more effective.

The City generally does not on its own initiative inspect private properties or cite owners for code or zoning violations, but only in response to citizen complains. Inquiries to the Department in early February found that some 70-80 complaints are received and violation notices mailed annually, approximately five/month (and approximately double that number in the summer and autumn growing season). About five cases are in process at any given time. Staff noted that most of the complaints are easily resolved upon notification, and many turn out not to be valid but, instead, result from feuds between neighbors.

Following the heavy rains in the summer of 1999, there was a noticeable increase in the number of complaints, which staff attributes to increased public concern about fires after several structures in the city had burned. During the same period, the Fire Department visibly patrolled the city on a frequent basis, raising people's awareness of the hazard and, staff felt, contributing to owners' readiness to keep vegetation trimmed on their private property. Ordinarily, however, the Fire Department laves abatement actions to the Community Development Department.

The conspicuous absence of formal objectives on vegetation management of public properties, and the comparatively low budgets (compared to other small Arizona cities) for upkeep of those properties, the Committee found to be major contributing factors to the long general neglect and current deteriorated condition of the City's thirteen parks and numerous landscape areas.

The Committee found that soil compaction and other undesirable conditions, including proliferation of "stickers", were principally caused by lack of systematic preventative maintenance in high-use turf areas, as well as by inappropriate design of ornamental landscape areas to require intensive maintenance of high water-use plants, and that conditions could be reversed by application of better vegetation management practices.

Although the Committee found that considerable improvement has occurred in the past two years since a fulltime Groundskeeper was hired the Committee also found room for condierably more improvement, requiring more resources than could be provided by the two employees Community Development currently employs for vegetation management.

E. Best Management Practices

The Committee's research yielded a preliminary list of general principles and sound management practices which reduce the incidence of unwanted vegetation and provide a basis for reducing long-term management needs. The key to such management was found to be well-planned, holistic, systematic, site-specific preventative maintenance. Several (though hardly all) essential elements in such a program of best management practices are found below.

E.1. Levels of Acceptance and Action

A logical first step in any rational plan is to determine the goal. A reasonable next step is to determine the limits of tolerance for barriers to that goal, and to decide what action will be taken when those limits are reached. The City of Bisbee has set neither goals nor action levels for vegetation management, both of which steps necessarily involve identifying levels of community acceptance for vegetation and for vegetation management activities.

As the controversy about management of the Old Bisbee ditch indicates, levels of public acceptance for relatively unmanaged vegetation may be quite high and acceptance of management methods quite low. Levels may vary considerably according to neighborhood or tratment site. For instance, the public may find treatment of relatively natural areas generally unacceptable, but be strongly in favor of controlling "sticker plants" in parks and playgrounds.

Similarly, the public may find treatment by manual or mechanical methods acceptable where chemical applications would be strongly posed.

E.2. Pre-planning and Design

Like any architectural project, landscape architecture requires considerable forethought, pre-planning, and detailed design. Vegetation management, which may be seen as a kind of landscape architecture, is no exception. Pre-planning for effective vegetation management involved use of calendars (to coordinate seasonal cycles of precipitation, plant growth, harmful and beneficial insects, site use by humans, etc.) as well as maps (to determine appropriate locations of plant types according to the factors just mentioned as well as sunlight, wind, drainage, etc.). It also requires detailed setting of priorities and scheduling of activities over several years at a time. Effective planning takes account of long-term goals as well as short-term objectives.

Sometimes major re-visioning and systematic re-design is required to correct "inherited" problems of previous inappropriate design. The Upper Vista area in Warren, for example, presents significant (and, therefore, costly) management problems due to incompatible plant groupings (e.g., cactus adjacent to high water-use plants) and unstable decorative rocks that have deteriorated over time, leaving pieces scattered about. While it might appear that retaining the existing design rather than restructuring the area may make economic sens, given the probable cost of restructuring, correcting such inherited problems does not always require infeasible outlay of resources since sometimes two apparently distinct problems can be dealt with simultaneously. Again using the Upper Vista as an example, for instance, replacing the crumbling boulders and incompatible plants groupings with more appropriate features could be done at relatively low cost during the rehabilitation that must occur in the area to correct the soil compaction problem. Not quite two for the cost of one, but less than doing each job separately.

E.3. Timing

Besides scheduling to combine otherwise separate projects, management activities must be timed to The advantage of natural plant growth cycles, as well as patterns of use by the public. Regular but flexible rehabilitation ans maintenance schedules should be developed and kept in accord with seasonal fluctuations in growth cycles, climate, precipitation, population dynamics of natural predators and diseases, human use patterns, etc. Appropriate timing requires attention to varying kinds and degrees of management activities; for instance, the need to apply different frequencies and duration of treatments according to different phases of the growing season.

Different plant species planted in the same landscape grouping may have considerably different needs and plant growth patterns, and these must also be addressed in scheduling appropriate timing of management activities.

Treatment of unwanted vegetation must be timed to prevent dispersal of mature seeds of grassy and herbaceous species, and to prevent deep rooting Insofar ad the goal is to reduce asthma, allergies and other respiratory problems, management of woody species. must be geared to pollination cycles.

In order to deter takeover of disturbed soils by unwanted vegetation, disturbed soil or pavement caused by City, County or public utility work crews must be promtly sealed, capped with mulch or other materials, or replanted with appropriate species of native grasses or other vegetation that will crowd out or out-compete unwanted species (Exhibit C.22).

E.4. Site-Specific Focus

Every site is unique. While some management practices have broad applications, one size does not fit all and each site has a different set of management needs due to sometimes subtle differences in ecological situation and desired use. Some differences are obvious: a rock garden requires different care from a playground or turf site. But apparently slight differences in terrain (e.g., slope, elevation, relation to sun and wind) are also important: when examined more closely they will reveal significant differences in micro-climates and other growing conditions. Peaches, for example, tend to do well in Warren but not Old Bisbee, while apricots tend to do better in Old Bisbee than in Warren. The same principles apply to turf species, which must be selected on the basis of factors like sun/shade ration, availability of water, types of recreational use they will be subjected to, etc. (Exhibit F.2). In order to make best use of resources, sound management begins with understanding the natural environment of a location, then taking account of varying site-specific needs and capabilities to plan accordingly.

E.5. Cultural Practices

Good vegetation management is often a matter of good soil management. it is widely recognized that healthy, well-conditioned soil planted with the appropriate vegetation will deter unwanted growth. According to some, soil cultivation is the most important management practice. Hoeing and tilling of soil is a time-honored and effective method o controlling unwanted vegetation. So is smothering it with heavy layers of organic mulch made of lawn clippings, leaves, newspapers or compost. Desert hard-pack soil or rocks are more suitable for use around cacti than mulch.

Cultivating the soil also alleviates soil compaction caused by trampling, improves tilth and friability, allows for necessary drainage to leach out unwanted mineral salts. In addition, "working up" the soil provides a better habitat or soil micro-organisms and earthworms, which in turn help provide aeration and fertilization.

There are a great variety of cultural practices, including the following.

E.5.a. Conditioning

Conditioning is needed by soils that have excesses of harmful salts, poor internal drainage, heavy clays ans caliche, compaction, hardpan, crusting or other obstructions. Usually it requires improvement of some physical property of the soil, like structure, to improve conditions for growth or desirable plant species.

Conditioning may involve replacing sodium components of the soil with calcium, which promotes easier movement of soul and water in the soil. Or it may involve surrounding seeds with materials like sawdust, compost, sand, perlite, etc., that facilitate germination and sprouting.

There are two major kinds of conditioning practices: mechanical manipulation and addition of soil amendments. Mechanical manipulation includes practices like tilling and growing of cover or manure crops like ryegrass, clover, etc., which are tilled into the ground to provide nutrition and tilth. There are several kinds of soil amendments, including 1) inorganic chemicals (e.g., gypsum, sulfur, iron sulfates); 2) inert materials (e.g., sand, vermiculite, perlite, gravel); and 3) organic material (e.g., rotted manures, composts, sawdust, bark, straw). Organic materials are especially needed in Bisbee soils, as they are throughout much of the arid Southwest.

E.5.b. Aeration

Aeration is a specific kind of soil conditioning essential to the formation of turf and reduction of unwanted vegetation. It is especially effective in preventing soil compaction. One simple aeration method involved drilling holes and then filling them with mortar sand, water and fertilizer after aeration. This process should be carried out at least twice per year in turf areas (e.g., Vista Park).

E.5.c. Site Preparation

As every gardener knows, the most important time in gardening is spent before planting, in preparing the seedbed. Besides proper preparation of soil condition, best management may also include use of a variety of methods hat control unwanted plants by first encouraging heir germination, then killing their seedlings. For instance, a seedbed to be planted to desirable species may first be watered, covered with sheets of thin pastic and then letting the sprouts of the unwanted species to be seared by the greenhouse effect of the plastic covering before removing it and planting the desired species. Or the unwanted seedlings may be burned off with flamethrowers o sprayed with hot water or steam (Exhibit .22).

Another useful pre-planting technique for preventing unwanted plants is to place several layers of newspapers or similar material under areas where walkways are planned. Although this method was once discouraged because of the lead content in printing ink, most newspapers are not printed with soybean-based inks which are less toxic (although color pigments in the ink and paper as well as chlorine-based chemicals used for bleaching the paper may still be considered undesirable additions ro the soil).

As noted above, every site has different needs and capabilities, and site preparation must take account of these.

E.6. Nutrition

Only sixteen elements are generally recognized as essential to plant growth, and of the six of these need in relatively large amounts, only two are generally lacking in Southwest soils: Phosphorous and Nitrogen. In some cases, to satisfy needs of particular plants, it may also be necessary to supply certain micro-nutrients (also known as trace elements). Soil sampling is an essential part of providing proper nutrition for plants.

Use of chemical fertilizers, while not as generally controversial as use of chemical pesticides, raises similar concerns about contamination of water resources and effects on soil health. Use of chemical fertilizers, especially concentrated nitrogen formulations, has been associated with loss of essential soil micro-organisms, water contamination and, most recently, deformities in frogs exposed to the runoff from fertilized fields, even at concentrations far too low to violate PA drinking water quality standards (Exhibit C.1).

There are a wide variety of organic fertilizers available that avoid the problems associated with concentrated chemical products. These include products made from seaweeds, fish byproducts, forestry byproducts, animal byproducts, and pulverized mineral rocks. Some organic fertilizers have problems of their own (sewage sludge, for instance, often sold as organic fertilizer, can contain a variety of toxic metals and pathogens), but others have been used successfully by organic gardeners for many years without problems. Recently, slow-release organic fertilizers have become available and hold promise of providing relatively high levels of nitrogen without the “chemical burn” sometimes resulting from use of concentrated chemical products (Exhibit C.22).

V. Exhibits (descriptive titles only)

A. Committee Documents
- A.1. List of Committee Members
- A.2. Sites of Concern Identified by the City
- A.3. Map of Sites of Concern Identified by the City
- A.4. Data Identification Matrix
- A.5. Brief Overview of the History of the Parks and Recreation Committee

B. City of Bisbee Documents
- B.1. Bisbee City Council Minutes of November 1, 1983 ("Motion on Use of Herbicides and/or Pesticides in the City and City Cemetery")
- B.2. City Code Article 9.4. Removal of Litter
- B.3. Uniform Fire Code §1103.2.4 on Combustible Vegetation
- B.4. FY 1999 Parks and Recreation Budget
- B.5. Bisbee Beautification Committee Recommendations (December 16, 1985)
- B.6. Lovers of the Green Recommendations (December 1998)

C. Chemicals: General
- C.1. Associated Press, "Fertilizer Levels Deadly to Frogs, Study Says," *Sierra Vista Herald/Bisbee Review* (January 6, 2000).
- C.2. Sharon Batt and Liza Gross, "Cancer, Inc.," *Sierra Magazine* (September/October 1999), pp.36-43, 63.
- C.3. California Senate Office of Research, *Pesticides and Regulation: The Myth of Safety* (April 1991).
- C.4. Caroline Cox, "Toxicology of 'Inerts' in 2,4-D Products," *Journal of Pesticide Reform* 19(1)(Summer 1999), p.18.
- C.5. Beyond Pesticides/National Coalition Against Misuse of Pesticides, "Health Effects of 48 Commonly Used Pesticides in Schools," *Pesticides and You* 19(3)(1999), p.15.
- C.6. Caroline Cox, "Inert Ingredients in Pesticides: Who's Keeping Secrets?" *Journal of Pesticide Reform* 19(3)(Fall 1999), pp.2-7.
- C.7. Reto Engler, *List of Chemicals Evaluated for Carcinogenic Potential*, US-EPA Health Effects Division (December 31, 1994).
- C.8. Environmental Working Group and Physicians for Social Responsibility, *Pesticide Industry Propaganda: The Real Story* (1995).
- C.9. L.J. Guilette, "Endocrine-disrupting Environmental Contaminants and Reproductioin: Lessons from the Study of Wildlife," in D.R. Popkin and L.J. Peddie, eds., *Women's Health Today: Perspectives on Current Research and Clinical Practice* (1994), pp.201-207.
- C.10. Elsie Heath, "New World Order: 115 Nations Take a Step to Eliminate or Phase Out 12 Toxic Chemicals," MAMM (January 2000).
- C.11. Gwynne Lyons, "Endocrine Disrupting Pesticides," *Pesticide News* 46 (Decemeber 1999), pp.16-19.
- C.12. Hillary Melcarek, "Chemicals found to Affect Male Reproductive System in New Way," *Pesticides and You* 19(1)(1999), pp.18-19.
- C.13. Peter Montague, "Chemical World: A Special Report on New Pesticide Dangers Uncovered So Far This Year," *The Ecologist* 29(6)(October 1999), p.351.
- C.14. J.P Myers and Theo Colburn, "Blundering Questions, Weak Answers Lead to Poor Pesticide Policies," *Chemical and Engineering News* (June 7, 1991), pp.40-43.
- C.15. National Academy of Sciences, "Potentially Oncogenic Pesticides Identified by the

EPA," *Regulating Pesticides in Food* (1987).
C.16. Lauran Neergard, "Yard Chemicals, Childhood Cancer Linked," *Albuquerque Journal* (February 29, 1995).
C.17. New York Coalition for Alternatives to Pesticides, *NYCAP Herbicide Fact Sheet, Common Weed & Brush Killers Used on Lawns and Rights of Way: Acute Health Effects & Environmental Impacts* (June 1992).
C.18. Northwest Coalition for Alternatives to Pesticides, "Hazards of Flea Control Pesticides," *Journal of Pesticide Reform* 17(2)(Fall 1997), pp.20-21.
C.19. Mary H. O'Brien, "Why No One Can Say 'Pesticides are Safe'" *Pesticide Action Network International* (n.d.).
C.20. Physicians for Social Responsibility, *Pesticides and Children: What the Pediatric Practitioner Needs to Know*, (n.d.).
C.21. David Pimentel, H. Acquay, et al., "Environmental and Economic Costs of Pesticide Use," *BioScience* 42(10)(November 1992), pp.750-760.
C.22. Gregg Small and Dorothy Raphael, "San Francisco's Pesticide Phase-Out," *Pesticides and You* 19(3)(Fall 1999): 16-22.
C.23. William E. Stevens, "Pesticides May Leave a Legacy of Hormonal Chaos,"*New York Times Science News* (August 23, 1994), pp.C1,C6.
C.24. USDA-Forest Service, Pacific Northwest Region, "Characterization and Management of Risk," *Managing Competing and Unwanted Vegetation, Final Environmental I [act Statement* (selections), (November 1988).
C.25. US Environmental Protection Agency, Office of Prevention, Pesticides and Toxic Substances, *Background Questions and Answers, National Academy of Sciences Report; Pesticides in the Diets of Infants and Children* (June 1993).

D. Chemicals: Specific
D.1. Meriel Watts and Ronald MacFarlane, "Glyphosate,," *Pesticide Action Network Asia and the Pacific* (June 1999), pp.1-8.
D.2. Caroline Cox, "Glyphosate, Part I: Toxicology," Journal of Pesticide Reform 15(3)(Fal1995), pp.14-20.
D.3. Caroline Cox, "Glyphosate, Part II: Human Exposure and Ecological Effects," *Journal of Pesticide Reform* 15(4)(Winter1995), pp.14-20.
D.5. Caroline Cox, "2,4-D: Ecological Effects," *Journal of Pesticide Reform* 19(3)(Fall 1999), pp.14-19.
D.6. Caroline Cox, "2,4-D: Exposure," *Journal of Pesticide Reform* 19(4)(Winter 1999), pp.14-19.
D.7. National Cancer Institute, "Summary," *Bioassay of Trifluralin for Possible Carcinogenicity*, NCI Technical Report Series No 34, NCI-CG-TR-34 (1978).
D.8. National Coalition Against the Misuse of Pesticides, "Trifluralin," *Pesticides and You* (October 1992), pp.14-15.

E. Plant Species
E.1. Arizona Department of Agriculture, Plant Sciences Division, *Arizona Noxious Weed List* (n.d.).

F. Management Methods
F.1. Howard Horowitz, "Manual Pulling of Brush," *NCAP News* (Winter 1985), pp.14-15.
F.2. David Kopec, *Lawn Care for Cochise County and Sierra Vista Area*, University of Arizona Cooperative Extension, Cochise Master Gardeners (n.d.).
F.3. Pesticides Trust, "Weed Control in Hot Water," *Pesticide News* 21 (September 1993), p.17.
F.4. Pollyanna Lind, "Preparing a Landscape Site without Chemicals," *Journal of*

Pesticide Reform 19(4)(Winter 1999), pp.22-23.

G. Resources
G.1. Resource Conservation and Development: Making Things Happen.
G.2. Welcome to Peaceful Valley Farm Supply's Website (January 10, 000).
G.3. Arizona Division of Forestry, *Urban and Community Forestry in Arizona* (n.d.)