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REPORT OF THE INTERAGENCY IPM COORDINATING COMMITTEE

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REPORT OF THE INTERAGENCY IPM COORDINATING COMMITTEE

I. INTRODUCTION

This report was prepared in response to the President's directive of August 2, 1979, in which he established the Interagency Integrated Pest Management Coordinating Committee and instructed the committee to report on the progress made by federal agencies in the advancement of IPM and on any institutional barriers preventing progress. This report addresses the national policy on IPM, the progress made toward implementing the policy, the barriers preventing or slowing progress, and recommendations for overcoming these barriers.

In his 1977 Environmental Message, the President instructed the Council on Environmental Quality "to recommend action which the federal government can take to encourage the development and application" of techniques used in IPM. In 1979 the Council published its report, "Integrated Pest Management" in which policy initiatives as well as additional research and education efforts were recommended to provide a sound basis for the advancement of IPM. As a result of this report, the Interagency IPM Coordinating Committee was established in a directive from the President that accompanied his 1979 Environmental Message on IPM. The committee is composed of policy-level officials from 10 agencies:

Agriculture	Health, Education and Welfare,
Commerce	Housing and Urban Development
Defense	Environmental Protection Agency
Interior	General Services Administration
Labor	Transportation

The committee is chaired by the Council on Environmental Quality. In determining the scope of IPM activities in the federal government, the following additional agencies were invited to participate in the work of the committee:

Agency for International Development
 Appalachian Regional Commission
 National Aeronautics and Space Admin.
 National Science Foundation
 Small Business Administration
 Tennessee Valley Authority

Treasury
 State
 Postal Service
 Veterans Administration
 Energy
 Peace Corps

All of these agencies either have a current federal role in pest control or activities related to pest control, or are seen by the committee as having a responsibility for a future role in the advancement of IPM. The roles of all involved agencies are presented in Appendix A of the report.

II. THE IPM APPROACH

A. The Concept and the President's Definition

Mankind has always had to deal with the detrimental influences of pests. Significant progress was made during the past 50 years on alleviation of these problems. In many cases, however, too much emphasis was placed on single control tactics and not enough on the influence of pest control practices on natural resources, such as air, water, soil and wild life. IPM is designed to overcome this potentially serious problem. The 1979 Environmental Message to Congress described IPM as "a systems approach to reduce pest damage to tolerable levels through a variety of techniques, including predators and parasites, genetically resistant hosts, natural environmental modifications and, when necessary and appropriate, chemical pesticides." This concept was adopted as the working base for the Interagency IPM Coordinating Committee deliberations. The IPM Approach includes a description of the management systems, how they should be managed, and what resources will be required.

B. Management Systems

Pest management is diverse and has institutional, production system and natural resource components. It is truly transagency in nature

with activities conducted in diverse federal spheres. Because of this diversity it is difficult to address the progress made by individual federal agencies in the implementation of IPM. For this reason, the committee has divided the activities of the federal agencies into 6 management systems:

1. Agriculture

Activities related to production of food and fiber crops and livestock, including pasture management and post harvest aspects such as storage.

2. Forestry

Activities related to the production of wood and wood products, including post-harvest storage, but not activities related to wooden structures.

3. Rangeland

Activities related to the maintenance and utilization of public rangeland, not including private agricultural pasture land.

4. Rights-of-Way

Activities related to the maintenance of rights-of-way such as public roads, highways, power lines, pipelines, public waterways and railways.

5. Urban Environments

Activities related to maintenance of structures and associated grounds, including private and commercial sites, parks, cemeteries and watersheds. Public lands maintained for agricultural, range and forestry purposes are not considered under this system.

6. Public Health

Activities related to the maintenance of public health, including mosquito, rodent and other disease vector control.

Federal pest control responsibilities in these management systems, either current or potential, have been identified in 22 agencies and presently include an annual expenditure of approximately \$700,000,000. (Table 1.)

TABLE 1. Estimated FY 1980 expenditures of the U.S. government for activities related to pest control. (\$ millions).

Management Systems	Activities				Total
	Research	Technology Transfer	Implementation	Assistance	
Agriculture	104.96	10.95	49.03	-	164.94
Forestry	33.92	9.83	61.51	7.10	112.36
Rangeland	1.79	3.91	6.58	0.90	13.18
Rights-of-way	2.23	0.06	13.40	-	15.69
Urban	4.57	2.97	127.04	-	134.58
Public Health	6.42	2.69	81.44	-	90.55
Other ⁽¹⁾	24.50	0.21	134.22	-	158.93
Total ⁽²⁾	178.39	30.62	473.22	8.00	690.23

(1) Resources that cannot be assigned to a single management system (e.g. Pesticide registration, enforcement, and pesticide toxicology research).

(2) Does not include approximately \$106 million expended by state institutions for pest management research and \$35 million by state and county extension service for technology transfer.

C. Goal

The national goal is to manage pests at an acceptable level through the use of procedures that result in favorable socio-economic consequences with minimum adverse environmental impacts. It should be possible to achieve this national goal by the mid-1990's through systematic development and implementation of IPM programs. National policy must support this goal whenever possible. A national IPM program is needed to coordinate agency pest control activities related to the interactions among our institutions, production systems and natural resources. The program must be designed to stimulate appropriate IPM activities in state and local governments, and private enterprise. It must place strong emphasis on the systems approach and environmental impact, in addition to the economics of the managements systems.

D. Activities

To achieve the recommended national goal, IPM programs must include in a reasonable balance of effort and accomplishment the following 4 activities:

1. Research

To acquire new information about pests, pest control and the interaction of pests and their environment. A significant amount of basic and applied research is necessary before sound IPM programs can be implemented in all management systems.

2. Technology Transfer

To make IPM procedures readily available for implementation in management systems. This includes constraint resolution, demonstration, extension education, higher education and public awareness activities.

3. Implementation

Activities conducted by system managers to reduce the impact of pests to an acceptable level, including all public and private sector activities in the use of IPM procedures. Achievement of the national goal depends on IPM implementation.

4. Assistance

To stimulate the implementation of IPM by providing appropriate economic and natural resource programs, such as loans, insurance programs and environmental cooperation projects.

Legislative authority to federal agencies in each of the IPM activities is outlined in Appendix A. Additional legislation may be required to implement IPM in all management systems and achieve the recommended national pest management goal by the 1990's.

III. PROGRESS AND STATUS OF IPM IMPLEMENTATION IN FEDERAL PEST CONTROL PROGRAMS

A. Policy

Most federal agencies engaged in pest control activities have policies or directives that either advocate the use of IPM in their activities or promote the use of pesticides in an environmentally safe manner. Some agencies not having a written directive on IPM promote some of the principles, such as the use of biological controls. The issuance of statements or directives by agency administrators, however, frequently lacks the management structure to assure that these directives are implemented in a systematic manner.

Among the agencies with major roles in pest control, DOD, USDA, and AID have clearly stated IPM policies that have resulted in the development of an internal plan to address the advancement of IPM. EPA has clearly accepted the philosophy of IPM and is evolving a plan designed to accelerate adoption of appropriate IPM procedures in agency activities. DOI, while endorsing the practice of IPM in its pest control activities, has a variety of policies in its various agencies. These result in various approaches to the concept.

HUD, GSA, Post Office, and VA have a more limited or specific involvement in pest control and are primarily concerned with pests infesting structures. Their policies are largely oriented toward sanitation and the safe use of pesticides. If this policy doesn't result in adequate pest suppression, they basically lack the expertise to develop more innovative programs. HUD has recently used consultants to assist in program development. The rest of the agencies either have no written policy, or at best have a policy advocating pesticide safety in pest control programs. In many of these latter agencies, pest control is considered a peripheral activity. It is nearly invisible at the policy-making level.

B. Analysis of IPM Implementation in Management Systems The extent to which IPM has been implemented in federal pest management activities cannot be accurately measured. Although many research, technology transfer and assistance activities contribute to the use of IPM, it is evident that much remains to be done before effective IPM programs can be implemented in many management systems. While research, education and assistance programs may be pursuing the IPM goals, the

best measure of success is the degree to which IPM is practiced in management systems.

1. Agriculture

Implementation of IPM in agricultural management systems is more advanced than in the other systems. IPM strategies currently employed in most agricultural systems are relatively simple and usually directed at one pest. There is only limited IPM practiced in the livestock sector of agriculture.

The IPM approach received a major impetus with the funding of the "Huffaker Project" (1972-79) by NSF, EPA, and USDA. The program focused primarily on insects and firmly established that economic and environmental benefits could be achieved through a systems approach to pest management. From 1971 to 1979 the Cooperative Extension Service of the land grant universities and the USDA initiated a series of IPM demonstration programs in cotton, soybeans and alfalfa. These have expanded to all states and cover substantial acreage today. The program stressed the practice of monitoring pests and applying pesticides only when economically damaging pest levels are present. Many of these programs have expanded from being insect-oriented and now include disease, weeds and nematodes, and incorporate alternative control tactics in addition to pesticides. The success of these programs has resulted in an increased number of private IPM consultants serving farmers.

This modest success in IPM implementation may be misleading. Very little current IPM deals with the entire pest spectrum, and many programs

employ a single control technology (pesticides). Additionally, very little is known about combined effects of pests. The scientific base is derived from single component research that has not been analyzed in a systematic manner in terms of interactions in the management system.

A recent program involving a 15-university consortium (Adkisson project) was funded by EPA. Beginning in FY 1981, EPA and USDA plan on joint funding and management of this project. It is designed to address pest problems in cotton, soybeans, apples and alfalfa. A comprehensive IPM approach is used, including systems analysis and modeling to unify the multiple factors involved. This program promises to provide appropriate IPM implementation systems for these crops for the future. The program should impact on-farm IPM implementation in 3-5 years. In addition, each of the four USDA regions are developing priority IPM plans for Federal and state research, extension and instruction programs in crops, livestock and urban pest management systems.

Although it is difficult to measure the level of IPM implementation in agriculture, at least 90% of the potential for IPM in agriculture remains to be achieved.

2. Forestry

The nature of forest production systems and forest management is vastly different from agriculture. The long-term economic and environmental considerations in forestry have dictated pest control practices that are more in tune with the principles of IPM. However, when pest outbreaks occur in forests, the devastation is much more cataclysmic and frequently triggers large-scale pesticide usage in U.S. forests. Because of the difficulties associated with the control of pests in an outbreak

situation, forest managers have stressed practices that minimize conditions that provoke outbreaks. These practices, which include selective harvesting, resistant hosts, biological controls, maintenance of genetic diversity and the removal of damaged trees are all compatible with IPM. The USDA Forest Service has incorporated a systems approach in their management of forest insect and disease problems, and recently issued a directive intended to incorporate the control of undesirable vegetation into the overall management system.

In general, the forest management system for insect and diseases appears to be where IPM is in a relatively advanced state. However, portions of the vegetation management program are still completely reliant on herbicides as the sole tactic. Some of the important pests of forests are being reasonably managed. Many pests continue to sporadically break out and provoke intensive short-term control measures. In many instances this is detrimental to the long-term management of the site.

3. Rangeland.

The rangeland of the U.S. is composed of relatively large areas of native grasses that are utilized for grazing livestock or wildlife. The management of most of these areas fall under the jurisdiction of the Departments of Agriculture and Interior. Other federal agencies such as Defense have responsibility for limited amounts of rangeland. The basic management principle of rangeland maintenance is to preserve the natural state of the site while utilizing a portion of the resources. The principal pests of rangeland include insects, undesirable vegetation and some vertebrate predators. The invasion of rangeland by weeds is

largely a result of man's activities in improper use of the resource. Weed and brush control usually includes the use of herbicides. A limited amount of biological control of weeds has been implemented by the Department of the Interior and the Department of Commerce. Insect problems on rangeland are mostly limited to outbreaks of pests such as grasshoppers and range caterpillars. Extensive pesticide application programs have been used to control grasshoppers on rangeland. In 1980, the USDA Animal and Plant Health Inspection Service initiated a pilot biological control project using a protozoan disease (Nosema) to control grasshoppers.

Vertebrate control, principally coyotes, continues to be a serious and controversial problem. A recent policy directive from the Secretary of the Interior that promulgates the principles of IPM in management of coyotes has been severely criticized by livestock ranchers. Conservationists and livestock producers are in opposition regarding methods of coyote management.

Environmentally and economically sound pest control is an objective in all management systems. This is particularly important in rangeland where only minimal economic inputs are practical and maximum environmental results desirable. This combination of factors necessitates the adoption of IPM. The current status of rangeland pest management suggests that there is little integration of pest control activities and that coordination is needed.

4. Rights-of-Way

The major problem along rights-of-way is weed and brush control. Insects, diseases, nematodes and vertebrate pests are secondary. Rights-of-way are generally managed to promote desirable and eliminate undesirable vegetation. The primary focus is management of weeds and the principal tactic is the use of herbicides or plant growth regulators. Herbicide use is generally unacceptable along waterways and the primary tactics are mechanical removal and in some instances, biological control. The utilization of IPM along rights-of-way is in its infancy. Federal agencies with jurisdiction on various rights-of-way include the Corps of Engineers (waterways), Interior's Bureau of Water and Power Resources (waterways), Energy (power lines and pipelines), Transportation (highways), and a number of other landed agencies on numerous access roadways. Some agencies such as the Tennessee Valley Authority are engaged in mosquito control in water impoundments; however, these activities are more appropriately discussed under the section on public health.

Herbicides and cultivation or mechanical removal are the two weed control tactics that are most frequently used. Because of major increases in energy costs, herbicide use has increased significantly in recent years. Along roadways, highways, power lines, railways and pipelines, herbicides are used almost exclusively. Very few alternatives currently exist for control of most species of weeds encountered along rights-of-way. There is limited use of desirable plants that out-compete weeds. Frequently the factor of esthetic beauty precludes these more adaptable plants for right-of-way use. There is an awareness of the need to develop IPM practices for the right-of-way management system. Most system managers are somewhat frustrated at the lack of alternatives that are economically and environmentally sound.

The State of California Department of Highways has instituted an IPM approach for terrestrial rights-of-way which utilizes biological control of pests of some desirable roadside plants and the monitoring of roadside weeds for prescribed herbicide applications. The Federal Department of Transportation presently has little influence over individual state highway right-of-way pest management programs. The Environmental Protection Agency recently initiated a \$3.8 million integrated aquatic weed management program involving other federal agencies to determine environmentally acceptable management measures.

In summary, IPM implementation along rights-of-way is not advancing at a rate that would allow the achievement of the national IPM goal. The primary reasons include the lack of feasible IPM tactics and the lack of a coordinated effort to address the problems peculiar to these management systems.

5. Urban Environments

The agencies of the U.S. Government administer the construction, maintenance and preservation of thousands of structures in urban environments, as well as millions of acres of parkland used for public recreation. Furthermore, most local governments receive federal funds used for urban sanitation, construction, public health and mortgage insurance. Pest control is a significant component of the management of these resources. There is currently no coordination of this activity within the federal system. The DOD is an exception, since it has an established coordinated program since 1956. Although there are some efforts between specific agencies to coordinate their programs, these efforts are too recent for the impact to be felt. Pest control in urban environments will be

discussed first as it pertains to buildings and structures, and second as it pertains to the maintenance of outdoor areas. A unique feature of urban environments is that generally, there is a very low level of pest presence that is perceived to be tolerable. This alleged feature is not compatible with IPM.

There are more federal agencies involved in pest control in buildings than any other management system. HUD, EPA, USDA, DOD, GSA, VA, DOC, NASA, Postal Service, AID, HEW, and DOI all have some degree of involvement. For the most part, agencies use private contractors for pest control in buildings. Some agencies (Defense) utilize a combination of in-house operators as well as contracted pest control firms. Because of federal procurement regulations, the bids usually are placed with the low bidder. This normally means the complete reliance on pesticides. In recent years, building infesting insects, such as cockroaches, have become increasingly resistant to many of the commonly-used pesticides. This results in more frequent and excessive pesticide applications. Attempts to remedy this situation are just beginning. Sufficient knowledge is available to increase effectiveness of control and reduce reliance on pesticides in an economically acceptable manner. The application of the systems approach to structural pest management is recognized as an important component of the solution to the problem. This involves such features as the design of the structure, proper construction, sanitation, monitoring by management of the structure, and the judicious use of pesticides. These practices have long been recognized by the National Pest Control Association and recommended to their members. There is presently emerging an agreement between USDA, EPA, HUD, and several DOD components to demonstrate the principles and economic implications of cockroach control, and provide appropriate training material for further implementation by

the cooperating agencies. This demonstration will be based on work done by the University of Maryland with the Baltimore Housing Authority and studies at Virginia Polytechnic Institute and State University. Such programs can have a major impact on the private sector, particularly if the result is that standardized contracts stipulating IPM practices become uniform among federal agencies. Once the effectiveness and economic advantages of the systems approach is demonstrated it will be adopted by the private sector as well as state and local governments.

The management of pests in outdoor urban situations, parks and recreational areas is complex. Frequently the vegetation desired is not compatible with site use. The presence of pests is to be expected, but is generally not tolerated. Pests are usually managed on a preventative basis, with control tactics applied according to a schedule, rather than as a result of diagnosis and determination of permissible levels of infestation.

Only in the past few years have any attempts been made to determine if IPM principles are practical for use in suburban environments. Programs conducted in California, Texas and Maryland, have shown that homeowners can be educated to using IPM and that they result in economic savings. These demonstrations have opened a vast frontier for the implementation of IPM as soon as appropriate delivery systems can be implemented and the educational requirements executed. The USDA-SEA-Extension through the Cooperative Extension Service and EPA are currently initiating activity in this area. The Cooperative Extension Service has a national committee in the process of inventorying and identifying the needs of an urban IPM program.

In the area of parks and publicly maintained outdoor areas, some current demonstrations involving the EPA, Interior's National Park Service, and the John Muir Institute are applying IPM principles to pest control. This may serve as a prototype program for parks and recreational areas.

6. Public Health

The management system categorized as public health includes all activities related to pests that have a direct or indirect adverse effect on human health. This encompasses the control of mosquitoes and rodents, both of which are known vectors of many diseases in urban environments, and plants such as poison ivy and ragweed which produces pollen that causes allergies and discomfort. Many additional pests such as stinging insects, flies, fleas, and cockroaches, are usually considered as nuisance pests and are significant problems, particularly in urban environments.

It is recognized that sole reliance on pesticides as a means of controlling mosquitoes is not compatible with long term health and environmental goals. Many of the great advances in human health worldwide have been set back by the development of resistance of mosquitoes to pesticides. It is possible that future crises in human health may have been compromised by the lack of integrated programs in the past. Present management of mosquito problems centers on the management of breeding sites, augmentation of biological control, exclusion and the use of pesticides. Most mosquito control in the U.S. is conducted by the states and municipalities where mosquito populations are considered to constitute a health hazard. These regions are usually located along coastal areas and waterways where suitable mosquito breeding sites are abundant. Federal agencies with facilities or roles in these areas are presently engaged in management of mosquito populations, such as

Defense on their military establishments and TVA in mosquito breeding areas in their jurisdiction. Most mosquito control is conducted by non-federal agencies. Frequently, the IPM practices designed to suppress mosquitoes come into conflict with conservationist objectives in the marshes and impoundments where mosquitoes breed. The major difficulty with current mosquito management is the lack of knowledge regarding the consequences of control tactics in relation to wildlife. Heavy reliance of some programs on pesticides may find the nation short of effective chemicals in the event of a national emergency. In FY 1979, EPA initiated a 5-year, \$2.4 million research program to develop IPM strategies for the control of mosquitoes in rice production systems. This program is being conducted by a 6-university consortium led by the Texas A&M Research Foundation.

The rodent control responsibilities of the federal government are under the jurisdiction of the HEW Center for Disease Control. The program's mission is to implement rat control programs in cities where populations are considered to be a health hazard. Unfortunately, once the population is reduced funds are shifted to more needed areas, and the program is left on its own without adequate permanent management. The technology exists to sustain rat suppression once it is achieved. This, however, requires dedicated community participation and a strong educational program. The scientific resources to develop more adequate programs are not now available. There is an increasing problem in urban environments with mice. There is no federal program that deals with these pests of human habitations.

C. Innovative Developments in IPM

The utilization of system science and modeling in the development of IPM is probably the first use in a biological science. It serves not only

to integrate known facts into management systems, but also identify deficiencies in our knowledge. As a result, many needs have been addressed. Also, the separate disciplinary efforts of IPM related science have contributed significant new technology in recent years.

Among the more recent developments are: the manipulation of parasites and predators in crop systems to reduce pest populations, and conversely, to manipulate pesticide use to minimize effects on parasites and predators; the development of electrostatic pesticide applications which reduces the amounts needed and places them more effectively; the development of short season cotton to avoid late season pest populations; the development of fungus diseases to control specific weeds; the use of pheromones for insect detection and trapping; the use of viruses, bacteria and microsporidia to control insects; the development of crop-loss methodology; and interdisciplinary coordination at the administrator level for research, education and implementation.

D. Coordination

1. Interagency.—The establishment of the Interagency IPM Coordinating Committee is an important step in the advancement of IPM. Since the termination of the Interagency Federal Pest Management Working Group in 1976, there has been no convenient mechanism for coordinating federal activities in pest control. In 1972, CEQ recognized that IPM afforded an environmentally and economically sound approach to pest control and has promoted its implementation. Until the President's Environmental Message of 1979, however, no mandate existed for federal implementation of IPM, and no mechanism was available to coordinate the progress. The Interagency IPM Coordinating Committee is designed to fill this void. This report includes recommendations for advancement of federal IPM programs in the future.

2. Intra-agency.--As a result of the President's August 2, 1979 directive, federal agencies involved in pest control or related activities were required to report these activities to the Interagency IPM Coordinating Committee. This stimulated an effort on the part of most agencies to identify their relevant contributions to IPM advancement and pest control in general. Some agencies had difficulty with identifying their role and providing supporting documentation of their involvement with IPM. The clarification of responsibility in the advancement of IPM in each federal agency should be a distinct step toward IPM implementation. This report includes recommendations for future intra-agency coordination of federal IPM activities.

IV. PROBLEMS AND RECOMMENDATIONS

A. Policy

Although the President clearly defined the national policy on integrated pest management in his 1979 Environmental Message, the complexity of the IPM approach at various levels of the federal government has resulted in an inconsistent and sometimes less than adequate implementation of the directive. The reasons for this are complex. The principal barrier, however, pertains to the difficulty many agencies have in visualizing how their mandate encompasses IPM.

Recommendation.--Federal agencies should adopt and formalize a policy on IPM. The policy should be based on the President's statement on IPM in the 1979 Environmental Message. The policy should apply to all federal activities related to the control of pests, including research, education, federal assistance programs, and implementation programs, including such activities as regulation and monitoring.

The policy should advocate an increased effort in research on control tactics, including, but not limited to the basic biology of pests, biological controls, host resistance, and the establishment of action thresholds for the use of pesticides to further the specific technology needed for the implementation of IPM programs. It should also stimulate the study of the ecological inter-relationships of the biological organisms in management systems, and promote the use of systems science to help elucidate those inter-relationships in respect to pest management tactics and their implementation.

The policy should emphasize the increased need for training personnel involved in pest control implementation programs to effectively utilize IPM approaches and promote availability of in-service training.

The policy should stimulate educational institutions in the U.S. to establish curricula for IPM recognizing the interdisciplinary IPM approach.

The policy should encourage international components in education.

Federal assistance program policy should encourage practitioners in both the private and public sector to adopt IPM through the use of innovative methods designed to achieve the national goal. When appropriate, these should include international projects.

The policy must recognize that the true measure of IPM implementation is its use in management systems; farms, forest, buildings or parks, and that economic considerations as well as environmental and social values are vital to the success of IPM and the attainment of the national goal.

B. Management

1. In his 1979 Environmental Message, the President stated that the federal government spends over \$200 million annually on pest control research and implementation. This report indicates that the total expenditure for all activities related to pest control is actually close to \$700 million (Table 1). The difficulty in accurately determining annual expenditures is a reflection of the fact that pest control activities are not identifiable in many federal agency budgets. Pest control resources are included under other programs and it is difficult to identify existing programs, let alone their priorities. Management is able to impose independent priorities and programs that are not in agreement with the IPM directive. IPM frequently suffers for funding when competing with well-entrenched older programs.

Recommendation.--Federal agencies should construct their budgets so that pest control and related activities are identifiable and supportive of IPM. Intra- and interagency cross-cut analyses should be conducted to determine budget projections for each IPM management system. This will enable future tracking of progress in the implementation of IPM.

2. Since no single agency has been designated as the lead agency in the advancement of IPM, the separate agency roles that have evolved are guarded and there is some interagency polarity. At times this has been a barrier to interagency cooperation. While many interagency agreements have been promulgated to formalize specific activities, the participating agencies are frequently not able to inter-relate with other pertinent activities bearing upon the same management systems. This may result in non-parallel evolution of programs not involved in the specific agreement, with a resultant delay in the incorporation of findings into ongoing programs of pest control. This situation is particularly evident in the case of agencies whose principal role is the management of pests in buildings and structures.

Recommendation.--Active interagency coordination that spans all management systems and pest control activities must be enhanced.

3. The principal roles of the federal agencies that conduct pest control activities vary. They may be production oriented as in Agriculture, environmentally oriented as in EPA, or the role may be a social one as in the case with Labor and HUD. As a result, agency management perceives their roles in the light of the principal mission of the agency. This can result in a low priority or lack of emphasis for programs designed to achieve objectives that are economically, environmentally and socially

integrated. Management may not oppose progress in IPM, but their desire to achieve in a single-goal oriented system makes it difficult to change to an integrated approach.

Recommendation.--Modify the attitudes of management to integrated approaches to problem solving by initiating training programs in the systems approach to problem solving.

C. Human, Scientific, and Technical Resources

The Interagency IPM Coordinating Committee has evaluated the current status of IPM implementation. Of particular value to the committee were the Congress of the United State's Office of Technology Assessment report on "Pest Management Strategies in Crop Production" (1979) and the Council on Environmental Quality's report "Integrated Pest Management" (1979). Unfortunately, a National Academy of Science report on pest management in the urban environment was not completed in time to be used as a resource. Many IPM constraints were identified and recommendations proposed in both of these reports. They addressed the IPM universe, while the Interagency IPM Coordinating Committee concentrated on the current role of federal agencies. Most of the recommendations in the OTA and CEQ reports bear directly on the federal involvement in IPM. The Committee has placed significant reliance on their merits. These reports, as well as a 1979 IPM report prepared for the USDA Experiment Station Committee on Organization and Policy by the Intersociety Consortium on Plant Protection, and the Extension Committee on Organization and Policy IPM report have all singled out as a major restraint to the accelerated implementation of IPM the lack of sufficient human, scientific, and

technological resources. The Interagency IPM Coordinating Committee acknowledges the following constraints and proposes recommendations that will help alleviate these barriers.

1. Human Resources

(a) Existing.--The relatively recent development of the IPM approach has found most current scientists, educators, and practitioners of pest control with less than adequate knowledge and understanding of systems science and ecological aspects of the management systems. A similar problem exists with administrative personnel in many institutions with pest management responsibilities. It is very important that these individuals understand the integrated approach to pest control and make both short- and long-term decisions that are environmentally and economically sound. To assure that existing human resources have an opportunity to receive in-service training in IPM, coordinated educational programs must be developed immediately and made available to pertinent personnel.

Recommendation.--The USDA, in conjunction with appropriate federal agencies and the land grant universities, should develop regional training programs at strategically located sites throughout the U.S. Appropriate intensive short-courses must be designed to introduce existing scientists, educators, extension personnel, administrators, and other individuals in a position to influence the advancement of IPM to the integrated systems science and ecologically compatible approach to pest control. The courses should be practical in content and concept, and provide participants with the understanding of how to contribute to the advancement of IPM. The courses must include segments related to economic, environmental and social goals of IPM.

(b) New.--The continued development of IPM will depend on the availability of persons trained to function at all levels of IPM, including the scientist studying ecosystem relationships and individual system managers implementing the tactics of IPM on a day-to-day basis. These resources do not currently exist and will be in critically short supply in the near future. The full implementation of IPM depends on the development and availability of this resource over the next 10 to 20 years. The major deficiency with most current university-level programs is the lack of interdisciplinary curricula to integrate essential disciplinary inputs into appropriate units of IPM. Because of the disciplinary structure of most universities, interdisciplinary programs are usually neglected and frequently discouraged. This problem was reviewed and acknowledged in a 1979 report of the land grant university Resident Instruction Committee on Policy. The teaching of IPM must be encouraged by the federal government.

Recommendation--The USDA and other appropriate federal agencies, in conjunction with the land grant and other interested universities should actively develop and promote the development of IPM programs of instruction leading to the B.S. and M.S. degrees. The programs should include essential disciplinary instruction, and contain a significant interdisciplinary component with appropriate emphasis on system science, economics and ecology. At the Ph.D. level, students should be encouraged to cross disciplinary lines and use system science approaches in research.

2. Scientific Resources

(a) Improved biological data base.--The OTA report on pest management strategies concluded that "an inadequate base of knowledge in the basic biology, bionomics, and interactions of crop pests seriously limits the range of control tactics available for integrating pest management into a total crop protection system." This report was limited to several major agricultural crops. The conclusion is equally applicable to other managements systems discussed in this report. The committee has identified some of the major scientific areas perceived as being deficient and particularly critical for the advancement of IPM.

(1) Basic research: The erosion of federal support for basic research in all sciences over the past 20 years has left technology in a vulnerable position for future development. It is highly unlikely that any single break-through comparable to the development of synthetic organic pesticides will emerge to offer a relatively simple solution to most pest problems. Instead small incremental advances in science will probably be the path to future progress. The existing scientific data base is being utilized in present IPM development efforts; however most pests are not well understood and their extremely complex ecological interrelationships are barely known.

Recommendation:--The USDA, NSF, and EPA and other federal agencies that perform or sponsor basic research, together with the universities should place a renewed emphasis on basic research related to pests (including weeds, diseases, insects, nematodes and vertebrates), with particular priority

on basic ecological studies and interdisciplinary research leading to a broader understanding of the interaction of pests with their environment.

(2) Component science priorities: Many tactics that are effective, environmentally sound and economically feasible have been developed for pest control. Although these developments are frequently not interdisciplinary, such as a disease-resistant crop plant, or a biological control of an insect pest, they may integrate easily into management systems in a highly cost-effective manner. Unfortunately, these types of component science tactics have been exploited in a relatively few pest situations currently plaguing society. The relative ease with which pesticide technology has been implementable in the past has tended to diminish the urgency for the development of alternate tactics. One aim of IPM is to develop selective pesticides. Significant gains could be made in the areas of pesticide science through the development of more environmentally compatible pesticides such as insect hormones, and the technology of application of conventional pesticides to increase their effectiveness and reduce environmental impacts. The committee makes the following recommendations to accelerate component science development.

Recommendation: The USDA, EPA, DOI, HEW, and NSF should accelerate investigations and support for the development of biological controls of insects, diseases, weeds, nematodes and vertebrate pests. National programs involving the human resources of the nations' universities and research institutions should be promoted through participation and funding to unify existing efforts and develop new thrusts. The biological control of insects, diseases and aquatic weeds should be particularly exploited.

Recommendation.--The USDA should increase their emphasis on the development of pest-resistant or tolerant hosts. With estimates that one-third of all agricultural production in the country is lost to pests prior to harvest, more emphasis on breeding pest-resistant hosts is essential for achieving the proposed national IPM goal.

(3) Systems management science: The USDA Science and Education Administration, the federal agency with the largest role in pest management research, has determined that less than 1% of their research effort involves systems development at the interdisciplinary level. A significant increase in systems science and modeling research is necessary for the integration of component science developments, and the incorporation of economic and environmental parameters into workable IPM programs. The principal feature of IPM that distinguishes it from other approaches to pest control is that it is system oriented. Future development, refinement and implementation of IPM depends on the capability of system science to develop workable prototypes that will be able to integrate multidisciplinary inputs and provide timely IPM outputs. This capability is largely lacking at present. The USDA and land grant university Experiment Station Committee on Policy in 1979 indicated that at least a doubling of systems scientists was needed to work in both disciplinary and interdisciplinary areas of crop protection. The adoption by federal agencies of a strong commitment to system science in pest control research will stimulate the development of the systems approach needed to deal with problems of pest management systems:

Recommendation: All federal agencies that conduct or sponsor pest control research should promote the use of systems science as a unifying component of their research efforts.

(b) Technology transfer research.--Frequently, researchers develop new technology that would improve existing pest management programs, but is either slow to be utilized or abandoned without implementation. This may be a function of an inadequate mechanism to evaluate the technology and determine its economic acceptability in the management system. This role is not clearly established in either the research or technology transfer components of our institutions. Significantly more attention to this intermediary function is necessary to accelerate the implementation of IPM.

Recommendation: Federal agencies should increase their efforts in demonstration or pilot project research that integrates new methodologies and determines the economic implications of these innovations.

3. Monitoring Programs

(a) Biological monitoring.--All management systems would be more effectively managed if system managers had ready access to timely information on the status of pests locally, regionally and nationally. Conditions such as pest abundance and distribution, as well as an early warning system are needed for the implementation of IPM. Such a monitoring system would also provide researchers with some lead-time in devising tactics for control of pests that have acquired or are in the process of acquiring resistance to commonly used pesticides. The system should be sensitive enough to detect changing levels of susceptibility to control tactics, and timely enough to provide IPM practitioners with information that will be valuable to them in current season activities.

Recommendation.--The USDA should upgrade their pest monitoring programs to have the capability to recognize changing pest situations, including distribution, abundance, natural enemy information and indications of failure of commonly used control tactics. EPA should provide the necessary monitoring for appropriate aspects of the environment. The monitoring information should be coupled to a delivery system accessible to both public and private users.

(b) Chemical monitoring.--A knowledge of the amounts and kinds of pesticides applied to the nation's environment, the residues that can be detected in the various components of the ecosystem, and those finding their way into tissues of the human body is essential to developing policy for pesticide use, and measuring the long-range effectiveness of IPM implementation.

Recommendation.--Current activities of the USDA, EPA and HEW in monitoring and surveying pesticide use and residues should be modified to produce a coordinated program that would ascertain the current status of pesticide registration, identify the amounts and kinds of pesticides applied to the different management systems, the levels of residue that can be detected in soils and water in applicable management systems, and current status of exposure of the population of the U.S. as measured by the presence of residues in human tissue samples. The results of these efforts should be made available in a timely manner.

(c) Weather monitoring.--Most pest, host and other pest-environment interactions are directly related to weather, particularly temperature and precipitation. Sound IPM programs are dependent on real-time weather inputs for determination of the host and pest development rates required for the prediction of the need for implementation of IPM tactics. The acquisition of weather data of value to the implementation of IPM can be accomplished using existing technology. A national agricultural weather monitoring system would be of value immediately to systems managers in agriculture and forestry, and there would be great future value to other management systems.

Recommendation.--The Department of Commerce's National Weather Service, in collaboration with the USDA, should accelerate their development efforts for implementation of a National Agricultural Weather Network. The availability of on-line weather information for IPM should be a high national priority. The system should be coupled with an appropriate delivery system for making the information available to users in a timely manner.

4. Management System Technology

(a) Information delivery.--Full-scale implementation of IPM at the level of the management system will depend on the availability of useful information delivered in a timely manner. In some management systems, particularly agriculture, IPM information will have to be available on a real-time basis. Computer technology exists that can provide appropriate users with the necessary information, provide access

to the information source for two-way transmittal of data, and contain a predictive component. The user, whether an extension agency, urban planner, private consultant, or regional forester, must have the inputs to make the correct decisions regarding pest management tactics. The system should be coupled to a weather monitoring network, as well as a biological monitoring system.

Recommendation.-- The USDA and DOC should accelerate their development of a suitable delivery system. The system should be compatible with the biological and weather monitoring systems recommended previously. It should also be compatible with future possible mass media utilization of the information.

(b) Socio-economic environment.--The adoption of IPM by persons engaged in pest control, could be significantly accelerated by the provision of specific incentives designed to promote the use of IPM. Farm loans, reconstruction loans, and crop insurance are areas that appear to have practical value in promoting the adoption of IPM.

Recommendation.--The USDA and EPA should determine ways in which farmers could be encouraged to adopt IPM through the development of appropriate incentives. The EPA, USDA, HEW, HUD and SBA should examine the availability of loans and insurance for both private and public entities to determine if such programs as the design and construction of buildings to deter infestation by insects and rats, the adoption of IPM by pest control companies, or the initiation of private IPM consultant companies can be accelerated through the availability of favorable financial conditions.

5. Federal Implementation Programs

There are a number of federal programs that are incompatible with the IPM approach, either because of federal regulations governing their role, or because they are resistant to change due to their entrenched position within their agency. The committee has identified the following programs as examples of areas needing immediate attention.

(a) Eradication programs.--Some federal agencies conduct pest eradication programs. The objective of these programs is to eliminate the existence of pest populations from defined geographic areas. The attainment of that objective is frequently impractical, and usually very expensive. The justification for eradication is that a massive single effort can eliminate the pest, thereby accruing long-term benefits. Several eradication attempts have been successful i.e. Giant African snail, Mediterranean Fruit fly, red scale. The USDA is currently conducting a pilot study comparing an eradication scheme for cotton boll weevil with an IPM approach. The NAS is to study the results and recommend whether to continue the eradication effort.

Recommendation.--The USDA should commission the NAS or other comparable technical source to review all major pest eradication programs as to long-term benefits as compared to costs, including environmental effects. Criteria for evaluation and approach of all future eradication programs should be developed.

(b) Cosmetic standards.--Federal, state, local and food industry regulations may provoke unnecessary pesticide applications to provide pest blemish-free products. This potential deterrent to IPM implementation has been pointed out by the OTA and CEQ reports. As yet,

there has been no evaluation of the effect of these standards on the amount of pesticide use on fruits and vegetables that have no effect on the commodity's taste, nutrition or storageability.

Recommendation.--The USDA, FDA and EPA should commission the NAS or other comparable technical source to study the effect of cosmetic standards on pesticide use, and make recommendations for changes in regulation if they are warranted.

(c) Federal pest control contracts.--In all areas of pest control, much of the federal effort is contracted to commercial services. For these contracted services, agencies do not presently indicate in their contract provisions, adequate specifications which encourage the use of IPM practices. This process detracts from the effort to implement IPM.

Recommendation.--Federal agencies should revise contract specifications and devise requirements that will encourage the implementation of IPM.

6. International Programs

The development of IPM programs within the U.S. may both affect and be affected by pest control in foreign countries. For example, there are a number of migratory agricultural pests that are believed to originate in the Central American and Caribbean region. International cooperation in development of IPM programs for these pests could enhance results within the U.S. Of more importance are pesticide residues in

important agricultural commodities. Reduction of such residues can only be accomplished by the development of IPM programs in countries which export agricultural commodities to the U.S.

Recommendation.--The development of IPM programs in the U.S. should be closely coordinated with those being developed by AID and MAB to assure maximum utilization of both nationally and internationally developed technical and scientific resources.

D. Institutional Structure

No appropriate institutional structure exists to achieve the goal of the proposed national program on IPM. The discussion of problems and recommendations addressed the major barriers to progress in the advancement of IPM. The Interagency IPM Coordination Committee has determined that a sustained transagency federal effort will be necessary during the next few years to assure that the intent of the President's August 2, 1979 directive will be vigorously pursued. The Committee recommends the following coordination effort to assure a continuing IPM emphasis:

1. The Interagency IPM Coordinating Committee. This Committee should continue to function for the next 4 years. All federal agencies conducting pest control or related activities should participate. The Committee should meet annually to review the progress on advancement of IPM. The Committee should be chaired by CEQ. The Committee should assemble a panel of national experts to participate in the evaluation of federal progress in IPM. The panel should be composed of experienced individuals drawn from diverse disciplines, including expertise in the various management systems, and should not be federal employees.

The Committee should report to the President on the progress of the federal agencies in IPM implementation on June 30, 1981, and again on June 30, 1984.

2. Each federal agency with activity in pest control should designate an agency IPM coordinator. This position should be responsible for coordinating that agency's IPM role and interacting with the proposed management system task forces. The coordinator should have department-wide responsibility for monitoring and coordinating pest management activities.

3. State and local governments have many pest management programs and problems that are similar to those conducted on the national level. These programs in general are in no greater an advanced state of IPM implementation than most of the federal programs. A national effort is needed to provide state and local officials with information about the IPM approach. The CEQ should promote a White House Conference on State and Local Implementation of IPM.

4. This report has separated the major efforts in pest control into 6 management systems. Although many problems in IPM implementation are common to most systems, there are major differences in terms of scientific, educational, and technological needs. These must be addressed separately to assure proper program development and implementation. The Interagency IPM Coordinating Committee recommends the establishment of interagency task forces for the following 6 management systems:

- Agriculture
- Forestry
- Rangeland
- Rights-of-way
- Urban Environment
- Public Health

Each task force will:

- (a) Analyze current base programs in research, technology transfer, implementation and assistance;
- (b) Recommend program and budget needs;
- (c) Track development of participating agencies;
- (d) Review and make recommendations concerning legislative needs;
- (e) Review implementation of programs in the management system and interpret these programs in terms of IPM status;
- (f) Conduct state, regional, and federal symposia with public participation;
- (g) Assist in the development of programs for coordinated IPM efforts at the state, regional, and national levels;
- (h) Report progress to the Interagency IPM Coordinating Committee by May 1, annually through 1984.

5. Coordination of the 6 task forces will be provided by the equivalent of 3 full-time individuals with outstanding technical expertise, one for agriculture, one for forestry, rangeland and rights-of-way, and one for public health and the urban environment. Their activities will be coordinated by the Interagency IPM Coordinating Committee through a senior staff member of CEQ.

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APPENDIX A

PEST CONTROL ACTIVITIES OF THE VARIOUS
FEDERAL AGENCIES

AGENCY FOR INTERNATIONAL DEVELOPMENT

1. AID's Role

The Agency for International Development carries out assistance programs designed to help the peoples of certain less developed countries (LDC's) develop their human and economic resources, increase production capacities, and improve the quality of human life. Under Section 103 of the Foreign Assistance Act of 1961, as amended (1975), AID's objectives in the area of food and nutrition are to (1) increase the capacity of the LDC's to expand and distribute food supplies as required to alleviate hunger and malnutrition, and (2) increase participation of poor people in the process and benefits of development in the LDC's.

AID is one of three components of the International Development Cooperation Agency (IDCA) and has major responsibilities in U.S. foreign assistance programs. The Agency uses pesticides and other pest management techniques in its foreign assistance programs to the less developed countries, both for health and agriculturally related purposes. To the extent practical, AID has fostered use of integrated pest management in its programs. Since 1972 it has pursued a course of sensitizing

LDC officials and scientists to the need for scientifically structured and practical pest and pesticide management practices. Pest and pesticide management activities in AID fall within two broad categories: (1) control programs using established technologies and (2) research, extension, or training programs geared to improve the technology incorporated into existing and new control programs. This report primarily addresses the latter of these two areas. It is the policy of AID to use the most appropriate current technology in ongoing pest control projects. Therefore, the quality of pest control components of routine foreign assistance programs reflects AID's efforts in research, extension, and training.

2. Legislative Authority and Administrative Action Affecting IPM

AID's authority in foreign assistance is specified in the Foreign Assistance Act of 1961, as amended in 1975. Since its creation, AID has engaged in efforts worldwide to help developing countries increase food production and reduce disease. The supply and use of pesticides have played a large role in AID efforts, both in commodity import programs and specific project assistance.

On June 30, 1971, AID funded a project entitled "Pest Management and Related Environmental Protection" with the University of California at Berkeley. The purpose of this project was to provide less developed countries with assistance in devising and implementing ecologically sound and economically valid integrated pest management systems

for the control of agricultural pests. The project had two goals: (1) to reduce losses of agricultural crops caused by plant pests, and (2) to improve the ecological conditions caused by efforts to eradicate or reduce causes of such crop losses.

To the extent possible, IPM has been incorporated into the technical assistance and training components of the project. Special efforts are made to sensitize LDC officials in the ministries of health and agriculture in the LDC's to the need to minimize the use of pesticides and to encourage use of multidisciplinary integrated pest control techniques.

AID's policy to meet its goal to promote environmentally sound pest management in the LDC's was reinforced in 1976 with the amendment to Regulation 16 of the Code of Federal Regulations. Part 216 on *Environmental Procedures* and the adoption by AID of *Interim Regulations* governing assistance for the procurement and use of pesticides were established to ensure the use of sound pest control practices in AID projects.

In May 1978, the Environmental Procedures of Regulation 16 were amended to add "supplemental procedures for indepth evaluation of all proposed AID projects involving assistance for the procurement or use, or both, of pesticides and to remove pesticides from eligibility in the Commodity Import Program with certain stated exceptions."

On June 6, 1978, following the May 1978 amendment of the *Environmental Procedures*, AID's Administrator approved a revised AID "Pol-

icy on Pesticide Support." This supplements the formal procedure for evaluating pesticides requested by other governments. These policy guidelines provide for AID:

- (1) To establish wherever possible programs aimed at assisting developing countries in designing and operating economically and environmentally sound integrated pest management systems and procedures in which pesticides will be used only when necessary;
- (2) To exert a greater degree of international leadership by communicating U.S. policies and experience on pest control and pesticide problems to other nations and international organizations; and
- (3) To help develop infrastructures of developing countries for pest and pesticide management.

This need for continued and expanded efforts in all areas of pesticide management was reaffirmed at the June 7-8, 1979, "U.S. Strategy Conference on Pesticide Management" sponsored by the U.S. Department of State and the U.S. National Committee for Man and the Biosphere.

To assist AID in promulgating the policy items above, a revised

Pest Management and Related Environmental Protection Project, funded by AID's Development Support Bureau, has recently been approved. This project is being implemented through a contract with the Consortium for International Crop Protection (CICP), and will substantially increase AID's efforts in pest and pesticide management. CICP was organized in 1978 by a group of U.S. universities to pool their expertise, experience and other resources in an effort to respond to the crop protection needs of developing countries and assist them in the reduction of crop losses. CICP member universities possess resources appropriate for the development and upgrading of crop protection capabilities in developing nations, for technology transfer of plant protection methodology to limited resource people, and for the advancement of knowledge of important crop pests and their management.

3. AID Support of Pest Control by Activity and Sector

AID's support of pest control activities in FY 1980 is shown in Table 1.

Research: AID's support of IPM research includes that carried out by International Agricultural Research Centers (IARC's). All but one of the centers (Asian Vegetable Research and Development Center) are supported through the Consultative Group on International Agricultural Research (CGIAR). The IARC's link with LDC national programs to form a key element in an emergency global network to supply the technology needed to expand food production. Established in 1971, CGIAR is an organization of donors that coordinates funding and provides program guidance to the IARC's. AID helped establish CGIAR in 1971 and pledged about 25% of its required total annual funding. AID and other CGIAR members have encouraged the IARC's to focus on the problems of

small farmers and poor consumers.

The IARC's are as follows: International Rice Research Institute (Philippines); International Maize and Wheat Improvement Center (Mexico); International Livestock Center for Africa (Ethiopia); Asian Vegetable Research and Development Center (Taiwan); International Institute of Tropical Agriculture (Nigeria); International Center for Agricultural Research in the Dry Areas (Lebanon, Syria, and Iran); International Board for Plant Genetic Resources (Rome); International Laboratory for Research on Animal Diseases (Kenya); International Crops Research Institute for the Semi-Arid Tropics (India); West Africa Rice Development Association (Liberia); International Potato Center (Peru); and International Center for Tropical Agriculture (Colombia).

All of the IARC's carry out programs in pest control research, and some have major programs in IPM for specific pests.

Other AID-financed programs related to IPM include an international research effort on rootknot nematodes (*Meloidogyne* spp.) administered by North Carolina State University. Studies on the pests' biology, ecology, and management are being conducted. Oregon State University is evaluating techniques for integration of various weed control methods, including non-chemical methods. Emphasis is on semitropical and tropical small farm cropping systems. A number of U.S. universities are carrying out AID-financed plant breeding programs with the goal of increasing pest resistance in barley, wheat, soybean, sorghum, and millet.

Another research effort involves the use of remote sensing to aid in monitoring the development of vegetation serving as potential desert

locust breeding in the Sahara. The AID-financed work is being carried out by the Food and Agriculture Organization (FAO) of the United Nations.

Technology Transfer: AID's efforts to agricultural pest management and techniques is carried out mainly by eligible Title II Institutions¹ in conjunction with collaborators from the LDC's. On September 24, 1979, Purdue University was awarded a Title XII "Planning Grant for Integrated Crop Protection Methods Improvement." Upon completion of this planning grant it is expected that AID will be able to formulate a world-wide collaborative plan in the area of integrated pest management methods improvement, emphasizing the small farmer in a multiple cropping system context.

Upon completion of this planning grant a development plan for multiple cropping systems of small farmers will be available along with a mechanism for identifying and establishing linkages between Title XII universities in the United States and interested LDC research institutions. Beginning in FY 1981 the planning phase will be completed and specific Integrated Crop Protection Methods Improvement projects will be initiated with incremental funding through FY 1985. These projects will span a range of activities carried out by numerous national and multinational organizations. IPM systems will be developed for agriculture, the public health sector, and livestock operations in a large number of LDC's and will include most pest categories--insects, plant pathogens, nematodes, weeds, and vertebrates.

¹As defined under Title XII - Famine Prevention and Freedom from Hunger of the Foreign Assistance Act of 1961, as amended.

AID is involved in a range of programs in technology transfer. For example, a project is underway in the Philippines to establish a National Crop Protection Center and seven Regional Centers which will out research, extension, and training in integrated pest management; the centers will stress programs that demonstrate the techniques and concepts of IPM at the farmer's level. In Central America, a pest management specialist has been assigned to the AID Regional Office for Central American programs under contract to the Consortium for International Crop Protection. The specialist will work with farmers, governments, and private organizations to encourage the development and increased use of IPM in this region. In the African Sahel, AID has two training centers (Senegal and Camaroon) and is conducting field training of extension workers in seven countries. In addition, long-term training (including U.S. university training) will be provided to a number of LDC agricultural technicians, under this program.

AID, through its Pest Management and Related Environmental Protection Project with the University of California at Berkeley, operates a pesticides analysis training facility at the University of Miami, Florida. Generally, two courses per year are offered to 4-6 students (per course) from various LDC's. In addition, in-country training assistance is furnished, as requested by various AID Missions in the LDC's. Training courses also are developed as requested in providing assistance programs involved in monitoring pesticide residues in human populations. This program will be expanded in FY 1981.

Also, AID's Development Support Bureau, through its Pest Management and Related Environmental Protection Project, has provided the following additional types of services to the LDC's:

- (1) Country or regional surveys of pest and pesticide management problems;
- (2) In-country pesticide management workshops and seminars;
- (3) Regional short courses on integrated crop protection;
- (4) Services of short-term consultants to assist AID missions in the LDC's confronted with problems involving pesticides or pest management alternatives.

Additionally, in FY 1980-81 AID will provide the following new services:

- (5) In-country integrated crop protection demonstration projects in the LDC's;

- (6) Training courses on pesticide formulation analysis;
- (7) Training courses in pesticide safety;
- (8) In-country training courses in aerial and ground pesticide application methods;
- (9) In-country pesticide residue sampling and analysis familiarization short courses,
- (10) In-country training courses in basic pesticide residue analysis;
- (11) Technical backstopping to country or regional pest management specialists.

Implementation: AID has programs in the control of vectors of malaria, histosomiasis, and onchocerciasis. Other AID-funded pest control programs are for the most part integral components of general agricultural development projects.

Assistance: AID has no programs fitting into this category, as defined for this report.

4. MECHANISMS OF INTERAGENCY COORDINATION AND COOPERATION

Formal coordination is effected by the following arrangements:

- (1) Development Support Bureau, Office of Ag-

riculture, represents AID on the FAO Desert Locust Control Committee;

- (2) Development Support Bureau, Office of Agriculture, represents AID on the FAO Committee of Experts on Pest Control;
- (3) The Project Director of the Pest Management and Related Environmental Protection Project at Berkeley represents AID interests as chairman of the Panel of Experts on Integrated Pest Control, sponsored by FAO and the United Nations Environment Programme.

AID cooperates with the U.S. Department of Agriculture on a variety of programs. The two cooperate in several foreign countries where foreign assistance is involved. Another mechanism of cooperation involves various informal channels, such as exchange of plans of work and program reports among administrators and informal contacts among the technical staff. AID also cooperates with other federal agencies, e.g., Departments of Interior and State and the Peace Corps. Peace Corps volunteers in several LDC's cooperate with AID. In some of the LDC's, the Peace Corps receives small project grants from the AID missions and some of the projects involve use of pest control techniques.

TABLE 1

AGENCY FOR INTERNATIONAL DEVELOPMENT

ESTIMATED FISCAL YEAR 1980 SUPPORT OF PEST
CONTROL ACTIVITIES IN VARIOUS MANAGEMENT
SYSTEMS (IN \$ MILLIONS)

Activity	Agri- culture	Forestry	Range- land	Rights- of-way	Urban environ.	Public health	Multi- site
Research	<u>1/</u>						
Technology Transfer	5.123					2.200	
Suppression						25.350	
Weather Monitoring	.150						
						27.550	
TOTAL	5.273						

1/ AID funds to International Agricultural Research Centers
not included.

Total resources = \$32,823,000.

DEPARTMENT OF AGRICULTURE

1. USDA's Role

Established in 1862, the Department of Agriculture is a U.S. cabinet level department within the executive branch. It is directed by the Secretary of Agriculture who is a cabinet member. It accumulates and makes available agricultural information. It engages in many aspects of research, education, conservation, marketing, regulatory work, agricultural adjustment, surplus disposal, nutrition, and rural development. A principal mission of the Department is to assure an adequate supply of high quality food and fiber and a high quality environment for the American people. The Congress firmly established the USDA as the lead agency in the federal government for the food and agricultural sciences and emphasized that agricultural research, extension, and teaching are distinct missions of the Department, under Public Law 95-113 (Section 1403, Title 14), the National Agricultural Research, Extension, and Teaching Policy Act of 1977.

2. Legislative Authority and Administrative Action Affecting IPM

Responsibilities of the Department of Agriculture as lead agency of the federal government for agricultural research, extension, and teaching in the food and agricultural sciences are established in Section 1405, Title 14 of Public Law 95-113. That section specifies that the Department and the Secretary, in carrying out the Secretary's responsibilities, shall

"keep informed of developments in, and the Nation's need for research, extension, teaching, and manpower development in the food and agricultural sciences and represent such need in deliberations within the Department of Agriculture, elsewhere within the executive branch of the United States Government, and with the several States and their designated land-grant colleges and universities, other colleges and universities, agricultural and related industries, and other interested institutions and groups." Further, it specifies that the Department and Secretary shall "coordinate all agricultural research, extension, and teaching activity conducted or financed by the Department of Agriculture and, to the maximum extent practicable, by other agencies of the executive branch of the United States Government" and shall "take the initiative in establishing coordination of State-Federal cooperative agricultural research, extension, and teaching programs, funded in whole or in part by the Department of Agriculture in each State, through the administrators." In addition, Section 1405 specifies that the Department and the Secretary shall "consult the Joint Council (Joint Council on Food and Agricultural Sciences), Advisory Board (National Agricultural Research and Extension Users Advisory Board), and other appropriate advisory committees of the Department of Agriculture in the formulation of basic policies, goals, strategies, and priorities for programs of agricultural research, extension, and teaching." Of particular importance to the development of multi-pest, integrated schemes of pest management, Section 1405 designates the Department and the Secretary to "establish Federal or cooperative multidisciplinary research teams on major agricultural research problems with clearly defined leadership, budget responsibility, and research programs."

Title 14 of the Food and Agriculture Act of 1977 mandates that research be conducted "to find solutions to environmental problems caused by technological problems caused by changes in food and agriculture production" and "development and implementation through research of more efficient, less wasteful, and environmentally sound methods for producing, processing, marketing, and utilizing, food, fiber, waste products, other nonfood agricultural products, and forest and rangeland products."

In addition to the above principal statute, there are other laws as well as specific language in appropriation acts that have established the lead role of USDA in carrying out activities related to IPM, including:

- (1) Organic Act of USDA, 1862;
- (2) Hatch Act of 1887, as amended, PL 84-353;
- (3) Plant Quarantine Act of 1912;
- (4) Smith-Lever Act of 1914;
- (5) McSweeney-McNary Forest Research Act of 1928, as amended, PL 70-466;
- (6) Whitten Act of 1956, PL 84-473 (authorized advance of funds for cooperative forestry research);
- (7) McIntire-Stennis Act of 1962, PL 87-788 (also known as Cooperative Forestry Research Act);
- (8) Research and Marketing Act, 1946, PL 79-732;
- (9) Agricultural Trade Development and Assistance Act of 1954, PL 83-690;
- (10) USDA Organic Act of 1944, PL 78-425;
- (11) Federal Plant Pest Act, PL 85-36;
- (12) Research Grants-Basic, 1958, PL 85-934;

- (13) Facility Act, PL 88-74;
- (14) Research Grants-Special 1965, PL 89-106;
- (15) Special Foreign Currency Program, PL 83-480;
- (16) Federal Noxious Weed Act, PL 93-629;
- (17) Cooperative Forestry Assistance Act of 1978 (92 Stat. 365; 16 U.S.C. 2101-2111);
- (18) Forest and Rangeland Resources Extension Act of 1978 (92 Stat. 349; 16 U.S.C. 1600, 1601, 1671-1676);
- (19) Forest and Rangeland Renewable Resources Research Act of 1978 (92 Stat. 353; 16 U.S.C. 1600-1601, 1641-1647, 581-581c);
- (20) National Environmental Policy Act, PL 91-190.

3. USDA Support of Pest Control by Activity and Sector

USDA's support of pest control activities for FY 1980 is shown in Table 2.

Research: The USDA is the major federal institution involved in pest management research. The Department and the land-grant universities are the largest and most significant element in the development of new IPM technologies and practices. As noted in section 4 below, joint planning of pest management research between the USDA and the land-grant universities has been formalized. The State Agricultural Experiment Station at each land-grant university receives federal funds through the Science and Education Administration - Cooperative Research (SEA-CR) - of USDA under the provision of the Hatch Act. The SEA-CR approves all state projects for federal support under the Hatch Act, and federal funds must

usually be matched with funds from the states. Some Hatch Act funds (approximately 25 percent), designated Regional Research Funds, are restricted to joint projects among two or more states and may involve participation of USDA employees. State pest control research is also funded under the McIntire-Stennis Act for forestry, under Public Law 89-106, and to a minor extent under other laws. The McIntire-Stennis Act provides federal funds for research to all schools of forestry, including those that are not affiliated with land-grant universities.

The principal USDA agencies with programs in research related to IPM are the Science and Education Administration - Agricultural Research (SEA-AR) and Cooperative Research (SEA-CR), Forest Service (FS), and Economics, Statistics, and Cooperatives Service (ESCS). Other agencies (e.g. Animal and Plant Health Inspection Service) engage in methods development activities in support of their application programs.

Housed in the Science and Education Administration (SEA), Agricultural Research is USDA's largest in-house research agency engaging in pest control research. The greatest emphasis by SEA-AR scientists is the development of non-chemical methods of pest control, such as host plant resistance, biological control, and pheromones. SEA-AR also sponsors research on pesticides, including the development of selective application techniques and pesticide toxicology. Research is conducted extramurally when this is more efficient than in-house efforts or when superior expertise exists outside the agency. SEA-AR research on pests supports the following USDA missions:

- (1) Agricultural Production Efficiency;
- (2) Agricultural Marketing and Distribution;
- (3) Agricultural Exports;
- (4) Environmental Improvement and Resource Development and Use;

- (5) Consumer Services and Human Resource Development;
- (6) Foreign Agricultural Development.

Legislative authorities include the Organic Act of USDA, 1862; Research and Marketing Act, 1946 (PL 79-732); Agricultural Trade Development and Assistance Act, 1954 (PL 83-690); Special Foreign Currency Act (PL 83-480); and Title 14 of the National Agricultural Research, Extension, and Teaching Policy Act of 1977 (PL 95-113).

The Science and Education Administration/AR National Research Programs (NRP's) provide "blueprints" for the on-going and planned research. Special Research Programs also are established, for activities that cut across NRP's.

Among SEA-AR's most notable research efforts in integrated pest management is a pilot research program initiated in 1972. Its primary objective is development of new techniques of pest suppression and detection through large-scale field trials. It is largely a series of SEA-AR in-house projects, but several projects have extramural participants; in FY 1978, 31 projects were in progress. SEA-AR is proceeding with the implementation of a new Special Research Program, "Integrated Pest Management Systems."

Cooperative Research of SEA has no in-house research program, but it administers Hatch Act and McIntire-Stennis Act research funds to the land-grant universities and state forestry schools. In addition, SEA-CR provides money to the States for research on pest management. In FY 1975 to 1979, the agency sponsored a competitive special grants program in IPM under the PL 89-106 grants program, but no funds were appropriated for FY 1980. SEA-CR is also responsible for administering the USDA competitive

grants program for basic agricultural research.

Forest Service conducts research on the management, protection, and use of timber, water, forage, wildlife, and recreation resources of forests and rangelands. It employs biological, physical, economic, and social science to solve complex problems of forest and range management and forest products utilization. The development of integrated pest management systems is geared primarily to insect and disease pests and vegetation management. The majority of FS' budget supports in-house research conducted by FS personnel; the remaining supports extramural projects at the universities and state schools of forestry. More than one-half of its budget for FY 1978 supported research on IPM systems for forest pests.

The largest FS research effort on IPM was begun in FY 1974 under the "USDA-Combined Forest Pest Research and Development Program" which involved the gypsy moth, Douglas-fir tussock moth, and the southern pine beetle, three of the nation's most serious forest insect pests. The program on these major pests represented a 4-6 year accelerated effort through collaboration and cooperation of many disciplines in universities, four agencies of USDA, state organizations, and private forestry. The gypsy moth and Douglas-fir tussock moth accelerated programs were phased down in FY 1978 as planned. The southern pine beetle accelerated program will phase down at the end of FY 1980, but maintenance research programs on these insects are planned for the future to keep technology up to date.

In FY 1978 the FS entered into a cooperative agreement with the Department of Environment of Canada for a 5-year accelerated program of research on spruce budworms in eastern and western United States and Canada. The program, administered by the FS, emphasizes integrated pest management

systems including pest control through optimal forest management. It has utilized pest control specialists, economists, systems analysts and computer experts, and silviculturists in addition to traditional forest entomologists.

At various times since 1964, the Economics, Statistics, and Cooperatives Service, in cooperation with the Statistical Reporting Service, has surveyed farm use of pesticides. ESCS also is involved in assessing the economic implications of pending regulatory actions affecting pesticides, alternative procedures being considered, the economic feasibility of new pest control technologies and programs currently planned or implemented, and the economic implications of widespread adoption. Most of the research on IPM at ESCS is conducted by the Pest Control Economics Branch of the agency's Natural Resource Economics Division.

Technology Transfer: The Cooperative Extension Service, created in 1914 by the Smith-Lever Act, is the established public institution for transferring new technologies from centers of research and development to the public. Financing, planning, and conducting the educational programs of the CES are responsibilities shared by USDA and the land-grant universities. Extension personnel are located in nearly all counties of the United States, on the campuses of the land-grant universities, and in Washington, D.C.

CES is engaged in various phases of pest control education, including:

- (1) Training applicators of restricted pesticides who must be certified under the provisions of the Federal Insecticide, Fungicide, and Rodenticide Act;

- (2) Providing information on the description of pests and control procedures to farmers, homeowners, and other users;
- (3) Teaching and demonstration to farmers and other users the concepts and techniques of integrated pest management.

The CES has primary responsibility for administering the Extension IPM educational programs on agricultural crops and livestock operations. These projects represent the largest effort to date to demonstrate the IPM concept and techniques to crop and livestock producers. The participating state Cooperative Extension Services more than match the federal funds from state, county, and other sources. Participating crop and livestock producers also more than match USDA funds by paying for the services of field scouts.

Begun in 1971, the Extension program on crops and livestock has been very successful, resulting in generally less pesticide use on most commodities in the demonstration areas at no sacrifice in yield or quality.

Higher Education of SEA is USDA's agency that supports undergraduate and graduate IPM curricula in colleges and universities and training of IPM professionals engaging in research, extension, and other activities at the public and private institutions.

Other USDA agencies are involved in technology transfer to some extent. For example, the Soil Conservation Service gives information and assistance to encourage the use of no-tillage agriculture and necessary weed control practices.

Implementation: Implementation activities of the USDA are primarily the responsibility of the Animal Plant Health Inspection Service and the Forest Service. However, the Agricultural Stabilization and Conservation Service, Soil Conservation Service and SEA-Extension and some other USDA agencies are also involved.

Preventing the entry and establishment of foreign plant and

animal pests in this country or area and eradicating newly introduced pests or confining them to limited areas are important activities of USDA. Quarantine programs at U.S. ports of entry aim to prevent the entry of harmful pest species. APHIS has primary responsibility for port inspections and quarantines under the Plant Quarantine Act of 1912, as amended. In addition, APHIS and the states administer a variety of regulatory programs designed to retard the spread of pests of foreign origin or to eradicate them.

Some of APHIS' major programs employ biological control agents, such as parasites and diseases, against target pests. APHIS and cooperators in Florida adopted this approach for management of the citrus black fly, a serious insect pest of citrus recently introduced into Florida. The program focuses on the use of parasites to manage the black fly population. Other non-chemical control methods being used in APHIS programs include the sterile insect technique and pheromone traps.

The Forest Service's insect and disease management action program involves prevention of pest outbreak, detection, evaluation, and suppression. Detection and evaluation surveys are conducted annually by FS specialists on about 600 million acres of U.S. forest land. In addition, the Forest Service provides technical assistance and training to federal, state, and private land managers in insect and disease management, new methodology and techniques, environmental coordination, and environmental monitoring.

In addition, FS has a significant program in vegetation management and animal control which is integrated in the range, wildlife, and timber management and right-of-way maintenance programs. These include noxious weed control, rangeland improvement, and animal control programs in the

range and timber management programs; habitat manipulation, including aquatic weed control, in the wildlife management program; and site preparation and timber stand improvement work in the timber management program.

Assistance: The USDA administers a number of assistance programs related to pest management. The Agricultural Stabilization and Conservation Service (ASCS), through the Agricultural Conservation Program, provides cost sharing of conservation practices that involves the management of undesirable vegetation on farms and ranches. Improving vegetation cover by cultural and chemical measures and the seeding of highly competitive grasses and legumes are examples of the assistance involved. Under ASCS' price support programs for stored commodities, the use of pesticides is the responsibility of the farmers or commercial establishments. If such stored commodities are to be used for food purposes, ASCS specifies that certain pesticides are not to be used.

The Soil Conservation Service provides technical assistance in the management of undesirable vegetation on some non-federal lands. This largely involves management of woody plants on grazing land. The Cooperative Forestry Assistance Act of 1978 provides technical and financial assistance for cooperative pest control programs on private and state lands. It authorized the Forest Service to conduct surveys of destructive insect and disease pests and to execute control programs against these pests as demanded. The Federal Crop Insurance Corporation provides insurance on most field crops on an all-risk basis. The program is designed to guarantee the

producer the return of production costs. The program does not provide insurance for poor farming practices or neglect of the crop. Considerable indemnities have been paid for losses caused by the pink bollworm, western corn rootworm, and other pests. USDA and the Environmental Protection Agency are determining the feasibility of encouraging the acceptance of IPM through the FCIC crop insurance program. One way to encourage the acceptance of IPM might be through pest-specific insurance plans tailored to the specific pest complexes and specific crops for which effective IPM technology and accurate pest damage assessment procedures have been developed.

Through some of the loan programs of the Farmers Home Administration (FmHA), funds are made available for farmers to carry out pest control programs. The borrowers are required to comply with pest control recommendations and laws of relevant local, state, and Federal institutions.

Under FmHA's operating loan authority, funds for chemicals and other items are provided for pest control or management. Also these same items can be provided with emergency and economic emergency loan funds for production purposes.

FmHA also issues real estate loans for buildings. The buildings conform to the Housing and Urban Development Minimum Property Standards and local and state construction codes. Even though no funds are especially set aside for pest management, the fact that these buildings are properly constructed does play a part in pest management.

4. Mechanisms of Interagency Coordination and Cooperation

The USDA cooperates with other cabinet level departments and federal agencies on a variety of programs in the United States and other countries. Funding and management of the activities are frequently shared between different agencies or levels of government. Protocols for inter-agency consultation and the reviews provided by the Congress and the state governments provide a means of formal cooperation. Coordination also is effected through various informal channels, such as exchange of plans of work and progress reports among administrators and informal contacts among scientists.

The USDA and the state cooperative extension services cooperate with the Department of Interior in disseminating information and conducting educational programs for control of such pests as rodents, snakes, and bats. The USDA cooperates with the U.S. Public Health Service, the Department of Defense, and the Department of Interior pertaining to the management of pests affecting public health, forests, wood products, and plants. APHIS and Agricultural Research of USDA cooperate with the Agency for International Development in several foreign countries where U.S. assistance is involved.

In January 1979, USDA - Environmental Protection Agency cooperation was formalized in a Memorandum of Understanding between the Department and EPA. The objective of the Memorandum of Understanding is "to establish policies and administrative devices that will provide for a continuing working relationship between EPA and USDA in support of common objectives, interests, and statutory requirements, and to avoid duplication of effort in programs conducted by other cooperating agencies, departments,

or contractors."

Joint planning between USDA and the land-grant universities also has been formalized. The State Agricultural Experiment Station at each land-grant university receives federal research funds through SEA-Cooperative Research of USDA under provisions of the Hatch Act, which requires matched funding by the states. Whereas funds were matched dollar for dollar at the initiation of the Hatch Act, states on the average now provide about 4 dollars for every 1 dollar received from the Hatch Act. SEA-CR approves all state projects involving Hatch Act funds. Some Hatch Act funds (approximately 25 percent), designated Regional Research Funds, are restricted to joint projects among two or more states and may include federal participation.

The McIntire-Stennis Cooperative Forestry Research Act and other more recent Acts provide for formal mechanisms for joint planning. These Acts establish research in forestry as a definite and specific part of the agricultural research programs which are carried out cooperatively by the USDA and the land-grant universities, experiment stations, and other state supported institutions.

Financing, planning, and conducting the educational programs of the CES are responsibilities shared jointly by the USDA, the land-grant universities, and the Extension personnel.

The National Agricultural Research, Extension, and Teaching Policy Act of 1977 established coordination of state-federal cooperative agricultural research, extension, and teaching programs, funded in whole or in part by USDA. The USDA coordination of state-federal programs is adminis-

tered through the administrative heads of land-grant universities, state directors of agricultural experiment stations, CES, and other appropriate program administrators.

Title 14 of Public Law 95-113 and the subsequent reorganization within USDA to form the Science and Education Administration (the home of the USDA agencies Agricultural Research, Cooperative Research, Extension, and Higher Education) and the organization of Interregional Project 6 (entitled National and Regional Research Planning, Evaluation, Analysis, and Coordination) are important recent mechanisms for development of the planning and coordination of USDA and the Universities.

TABLE 2

DEPARTMENT OF AGRICULTURE

ESTIMATED FISCAL YEAR 1980 SUPPORT OF PEST
CONTROL ACTIVITIES IN VARIOUS MANAGEMENT
SYSTEMS (IN \$ MILLIONS) *

Activity	Agri- culture	Forestry	Range- land	Rights- of-way	Urban environ.	Public health	Multi- site
Research	88.97	33.920	1.790	1.100	2.510	4.720	13.60 ¹
Higher Education	*	*	*	*	*	*	<u>2</u> /
Extension	5.840	*	3.910	*	*	*	<u>3</u> /
Demonstration	*	9.830	*	*	*	*	<u>4</u> /
Suppression	16.190	44.850	5.300	3.800			
Biological Monitoring	8.130	12.100	.620	*	*	*	
Pesticide use Monitoring	.740	.300	*	*			
Quarantine	3.120	.680	*	*	*	*	38,990
Eradication	1.690						
Cooperative Assistance		7.100	.905				
TOTAL	124.470	108.780	12.52	4.900	2.510	4.720	52.590

- * Level of funding not known; inseparable from other systems.
1/ Does not include approximately \$106,000,000 of State Agricultural Experiment Station funds.
2/ Bankhead-Jones funds in pest control not identifiable.
3/ Does not include approximately \$35,000,000 in state and county contributions.
4/ Funds included under Extension, Agriculture.

Total resources = \$310,490,000 + \$106,000,000 for State Agricultural Experiment Stations + \$35,000,000 for Cooperative Extension Service.

DEPARTMENT OF COMMERCE

1. DOC's Role

The Department of Commerce is a cabinet level department within the executive branch that fosters, serves, and promotes the nation's economic development and technological advancement through activities that encourage and assist states, regions, communities, industries, and firms. Founded in 1903 as Department of Commerce and Labor, Commerce and Labor became separate departments in 1913. DOC is directed by a secretary who is a cabinet member. Its agencies include the Bureau of Census, Office of Business Economics, Patent Office, National Bureau of Standards, National Oceanic and Atmospheric Administration (NOAA), Maritime Administration, Economic Development Administration, Coastal Plains Regional Commission, Pacific Northwest Regional Commission, and others. The Department is not mandated with responsibilities in pest management, but several of its agencies engage in related activities. Some of the agencies use pesticides or other pest management techniques to protect their facilities from pest damage, and some support extramural work related to IPM.

2. Legislative Authority and Administrative Action Affecting IPM

The DOC is not mandated with responsibilities in pest management. It, therefore, has no legislative authority directly affecting IPM.

3. DOC Support of Pest Control by Activity and Sector

DOC's support of pest control activities for FY 1980 is shown in

Table 3.

Research: DOC has no formal research program in pest management. In peripheral areas, the National Bureau of Standards has researched the degradation of pesticides as they affect the environment and public health or safety of workers. This work has been performed for the Environmental Protection Agency, Department of Energy, and Department of Navy. The Pacific Northwest Regional Commission (PNRC) supports a regional program for control of weeds of crop fields and roadsides in the Northwest that has entailed research on biological control, herbicides, and remote sensing for the management of various species of weeds (rush skeletonweed, leafy spurge, and tansy ragwort).

Technology Transfer: DOC has no formal program in IPM technology transfer, but one agency, the Coastal Plains Regional Commission, is cooperating with North Carolina State University on a program to introduce farmers in a three-county region in North Carolina to pest management techniques.

Implementation: DOC uses pesticides and other control techniques (e.g., biological agents for control of tansy ragwort and rush skeletonweed in the PNRC program noted above under Research) on facilities and land owned or managed by its agencies. In the Northwest region, PNRC is examining the feasibility of using remote sensing in monitoring weeds included in the agency's weed management program.

The National Weather Service (NWS) of NOAA provides a variety of services which interlock with agricultural programs, including inte-

grated pest management. The "Touch-tone network" and "Green Thumb" are experimental projects particularly relevant to IPM.

In the Touch-tone network, observations are fed into a NWS computer via a tone-generator pad in a Touch-tone telephone. The system was first used experimentally in a newscasting program for Chesapeake Bay in the summer of 1975. It is now used primarily in gathering data for agricultural services in eight states. About 400 station reports per day are received. NWS plans on a gradual expansion of the program, depending upon expansion of the agricultural services program in general.

Green Thumb is a cooperative program of USDA and NWS to explore the possibilities of using home TV sets to display information sent via telephone from a computer (for example, a computer in the local County Agent's office). A 1-year experiment is just beginning in two counties in Kentucky, funded by NWS and USDA. Further plans depend upon the outcome of the experiment.

Assistance: DOC has no assistance program in pest management.

4. Mechanisms of Interagency Coordination and Cooperation

Due to its limited involvement in pest control, DOC's cooperation with other federal agencies is generally informal. In October 1976, the Bureau of Standards and the Environmental Protection Agency cooperated in sponsoring a workshop on effects of pesticide regulations on industry, and the workshop addressed some aspects of IPM. As noted under Section 3, Research, above, the Bureau of Standards has cooperated with various agencies in carrying out research. Mechanisms for interagency coordination and cooperation have not been formalized, however.

TABLE 3

DEPARTMENT OF COMMERCE

ESTIMATED FISCAL YEAR 1980 SUPPORT OF PEST
CONTROL ACTIVITIES IN VARIOUS MANAGEMENT
SYSTEMS (IN \$ MILLIONS)

Activity	Agri- culture	Forestry	Range- land	Rights- of-way	Urban environ.	Public health	Multi- site
Suppression	0.190		0.125		0.25		
Weather Monitoring	.100						
TOTAL	.290		.125		.25		

Total resources = \$665,000.

DEPARTMENT OF DEFENSE

1. DOD's Role

DOD is a cabinet level department within the executive branch and is responsible for national security. DOD consists of the Office of the Secretary of Defense, the organization of the Joint Chiefs of Staff, the military departments, the Defense agencies, and the operational military commands. The Secretary of Defense, with the President, is responsible for all operational military activities, and for providing civilian control of the Army, Navy, and Air Force. The DOD was originally established as the War Department in 1789. In 1947, the National Security Act brought the military forces together under the National Military Establishment, which in 1949 was renamed the Department of Defense.

The Department of Defense through its components has responsibility to provide pest management activities essential to the protection of its property and the health and welfare of its personnel and dependents. This responsibility extends over military facilities and installations in the continental United States, its territories, and overseas areas. The U.S. Army Corps of Engineers conducts pest management activities as a part of the Corps' civil works responsibilities. In addition, DOD carries on a research program that focuses on pests which interfere with its military capability or the Army Corps of Engineers' public programs. DOD supports the concept of integrated pest management and utilizes IPM techniques to the maximum extent possible.

DOD pest management on military installations is divided into

two major categories:

- (1) Disease vector control activities in support of operational forces which are directed under the guidance of the surgeons general of military medical departments, and;
- (2) Installation pest control programs which are equivalent to urban pest management. Each of DOD's 450 major and 3,500 minor installations are urban communities with differing environmental conditions and operational needs. DOD's IPM programs are designed to respond to these conditions and are site specific. Each installation, where pest control operations are performed, is required to develop a pest management plan. Pest management professionals evaluate the plan annually during an on-site technical review.

The U.S. Army Corps of Engineers (Civil Works) pest management program is limited to the control of pests along navigation routes, dams, and flood control projects, as well as associated recreational faci-

ities. This effort is accomplished primarily through contractual services.

2. Legislative Authority and Administrative Action Affecting IPM

DOD policy is to support, both operationally and investigationally, the concept of IPM. DOD Directive 4150.7, "Department of Defense Pest Management Program," of November 6, 1978, emphasizes the application of IPM. Additional guidance, which includes a definition of IPM, is provided in Defense Environmental Quality Program Memoranda (DEQPPM) 79-2 (January 5, 1979) and 80-2 (January 3, 1980). Policy implementation is monitored with management-by-objective goals established at the Deputy Assistant Secretary of Defense (Energy, Environment, and Safety) level. The military departments and the U.S. Army Corps of Engineers (Civil Works) further develop IPM policies appropriate to their programs. At the operational level, pest management programs within DOD and the various military services are encouraged to utilize integrated pest management techniques to the maximum extent possible. When pesticides are utilized, those with suitable ecological and/or physiological selectivity against a particular target pest will be recommended and will be made available through normal supply channels from the Defense Logistics Agency.

The DOD pest management program is operated in concert with the provisions of the following statutes and Executive Orders:

- (1) Federal Insecticide, Fungicide, and Rodenticide Act (Public Laws 92-516, 94-140, and

- 95-396);
- (2) National Environmental Policy Act (Public Law 91-190 as amended by PL 94-52 and 94-83);
 - (3) Environmental Quality Improvement Act of 1970 (Public Law PL 91-224 as amended by PL 94-52);
 - (4) River and Harbor Act of 1965 (PL 93-629);
 - (5) Noxious Weed Control Act (PL 93-629);
 - (6) Plant Quarantine Act of 1912;
 - (7) Occupational Safety and Health Act of 1970 (PL 91-569);
 - (8) Clean Water Act (PL 95-217);
 - (9) Protection and Enhancement of Environmental Quality (Executive Order 11514);
 - (10) Environmental Safeguards on Activities for Animal Damage Control on Federal Lands (Executive Order 11643 as amended by Executive Orders 11870 and 11917);
 - (11) Prevention Control and Abatement of Environmental Pollution (Executive Order 11752);
 - (12) Federal Compliance with Pollution Con-

- trol Standards (Executive Order 12088);
- (13) Occupational Safety and Health Programs for Federal Employees (Executive Order 12196);
- (14) Reporting requirements in connection with the Prevention, Control and Abatement of Environmental Pollution at established Federal Facilities (OMB Circular A106).

3. DOD Support of Pest Control

DOD's support of pest control activities for FY 1980 is shown in Table 4.

Research: Most defense components engage in pest control research. DOD funded research amounts to slightly more than one-third of the support effort; the USDA, through an interagency agreement, is responsible for nearly two-thirds of the DOD oriented effort. Basic and applied research is conducted on a variety of public health (e.g., mosquitoes, fleas, and ticks) and economic (e.g., stored product and structural pests).

In addition to the military oriented effort, the U.S. Army Corps of Engineers conducts an aquatic weed research program. This civil works program is split evenly between an in-house effort and contract research conducted by various federal or state agencies or universities.

The Office of the Under Secretary of Defense (Research and Engineering) and the Armed Forces Pest Management Board monitor the research programs of the various military departments in order to preclude duplication.

A major DOD-USDA IPM research effort is carried out at the Insects Affecting Man and Animal Research Laboratory, Gainesville, Florida; the Stored Product Insects R & D Laboratory, Savannah, Georgia; Forestry Sciences Laboratory, Gulfport, MS; and several other USDA laboratories. One phase of the research has been to develop a comprehensive mosquito IPM program that integrates predatory fish, insect growth regulators, habitat management, and selective use of insecticides as required to suppress the mosquito populations below acceptable threshold levels. Another involved the use of a parasitic wasp against populations of filth flies and the development of insect-proof containers for rations.

Technology Transfer: Pest control training is a large and important aspect of DOD's program. The military departments train pest management personnel at four locations in the United States. Triennial recertification is provided at the training centers or on a regional basis. A correspondence course in basic pest control technology (including IPM) is available prior to formal training. This course has been made available to all federal, state, and municipal agencies. Formal training is supplemented with work experience on-the-job. The U.S. Army Corps of Engineers (Civil Works) uses state certification programs to train the majority of the Corp's pest control contract supervisors. The

limited number of personnel actually performing pest control procedures are trained in the DOD training program.

DOD carries out training for both professional and technician levels which exceeds the minimal training requirements for pesticide application specified in the Federal Insecticide, Fungicide, and Rodenticide Act, as amended. All levels of in-house training have the IPM philosophy integrated with the "DOD Plan for the Certification of Pesticide Applicators." The DOD Plan is the first EPA approved federal pesticide applicators' plan and reflects the DOD policy of IPM rather than total reliance on pesticides. Professional level education includes DOD training and long-term civilian institutional training at the PH.D. and master degree levels. DOD has approximately 2,400 DOD certified individuals and 90 state certified individuals trained at the technician level and approximately 650 non-certified technicians. The professional cadre consists of approximately 450 professionals in the fields of entomology, agronomy, natural resources, wildlife biology, forestry, and land management and provides the nucleus for the interdisciplinary IPM systems approach through the Armed Forces Pest Management Board.

Implementation: The general implementation activities were described above in Section 1, DOD's Role. DOD's military pest management program covers approximately 26 million acres of land, buildings valued at \$100 billion, and 3 million people, their equipment and subsistence items. The civil works pest management program is conducted

at approximately 400 public sites throughout the United States. A major portion of the DOD program is devoted to pest surveillance activities at the installation level. The monitoring of pesticide use and accountability is the basis of the pest control report system established in DOD Directive 4150.7. Each military installation prepares and submits a pest control report for review by pest management consultants. Those reports are used to identify trends, pesticide use or misuse patterns, and progress of IPM implementation. The Department of Navy has completely computerized the reports to provide effective program management feedback. The Department of the Army is currently the only federal agency with a pesticide residue monitoring program designed in accordance with the National Pesticide Monitoring Program. Pollution abatement and occupational health and safety funds are used to correct deficiencies in installation pest control facilities. DOD pesticide registration activities are negligible.

Assistance: DOD has limited involvement with assistance programs, except for the cost-sharing federal-state cooperative assistance activities of the U.S. Army Corps of Engineer Civil Works Program. The major Corps effort in water management attempts to maximize IPM techniques in the control of pests such as mosquitoes and weeds. DOD also provides training for personnel in other federal agencies through memoranda of understanding. In emergency situations, the military has provided assistance in disease vector out-breaks.

4. Mechanisms of Interagency Coordination and Cooperation

The Armed Forces Pest Management Board coordinates pest management activities within DOD to ensure uniform compliance with environmental laws and regulations. The Board is a joint activity of the Department of Defense and is composed of members appointed from the Departments of the Army, Navy, and Air Force, and selected Defense Agencies. Other military agencies and federal organizations appoint liaison representatives. The Board develops and recommends policy for the DOD pest management program, serves as a consultant body on prevention and control of arthropod-borne diseases and economic pests, functions as a coordination activity of DOD for pest management, operates an Information Analysis Center, and maintains liaison with other federal agencies having similar programs. In addition, a military officer trained in pest management is located at the USDA Insects Affecting Man and Animal Research Laboratory to provide liaison between DOD and USDA and oversee contractual efforts.

The DOD has formalized memoranda of understanding with USDA, EPA, DOI, State of Texas, and other federal and state agencies. The Corps Civil Works Program constitutes a major cooperative effort with the states for the benefit of the public. DOD also cooperates with the National Center for Disease Control in training and suppression of disease vectors.

TABLE 4

DEPARTMENT OF DEFENSE

ESTIMATED FISCAL YEAR 1980 SUPPORT OF PEST
CONTROL ACTIVITIES IN VARIOUS MANAGEMENT
SYSTEMS (IN \$ MILLIONS) *

Activity	Agri- culture	Forestry	Range- land	Rights- of-way	Urban environ.	Public health	Multi- site
Research	0.200	*	*	*	1.500	0.500	1.000
Higher Education						.100	
Extension		*	*	*	.500	.390	.210
Demonstration					1.100		
Suppression	*	*	*	*	90.530 ^{1/}	40.610	25.380
Quarantine	*	*	*			*	.100
Biological Monitoring	*	*	*	*	*	*	7.700
Residue Monitoring	*	*	*	*	*	*	.300
Loss Monitoring	*	*	*	*	*	*	.150
Pesticide use Monitoring	*	*	*	*	*	*	.225
TOTAL	.200	*	*	*	93.630	41.600	35.065

* Level of funding not known; inseparable from other systems.
^{1/} Includes \$40,000,000 U.S. Army Corps of Engineers Federal-
State Civil Works Program.

Total resources = \$170,495,000.

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

1. HEW's Role

HEW is a cabinet level department within the executive branch. Created in 1953, the Department is charged with vast responsibilities that include the social security program, improving the quality of U.S. education, and making public health services more widely available. Important agencies include the Public Health Service, Office of Education, Social Security Administration, Food and Drug Administration, and the Social and Rehabilitation Service. It is directed by a cabinet member secretary.

HEW has major responsibilities for assessing the effects of pesticides and other environmental toxicants on human health and maintains a research program designed to produce new methods for controlling pest organisms. A significant portion of HEW's research is administered by the National Institutes of Health for studies of biological regulation of disease vectors and mechanisms of pesticide action and modes of action and metabolism of organic toxicants. Its Center for Disease Control conducts research and monitoring and carries out operational programs for a variety of pests of public health; CDC administers a major rat control program in cities and communities. The Food and Drug Administration is responsible for monitoring pesticide residue levels in foods and enforcing the tolerance levels established by the Environmental Protection Agency. FDA also is responsible for monitoring processed foods for the presence of "filth" or foreign objects, including pests and their contaminants.

The National Toxicology Program was established within HEW in 1978 to effect better management of the Departments' research programs on toxic

This report was prepared before the creation of the newly formed Department of Education which now has the responsibility for improving the quality of U.S. education.

substances. The cooperative effort includes all the Public Health Service agencies engaging in toxicological research and standard setting related to federal regulation.

2. Legislative Authority and Administrative Action Affecting IPM

HEW activities related to pesticides and pest control programs are carried out under the following legislative authorities:

- (1) For the National Cancer Institute, the National Cancer Act of 1971 (Public Law 92-218), as amended by the Community Mental Health Centers Act of 1978 (Public Law 95-622), Section 402;
- (2) The National Institute of Environmental Health Sciences utilizes the broad research authority in Section 301 of the Public Health Service Act;
- (3) The Center for Disease Control (CDC), for the Urban Rat Control Program, utilizes the Public Health Service Act, Section 317(a)(2), (42 U.S.C. 247b), as amended by the Health Services and Centers Amendments of 1978, (Public Law 95-626);
- (4) The Food and Drug Administration (FDA) utilizes the Federal Food, Drug, and

Cosmetic Act (21 U.S.C.). The operative sections of the statute are 402(A) (2) (B) for raw agricultural commodities and 402(A) (2) (C) for processed foods.

Tolerances and exemptions from a tolerance are established by the Environmental Protection Agency (EPA) pursuant to Section 406 (pesticides in or on raw agricultural commodities) and 409 (pesticides in or on processed foods). The FD&C Act authorizes the FDA to initiate three different legal sanctions to enforce the adulteration provisions of 402 (A) (2) (B) and (A) (2) (C), mentioned above. These are seizure (Section 304), injunction (Section 302), and prosecution (Section 301);

(5) The National Institute for Occupational Safety and Health uses for its authorization the Occupational Safety and Health Act (Public Law 91-596), Section 20, Section 22, as amended; and the Federal Mine Safety and Health Act of 1977;

(6) Any other research in the National Institutes of Health and CDC is carried out under Sections 301, 311, and 327 of the the Public Health Service Act.

3. HEW Support of Pest Control by Activity and Sector

HEW's support of pest control activities for FY 1980 is

shown in Table 5.

Research: HEW's research is carried out primarily by the National Cancer Institute (NCI), the National Institute of Environmental Health Sciences (NIEHS), and the Center for Disease Control.

NCI has tested agricultural chemicals for carcinogenicity since the mid-1960's. The results of the Institute's first major screening effort were published in 1960. In that effort, 104 pesticides were tested against mice for carcinogenicity. Many pesticides and other agricultural chemicals subsequently have been tested for carcinogenicity in rodent bioassay studies. NCI's research program includes epidemiology of pesticide applicators.

The NIEHS is the primary environmental health research unit in the National Institutes of Health. Research activities cover the full range of institutional studies of environmental health hazards. Programs support fundamental research and develop new methods and stabilize testing techniques. Intramural and extramural research is supported, and NIEHS has collaborative arrangements with scientific organizations in the United States and other countries. It is involved in studying the effects of traditional chemical pesticides and some alternative chemicals. The intramural research relating to the adverse effects of pesticides on health can be divided into three areas: neurobehavioral toxicology, marine pharmacology, and toxicity bioassay and chemical programs concerned with assessing the role of contaminants.

The CDC has a small in-house research group located in Atlanta and supports extramural research carried out at various locations in the United States and other countries. The research is mainly of an applied nature but includes some basic studies on pest biology, for example.

CDC's research program includes studies of the effects of pesticides on workers in pesticide factories, epidemiology/pathology interactions, and problems of the herbicide paraquat on marijuana, for example. CDC also conducts studies of pesticides used in tropical disease control programs.

Technology transfer: At various times HEW has supported educational activities related to pesticide safety and, to a minor degree, pest management. The Office of Environmental Education (OEE) of HEW's Office of Education sponsored the publication *A Source Book on Integrated Pest Management* by Mary Louise Flint and Robert van den Bosch through a grant to the University of California. In 1973, OEE sponsored *A Curriculum Report: Integrated Pest Management*, a survey of IPM curricula at U.S. universities. In 1977 through a grant from OEE the Grady County (Georgia) School District developed a pilot course on IPM for grades 9-12, and published *IPM: Preliminary Guide and Instructional Materials for Secondary School Vo-Ag Programs*.

The Department has sponsored numerous publications on pesticide epidemiology, pesticide safety, and on other topics related to pesticides.

The National Institute of Occupational Safety and Health (NIOSH), in carrying out its mandate to effect safe conditions for workers, engages in educational activities that include education on pesticides. Training and work force development is done in cooperation with HEW's Bureau of Health Manpower. Training modules are being developed to provide increased knowledge of pesticides for physicians, interns, residents, and farm workers;

teaching materials suitable for both medical and lay groups are being developed.

Implementation: HEW is mandated with a variety of pesticide monitoring, standard setting, and enforcement responsibilities and is responsible for establishing and enforcing the defect action levels (DALs), the allowable quantities of insects and insect parts found in food entering commercial markets. Under the Federal Food, Drug, and Cosmetic Act of 1938, the Food and Drug Administration is responsible for monitoring and enforcing pesticide residue levels and the DALs. FDA's programs in monitoring, standard setting, and enforcing the pesticide residue levels and the DALs greatly influence the kinds and levels of pesticides used in the United States. FDA engages in a variety of programs in surveillance, sampling, and surveys to carry out the mandate under FFDCA.

The National Center for Health Statistics (NCHS) administers programs designed to collect the kinds of needed health statistics obtainable only through direct examinations of probability samples of the population. Since 1970, the Center has been monitoring the nutritional status of the United States' population through the Health and Nutrition Examination Survey (HANES). Since February 1976 data collection has been underway for the HANES II program with broadened coverage to include sampling of the total U.S. civilian noninstitutionalized population. The Environmental Protection Agency is supporting the measurement of exposure of the general population to certain classes of pesticides. HANES II is collecting blood and urine samples specifically for these assessments. National estimates of population exposure will be available upon completion of the survey. Pre-

liminary data are now being reviewed by NCHS and EPA.

NIOSH has extensive activities related to pest management, including cooperative efforts with the Department of Labor to obtain data required for occupational safety and health, training and work force development, control toxicology assessment, analytic methods development and surveillance, hazard evaluation, and field studies.

NIOSH has transmitted to the Occupational Safety and Health Agency criteria for occupational exposure to carbaryl, malathion, methyl parathion, parathion, and generic criteria for occupational exposure during manufacture and formulation of pesticides.

Of the HEW agencies engaging in pest control activities, CDC is the only one supporting operational control programs. It has a major program directed at controlling rats in urban areas.

Assistance: HEW has no pest management assistance programs as defined in this report.

4. Mechanisms of Interagency Coordination and Cooperation

The HEW cooperates with other cabinet level departments and federal agencies. Mechanisms for cooperation depend on the activities and the departments and agencies involved. Funding and management of the activities are frequently shared between different agencies or levels of government. Protocols for interagency consultation and the reviews provided by the Congress and the state governments provide a means of formal cooperation. Coordination also is effected through various informal channels, such as exchange of plans of work and progress reports among administrators and informal contacts among scientists.

Important formal mechanisms of coordination and cooperation have been established through the National Toxicology Program (NTP), established in 1978, and the Interagency Regulatory Liaison Group (IRLG), established in 1977.

The NTP was established to facilitate improved management of research on toxic substances with special emphasis on effective utilization of resources so that competing needs are met as well as possible. The cooperative venture includes all of the Public Health Service agencies engaged in toxicological research which contribute to standard setting for the purpose of federal regulation. To assure effective consideration of both research (including testing) and regulatory needs, an Executive Committee was established with authority to review such NTP actions as the priority listing of chemical testing. Members of the Executive Committee include Food and Drug Administration, Occupational Safety and Health Administration, Consumer Product Safety Commission, Environmental Protection Agency, National Institutes of Health, National Institute for Occupational Safety and Health, National Cancer Institute, and the National Institute of Environmental Health Sciences. The NTP Second Annual Plan has been completed and is now being implemented in accordance with the understandings reached through an extensive review process. Pesticides are included among the chemicals to be tested utilizing criteria previously approved by the Executive Committee.

The IRLG was established when the four agencies, Environmental Protection Agency, FDA, Consumer Product Safety Commission, and the Occupational Safety and Health Administration, agreed on the need for closer working relationships on regulations aimed at protecting human health against toxic substances. Subsequently, a fifth agency, Food Safety and Quality Ser-

vice of the USDA, was added. IRLG identified eight areas where cooperation would improve Government effectiveness: (1) testing standards and guidelines, (2) epidemiology, (3) information exchange, (4) compliance and enforcement, (5) regulatory development, (6) research planning, (7) education and communication, (8) risk assessment. A major goal of IRLG is to achieve uniformity of as many required tests as possible. Since all of these agencies are directly affected by issues arising with pesticides the IRLG will continue to study the use of pesticides which are effective and which also offer the least possible risk to human health.

TABLE 5

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

ESTIMATED FISCAL YEAR 1980 SUPPORT OF PEST
CONTROL ACTIVITIES IN VARIOUS MANAGEMENT
SYSTEMS (IN \$ MILLIONS) *

Activity	Agri- culture	Forestry	Range- land	Rights- of-way	Urban environ.	Public health	Multi- site
Research						0.700	4.600
Suppression						14.500	
Enforcement	5.900					* <u>1</u> /	
TOTAL	5.900					15.200	4.600

* Level of funding not known; inseparable from other systems.
1/ Enforcement program deals with pesticide residues on food crops.

Total resources = \$25,700,000.

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

1. HUD's Role

Created in 1965 as a cabinet level department within the executive branch, HUD assists in the growth and development of urban communities and metropolitan areas to provide decent housing, a suitable living environment, and expanding economic opportunities. HUD's major function is in Housing and in Community Planning and Development. The Department is directed by a cabinet level secretary.

The HUD has developed policies dealing with pest control or pest management on a program basis, rather than department-wide. The subject is defined independently for each program within the framework of HUD policies dealing with the environment, building instruction, tenant management relations, and leases.

The Department's role in urban pest management is found mainly in the Housing Programs, comprising the Direct Loan and Mortgage Insurance Programs (including acquired properties); the Section 8 Housing Assistance Payments Program; and the Low-Income Public Housing Program. The Department's policies and role in pest control efforts vary in each of the above programs, as the role in project and property management varies.

2. Legislative Authority and Administrative Action Affecting IPM

HUD's legislative authority and administrative action to carry out the various activities under the housing programs are specified in

the National Housing Act of 1934, as amended, and the U.S. Housing Act of 1937, as amended.

3. HUD's Support of Pest Control by Activity and Sector

HUD's support of pest control activities for FY 1980 is shown in Table 6.

Research: HUD has no in-house research program related to pest control, but the Department supports some extramural research through contractual arrangements as required to carry out its mandate to establish and update Minimum Property Standards and Minimum Design Standards for Rehabilitation for Residential Properties. In order to obtain certain information required to effect the mandate, HUD has supported USDA-Forest Service research on wood-destroying organisms. Products of the research include slides and tapes on the control of, and protection against, these organisms. Three publications have resulted from this research to date. Their titles are *A Guide to the Inspection of New Houses for Wood-Inhabiting Fungi and Insects*, *Prevention and Control of Decay in Homes*, and *Wood-Inhabiting Insects in Houses*. Other manuals and slide/tapes are expected in the near future.

The Department currently is initiating research into pest infestation problems in public housing.

Technology Transfer: HUD's present program in technology transfer

is relatively modest. It is anticipated, however, that the demand for training will increase once new IPM programs are available for termites, household pests, rodents, and lawn care. On the management side, the workloads will include providing training for staffs of the public housing agencies (PHAs).

Technical advice is primarily given in the area of Public Housing and Indian Programs. PHAs are referred to local extension services for assistance when pest infestations are beyond the expertise of HUD staff. If problems in this area continue to increase significantly for the PHAs and if the staffing level of the extension service is not sufficient HUD will attempt to increase its technical assistance to local housing agencies nationally.

Implementation: The pest control policy in the Direct Loan, Mortgage Insurance, and Public Housing Programs requires the builder, seller, or owner to protect the structures against wood-boring pests. HUD's policy statements which require protection for residential buildings against termites and other wood destroying insects are found in the Minimum Property Standards (MPS) and in the Minimum Design Standards (MDS) for Rehabilitation for Residential Properties.

The established criteria for Pest Management are integrated into the overall requirements of the MPS and MDS which require protection against wood destroying insects in new and rehabilitated residential structures built under HUD programs. Approval, review, and evaluation of projects are based on the MPS and MDS requirements which reflect present-day technology. While the term IPM is not used, HUD's requirements include good practices

in site sanitation, which discourage burial of wood and encourages use of pressure-treated lumber, proper ventilation of structures, and the proper use of vapor barriers. Because of serious problems in properly installing termite shields, these are normally not relied upon.

Requiring protection from termites and wood-boring pests is the extent of HUD's role in pest control in the Homeownership Mortgage Insurance Programs. In the Multifamily Mortgage Insurance Programs, the Department monitors the effective management of the properties to insure that the tenants are provided a decent, safe, and sanitary dwelling based on local standards.

In the case of HUD-acquired properties, the Department is responsible for management policies and operating procedures. All pest control work for acquired properties is based on performance contracts for pesticide spraying.

In the case of the Public Housing Program, pest management aims are reflected in the management standards initially promulgated by the Public Housing Administration at least 30 years ago and still used by HUD. Traditionally, HUD publications and HUD staff emphasized sanitation and housekeeping as most important in preventing household pest infestations. While PHAs are fully responsible for the control of pest infestations, HUD field staff monitor the effectiveness of local pest control programs, including the review of pest control contracts during the course of housing authority reviews. HUD Maintenance Engineers provide PHAs with technical assistance on an as-needed-basis. When the problems are beyond their expertise, the PHAs are referred to the appropriate agency or the PHAs may

hire a professional consultant. The presence of pesticide resistant species of cockroaches and other vermin in urban areas are forcing PHAs to consider new and more sophisticated management systems for pest control.

To assist the PHAs, the Department is updating its Public Housing Management handbooks on household pest control, termite control, rodent control, and lawn care in view of the Federal Insecticide, Fungicide, and Rodenticide Act requirements and to provide further guidance in the utilization of IPM concepts.

The Department's Section 8 Program overlaps with both the Mortgage Insurance and Public Housing Programs. HUD's role in Section 8 is similar to that for the Mortgage Insurance Program. Section 8 projects and individual units may be owned and operated by private owners or Public Housing Authorities. In the case of individual units leased through Section 8 Existing, the PHA is responsible for monitoring Housing Quality Standards which requires that "the unit and its equipment shall be free of vermin and rodent infestation"

Assistance: HUD does not administer any assistance programs as defined in this report.

4. Mechanisms of Interagency Coordination and Cooperation

HUD has no ongoing formal arrangement with other agencies for assistance. Other agencies assist HUD's clientele on an individual basis when HUD cannot provide direct assistance.

The Public Health Service's Center for Disease Control (CDC) and its local lead agencies have assisted PHAs in reviewing or implemen-

ting their rodent control programs; however, CDC's rodent control program does not fund pest control operations in the public housing program. For example, in Washington, D.C., the local agency is under contract with the National Capital Housing Authority for both rodent and vermin control.

The EPA provides ongoing information and technical assistance on all phases of IPM to the Office of Public Housing, HUD. HUD has worked with other agencies to provide occasional training for its clientele. An example is the HUD-EPA Interagency Agreement, through which the Housing Authority of the City and County of Denver implemented a Pest Control Training Program for local PHAS in Colorado during 1978-1979.

TABLE 6

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

ESTIMATED FISCAL YEAR 1980 SUPPORT OF PEST
CONTROL ACTIVITIES IN VARIOUS MANAGEMENT
SYSTEMS (IN \$ MILLIONS)

Activity	Agri- culture	Forestry	Range- land	Rights- of-way	Urban environ.	Public health	Multi- site
Extension					1.050		
Suppression					26.000		
TOTAL					27.050		

Total resources = \$27,050,000.

DEPARTMENT OF INTERIOR

1. DOI's Role

Originally established in 1849 as the Home Department, DOI is a cabinet level department within the executive branch and directed by the Secretary of the Interior. The Department's responsibilities include the administration of approximately 0.5 billion acres of federal land and 50 million acres of trust land, mostly the conservation of mineral and water resources, fish, and wildlife, the preservation of scenic and historical areas, and the promotion of mine safety. The Department also is charged with the social and economic development of U.S. territories, and it administers service programs to Indians and Alaska native people. Its agencies include the Bureau of Land Management, Bureau of Reclamation, National Park Service, Fish and Wildlife Service, Water and Power Resources Service, Bureau of Mines, Bureau of Indian Affairs, and others.

In managing its resources, DOI uses pesticides and other methods to control organisms interfering with its objectives. Interior also supports research to develop new control technologies. Innovative efforts include testing chemicals for specific uses and integrating a variety of pest management techniques. Sometimes the Department gathers data necessary to register a specific chemical for a specific use. Other aspects of DOI's research include studies to determine the impact of pest control technologies on non-target species.

2. Legislative Authority and Administrative Action Affecting IPM

The Animal Damage Control program of the Fish and Wildlife Ser-

vice is conducted pursuant to the Animal Damage Control Act of March 2, 1931 (46 Stat. 1468; 7 USC 426-426b), as amended. Executive Order 11643 (1972) banned the use of specific toxicants on federal lands, and Executive Orders 11870 (1975) and 11917 (1976) allowed experimental and operational use of sodium cyanide, respectively.

Additional legislative authorities include:

- (1) Federal Land Policy and Management Act of 1976, as amended (43 USC 1701 et seq.);
- (2) Public Rangelands Improvement Act of 1978 (43 USC 1901 et seq.);
- (3) Federal Noxious Weed Act of 1974 (7 USC 2801-2813);
- (4) Federal Insecticide, Fungicide, and Rodenticide Act, 1972, as amended;
- (5) Public Law 90-583, October 17, 1968.

3. Support of Pest Control by Activity and Sector

DOI's support of pest control activities for FY 1980 is shown in Table 7.

Research: The Fish and Wildlife Service (FWS) is the primary DOI agency involved in pest management research. This research focuses on four major problems: sea lamprey, birds, mammal pests, and predators. All research is carried out by FWS' Animal Damage Control Division.

The objective of the sea lamprey research is to develop a man-

agement system that integrates chemical, physical, and biological techniques. Chemical control alone is expensive and not entirely effective. Repellents, attractants, irritants, sterilants, physical barriers, and other methods in addition to selective pesticides are being examined.

FWS is researching methods to alleviate bird problems at airports (aircraft strikes), bird damage to agricultural crops, and nuisance problems caused by large roosts of blackbirds. The research emphasizes controlling the damage, not the species. A major objective is to understand the population status and behavior of potentially damaging species. Methods development includes testing selected toxicants, development of bird scaring devices, searching for resistant strains of crops, testing of cultural control methods, and measurement techniques to quantify bird losses.

FWS' mammal damage control research involves a wide variety of pest species and resources: rats affecting sugarcane; pine voles affecting orchards; gnawing rodents affecting telephone cables; burrowing rodents affecting rangeland, and several species of mammals (e.g., pocket gophers, deer, and mountain beavers) affecting forests. Research is divided between problem definition (measurement of damage), methods development, and ecological and behavioral studies. As with bird damage research, the emphasis is on controlling the damage rather than the mammal species. Toxicants are tested and developed, but other control techniques such as the Vexar ® tube which protects young tree seedlings are also produced.

The research on predators focuses primarily on reducing losses

to livestock caused by coyotes. A major objective is to understand the coyotes' behavior and population dynamics and the behavior and dynamics of natural prey. Numerous non-lethal reductional methods are being investigated, e.g., cultural methods, repellants, and scaring devices. Considerable effort is being directed toward quantification of damage and identification of factors which affect predation by the coyote.

A large percentage of FWS' research is conducted in-house, but some (notably pine vole/orchard research) is contracted out to various collaborators.

The National Park Service (NPS) has a research program aimed primarily at studying non-chemical methods for controlling pests affecting the national parks.

The Water and Power Resources Service (WPRS) supports research on the control of aquatic vegetation using biological, chemical, physical, and environmental management methods.

Technology Transfer: The Animal Damage Control Division responds to requests concerning control of various types of wildlife problems. This is handled largely by personal communication and by distributing leaflets, but the Division's personnel also participate in pest control seminars, workshops, and conferences, some of which are international in scope. In addition, they conduct and demonstrate animal damage control techniques to individuals, groups, local governments, and various federal agencies.

The Bureau of Land Management (BLM) is represented on the USDA-DOI "Integrated Weed Management Systems" work group which is currently

developing a state-of-the-art paper on integrated weed management.

The Bureau of Indian Affairs engages in a variety of pest control activities on the Indian reservations. One aspect involves training Indian people to become certified applicators of pesticides.

Implementation: FWS carries out major operational pest control programs. Acting as the United States agent for the Great Lakes Fishery Commission, the FWS carries out a program under contract to control the sea lamprey in the Great Lakes. Lampreys in the Great Lakes have been reduced approximately 80-90 percent from their level of abundance in the late 1950's. This reduction has been accomplished by using chemicals, chiefly 3-Trifluoromethyl, 4-nitrophenol (TRM) to selectively destroy larval populations in spawning tributaries. Vertebrate pests (birds, mammals, and predators) are controlled through the Animal Damage Control program.

The WPRS carries out a substantial program involving the control of aquatic weeds of water canal systems under its authority.

The NPS uses substantial quantities of pesticides in parks managed by the agency. The NPS is supporting the John Muir Institute to develop a "model" IPM system for parks.

Some of the DOI's implementation programs utilize various non-chemical techniques, and some represent an "integrated" approach, as exemplified by BLM operational pest control programs on the public lands. The programs include biological control of weeds (tansy ragwort), genetic tree improvement to control blister rust, chaining, burning, and manual

removal of undesirable brush and trees, and some pesticides as needed.

Most DOI agencies are engaged in the implementation of pest control programs to the degree that they use pesticides and other controls as required to carry out their objectives.

Assistance: The ADC program provides assistance to individuals, groups, units of local government, federal agencies, and foreign countries in resolving animal damage problems. A great deal of assistance is provided through long-standing agreements and many other problems are handled on a case by case basis. The Department of the Interior provides funds to help support two state supervised cooperative animal damage control programs.

Through the federal aid in the Fish and Wildlife Restoration Program administered by FWS, funds are also provided to states for the conduct of research, development, land acquisition, or operational activities as necessary to carry out state fish and wildlife management functions. The activities include vegetation control using mechanical, biological, and chemical methods, insect control, and fish control.

4. Mechanisms of Interagency Coordination and Cooperation

DOI cooperates with other federal agencies on a range of programs. Much of the Department's basic research is carried out collaboratively with USDA's Science and Education Administration. The FWS programs in developing countries are carried out collaboratively with the

Agency for International Development. DOI has numerous cooperative programs with USDA's Forest Service and Animal and Plant Health Inspection Service.

The ADC Division coordinates and cooperates with other agencies chiefly through formal written agreements delineating responsibilities for wildlife damage control. Formal agreements with 16 state departments of agriculture, six state departments of health, 12 state departments of natural resources, six state universities, 280 counties, 70 associations, and 31 federal agencies are in effect. An agreement with the Federal Aviation Administration provides for technical assistance in vertebrate pest control at airports. Less formal agreements provide ADC assistance to individuals and other agencies as the need arises.

The National Park Service cooperates with the Forest Service when the two agencies operate adjoining land management units and/or where pest problems in one unit may affect resources in another. Examples of cooperation include control of spruce budworm populations and plant disease organisms such as white pine blister rust.

Principal interaction between NPS and the Fish and Wildlife Service occur in areas where FWS refuges or preserves are included within the boundaries of the NPS unit.

NPS cooperates with various states in the control of noxious plants. This effort usually involves the elimination of seed-producing weeds on NPS lands which present a problem of contamination to adjacent private lands (farm land, for example). In addition, the NPS cooperates

with state agencies and local communities in controlling various insect pests. NPS also cooperates with international organizations in pest control programs. For example, in Glacier National Park the International Boundary Commission may occasionally utilize pesticides for vegetation management along the U.S.-Canada border. NPS cooperates in carrying out the programs. FWS cooperates with several less developed countries (LDC's) and has personnel working full-time in some LDC's.

TABLE 7

DEPARTMENT OF INTERIOR

ESTIMATED FISCAL YEAR 1980 SUPPORT OF PEST
CONTROL ACTIVITIES IN VARIOUS MANAGEMENT
SYSTEMS (IN \$ MILLIONS)

Activity	Agri- culture	Forestry	Range- land	Rights- of-way	Urban environ.	Public health	Multi- site
Research	4.411	0.003		0.332	0.460		
Extension				.060	.208		
Suppression	12.176	3.310	0.402	7.700	2.840	0.931	3.363
Biological Monitoring		.010	.010		.003		
Health Monitoring		.250					
Residue Monitoring	.300						
Pesticide use Monitoring	.090						
TOTAL	16.977	3.573	.412	8.092	3.511	.931	3.363

Total resources = \$36,859,000.

DEPARTMENT OF TRANSPORTATION

1. DOT's Role

DOT is a cabinet level department within the Executive Branch, established in 1966 to assure effective administration of the transportation programs of the federal government. It also works to facilitate the development and improvement of coordinated transportation services to be provided by private enterprise to the maximum extent feasible.

Agencies of DOT include the Federal Aviation Administration (FAA), Federal Highway Administration (FHWA), and the United States Coast Guard (USCG). These agencies use pesticides and other pest management techniques as required to protect their facilities and to carry out their mandates. Further, the FAA regulates agricultural aircraft operations and certification, including aircraft involved in the application of pesticides. Aerial application of pesticides is a major business. Approximately 65 percent of all pesticides dispersed on U.S. agricultural and forest lands is applied by aircraft. Agricultural aerial operators, who apply pesticides as well as fertilizers and seeds, grossed more than \$450 million for their services in 1975.

One of FAA's major activities in pest management involves efforts to reduce bird strikes to aircraft. Every year there are some 10,000 bird strikes reported world-wide and over 800 bird strikes in the U.S. alone. The cost to the aviation community is estimated at \$100 million to \$1 billion per year world-wide. The potential for loss of hu-

man life exists as well. FAA is working with local airport authorities, the Department of Interior, and various other agencies to reduce these hazards primarily through training and educational programs.

The Department of Transportation, through some of its component organizations, serves as a conduit for funds to state and local jurisdictions who have the primary responsibility for implementing programs. With the Federal highway system, it is the responsibility of state agencies to be sensitive to the interaction between highways and the environment; the Federal Highway Administration serves in an oversight role, assuring that the state programs comply with requirements of the National Environmental Policy Act (NEPA).

Highway rights-of-way create special and often very difficult pest control problems and are a major consumer of herbicide products in the United States. Research and implementation efforts by FHWA, state agencies, and others are aiming for right-of-way pest management systems that will reduce maintenance costs while preventing insult to the environment.

2. Legislative Authority and Administrative Action Affecting IPM

While no specific legislative mandate concerning integrated pest management has been given to the Department, NEPA's requirements must be met. An Environmental Impact Statement (EIS) must be prepared for each federal project, including highway projects. From the time of the passage of NEPA in 1969 to 1976, approximately half of all EIS' pre-

pared for federal projects were for highway projects.

FAA, through Federal Air Regulations (Part 137) exercises control over the manner in which pesticides are applied by aircraft in the United States. The agency is also responsible for certification of the safety of the aircraft and the qualifications of pilots.

3. DOT Support of Pest Control by Activity and Sector

DOT's support of pest control activities for FY 1980 is shown in Table 8. FAA is the only agency actually involved in the implementation of pest control programs. The other agencies give this responsibility to the state and local agencies which collaborate.

Research: FAA has a modest research program to evaluate the effectiveness of bird hazard reduction techniques for use by airports, involving bird scaring devices.

Technology Transfer: FAA supports a small educational program to train U.S. Fish and Wildlife Service biologists on airport bird control.

Implementation: FAA cooperates with other federal agencies and wildlife groups in carrying out programs to reduce bird strike hazards. Concentrating its efforts on bird control within the airport environment, the FAA strives to reduce hazards; it employs a combination of monitoring (bird patrols), habitat modification, and land use techni-

ques. More than 52 percent of all bird strikes occur at the airports; thus, the anti-bird strike programs concentrate on solving problems at the airports. Additionally, the FAA is working with the aviation industry to develop new aircraft which are less susceptible to damage by birds. Six objectives of the overall FAA program in reducing bird strike hazards have been identified:

- (1) Develop information and technical materials which define the bird hazard problem, provide solutions to the problem, ensure compatible land use, and improve operational safety;
- (2) Establish a national bird hazard reduction working group to provide direction and coordination between various federal agencies and the aviation industry;
- (3) Identify research and development requirements to support wildlife management practices at airports;
- (4) Develop training programs in bird control for airport personnel;
- (5) Provide consulting assistance and inspection of airports experiencing bird hazard problems;
- (6) Develop national FAA policies and guidelines

for reduction of the hazard.

In other areas of pest control, FAA is working to control insects (occurring around airports) which serve as food for birds, often attracting large numbers to the airport environments.

4. Mechanisms of Interagency Coordination and Cooperation

FAA has a Memorandum of Agreement with the Department of Interior's Fish and Wildlife Service for cooperative technical support in the area of bird hazard reduction. Close liaison is maintained between the FAA and the U.S. Fish and Wildlife Service.

In 1970, FHWA initiated a national program of highway research and development, the Federally Coordinated Program of Research and Development in Highway Transportation (FCP). The FCP was designed to meet the needs of the customer - highway program managers and operating personnel in state and local agencies, as well as the general public. It was designed particularly to respond to urgent new problems in the environment, energy, and resource conservation.

An example of research conducted and disseminated under a federally coordinated program is that sponsored by the California DOT at the University of California, Berkeley. The research focused on the development of a non-chemical insect pest management program on highway landscapes. Results of the research have been disseminated to a wide range of potential users through coordinated federal-state mechanisms.

TABLE 8

DEPARTMENT OF TRANSPORTATION

ESTIMATED FISCAL YEAR 1980 SUPPORT OF PEST
CONTROL ACTIVITIES IN VARIOUS MANAGEMENT
SYSTEMS (IN \$ MILLIONS)

Activity	Agri- culture	Forestry	Range- land	Rights- of-way	Urban environ.	Public health	Multi- site
Extension					0.01		
Suppression					.03		
TOTAL					.04		

Total resources = \$40,000.

ENVIRONMENTAL PROTECTION AGENCY

1. EPA's Role

The EPA was created December 2, 1970, by a reorganization plan issued by the President. This action brought together the major environmental control programs of the federal government into a single agency. The pesticide regulatory functions of the Department of Agriculture, Interior, and Health, Education, and Welfare were transferred to the new agency. These regulatory functions included registration of pesticides as required under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) of 1947.

The agency's mandate is to protect public health and the environment. To carry out its mandate of protection of public health and the environment from unwarranted risks with pesticides, EPA engages in a variety of regulatory, research, educational, monitoring, standard setting, and enforcement activities. EPA views integrated pest management important in minimizing the risks of pesticides. The agency is mandated to inform pesticide applicator trainees about the use of IPM approaches through the State Cooperative Extension Services. The agency also encourages IPM in other ways. From 1972 to 1978, it was the principal funder of the IPM research project, "The Principles, Strategies, and Tactics of Pest Population Regulation and Control in Major Crop Ecosystems," the first major coordinated national effort to develop comprehensive IPM systems for crop insect and mite pests. EPA presently is funding a sequel of that project, "Development of Comprehensive, Unified, Economically, and Environmentally Sound Systems of Integrated Pest Management for Major Crops," and also several projects

that aim to develop IPM systems for various agricultural, public health, rangeland, and urban sectors. Other agency efforts to encourage IPM include exploring the feasibility of employing IPM in pesticide regulatory programs and using crop insurance to pay for pest damage incurred under an approved IPM protocol.

2. Legislative Authority and Administrative Action Affecting IPM

EPA's activities relating to and directly affecting IPM stem from its responsibility to regulate the use of pesticides under FIFRA, Public Law 80-104, enacted June 25, 1947, as amended. The most recent amendment, the Federal Pesticide Act of 1978, specifically directs EPA to conduct IPM-related activities:

Sec. 4 USE OF RESTRICTED USE PESTICIDES: CERTIFIED APPLICATORS

(c) INSTRUCTION IN INTEGRATED PEST MANAGEMENT TECHNIQUES--Standards prescribed by the Administrator for the certification of applicators of pesticides under subsection (a), and State plans submitted to the Administrator under subsections (a) and (b), shall include provision for making instructional materials concerning integrated pest management techniques available to individuals at their request in accordance with the provisions of section 23 (c) of this Act, but such plans may not require that an individual receive instruction concerning such techniques or be shown to be competent with respect to the use of such techniques. The Administrator and States implementing such plans shall provide that all interested individuals are notified of the availability of such instructional materials.

Sec. 20. RESEARCH AND MONITORING.

(a) Research.--The Administrator shall undertake research, including research

by grant or contract with other Federal agencies, universities, or others as may be necessary to carry out the purposes of this Act, and he shall conduct research into integrated pest management in coordination with the Secretary of Agriculture. The Administrator shall also take care to insure that such research does not duplicate research being undertaken by any other Federal agency.

Sec. 28. IDENTIFICATION OF PESTS: COOPERATION WITH DEPARTMENT
OF AGRICULTURES PROGRAM.

The Administrator, in coordination with the Secretary of Agriculture, shall identify those pests that must be brought under control. The Administrator shall also coordinate and cooperate with the Secretary of Agriculture's research and implementation programs to develop and improve the safe use and effectiveness of chemical, biological, and alternative methods to combat and control pests that reduce the quality and economical production and distribution of agricultural products to domestic and foreign consumers.

In addition, EPA's responsibilities regarding control of nonpoint sources of water pollution, under Section 208 of the Clean Water Act (PL 95-217), will involve IPM as well as soil, water, pesticides, and nutrient practices for improved water quality. Section 104 of the Act requires EPA to develop scientific data on the effects on health and welfare which may be expected from the presence of various quantities of pesticides in the water.

Under FIFRA, EPA has been mandated a variety of responsibilities for research to determine effects of pesticides on nontarget organisms, including human beings, and to develop criteria for defining the hazards associated with the use of pesticides and finding suitable substitutes for

compounds found to present unwarranted hazards.

3. EPA Support of Pest Control by Activity and Sector

EPA's support of pest control activities for FY 1980 is shown in Table 9.

Research: EPA's research focuses on (1) development of data to support administrative reviews and litigation, (2) obtaining data to permit the evaluation of the safety of "new generation" pest control agents, and (3) developing means of integrated pest management which can economically and acceptably reduce the quantity of pesticides applied.

As noted under 1 , Agency Role, EPA was the principal funder of the first major coordinated national effort to develop comprehensive IPM systems for crop insect and mite pests and currently is funding several projects aimed at developing IPM systems for agriculture as well as the public health, rangeland, and urban sectors. EPA's IPM research program is conducted totally through extramural grants, contracts, or interagency agreements.

Technology Transfer: Transfer of current available IPM technology is a high priority objective of EPA. As part of its responsibilities to the certified applicator training program, it supports extension activities carried out by the State Cooperative Extension Services and various educational activities for the general public. Support activities include applied pilot-scale research leading to the development and demonstration of promising control or monitoring techniques that result in more efficient and environmen-

tally safe use of pesticides, development of educational and training materials for use in the certified applicator training program, development of educational materials for the general public, and demonstration of IPM techniques in urban and recreational sites.

Implementation: Under FIFRA, EPA is mandated with a variety of regulatory and monitoring responsibilities as required to enforce the registration and use of effective, environmentally-sound pesticides. The activities are very broad in scope and entail cooperation with a number of federal agencies, the states, and the private sector.

Assistance: EPA's support of assistance programs is small, consisting only of two primary activities. The agency is supporting the "Texas Pest Management Association," a farmer-administered organization, to develop a "model" program for the "large-scale" state-wide implementation of IPM by farmer-financed associations. EPA is also exploring, in cooperation with USDA, the feasibility of offering farmers participating in approved IPM programs a reduced all-risk crop insurance premium, as an incentive to use IPM.

4. Mechanisms of Interagency Coordination and Cooperation

The EPA cooperates with various cabinet level departments and federal agencies on a variety of programs. Mechanisms for cooperation depend on the activities and the departments and agencies involved. In January 1979, EPA-USDA cooperation was formalized in a Memorandum of Under-

standing, explicitly "to establish policies and administrative devices that will provide for a continuing working relationship between EPA and USDA in support of common objectives, interests, and statutory requirements, and to avoid duplication of efforts in programs conducted by other cooperating agencies, departments, or contractors." The Memorandum identifies and defines the general principles of cooperation, coordination, and communications to be utilized between EPA and USDA; Public Law 95-396 specifies that the Administrator of EPA should take care to insure that research does not duplicate research being undertaken by any other federal agency.

The mandate for EPA and the Science and Education Administration of USDA to coordinate their IPM programs has been clearly and strongly expressed in several IPM reports, pesticide legislation hearings, and through EPA-USDA interagency agreements. During the last year, EPA and SEA have taken significant steps to improve coordination between the two agencies and cooperation with the cooperative state IPM programs. An "EPA-SEA, USDA Integrated Pest Management Coordination Plan" has been developed and will become operational soon. This plan has been reviewed extensively within EPA, SEA, and cooperating States through the Committees on Organization and Policy for Extension, Experiment Stations, and Resident Instruction.

TABLE 9

ENVIRONMENTAL PROTECTION AGENCY

ESTIMATED FISCAL YEAR 1980 SUPPORT OF PEST
CONTROL ACTIVITIES IN VARIOUS MANAGEMENT
SYSTEMS (IN \$ MILLIONS) *

Activity	Agri- culture	Forestry	Range- land	Rights- of-way	Urban environ.	Public health	Multi- site
Research	11.590			0.800	0.100	0.500	
Extension	* <u>1/</u>			* <u>1/</u>	* <u>1/</u>	* <u>1/</u>	
Registration	*	*	*	*	*	*	25.100
Enforcement	*	*	*	*	*	*	17.570
Standard Setting	*	*	*	*	*	*	12.520
Residue Monitoring	*	*	*	*	*	*	<u>2/</u>
Assistance	*	*	*	*	*	*	
TOTAL	11.590			.800	.100		55.190

* Level of funding not known; inseparable from other systems.

1/ Included under research

2/ Scheduled under regulatory activities of registration, enforcement,
and standard setting.

Total resources = \$68,180,000.

GENERAL SERVICES ADMINISTRATION

1. GSA's Role

GSA was established to provide a wide variety of property management and related services for the government. Among its principal areas of responsibility is real property management, which requires the agency to provide space and perform related "housekeeping" functions for other federal agencies. One of these functions is insect and rodent control. GSA provides insect and rodent control in and around federal buildings when the need arises. If an infestation cannot be contained by GSA employees, a professional exterminator is used.

2. Legislative Authority and Administrative Action Affecting IPM

The legislative authority affecting GSA pest control activities is contained in the Federal Insecticide, Fungicide, and Rodenticide Act (USC 135 et. seq.), as amended. The only pesticides to be used in federal buildings by either GSA or contract employees are those which comply with this Act.

3. GSA Support Of Pest Control By Activity And Sector

GSA's support of pest control activities for FY 1980 is shown in Table 10.

All GSA programs in pest control are in the category of implementation. GSA's implementation of pest control involves controlling pests in and around federal buildings when infestations develop. Pesti-

cides are used as required to correct problems with cockroaches, rodents, and other structural pests. Sanitation, sound engineering, and various other nonchemical methods are encouraged when known to be effective and economical. There currently are 148 full-time equivalent employees engaged in the pest control operations.

4. Mechanisms of Interagency Coordination and Cooperation

GSA uses the DOD *Military Entomology Operational Handbook* as guidance in pest control in public buildings. GSA Central Office also disseminates information to its regional offices on pest control, and responds to regional requests for assistance.

TABLE 10

GENERAL SERVICES ADMINISTRATION

ESTIMATED FISCAL YEAR 1980 SUPPORT OF PEST
CONTROL ACTIVITIES IN VARIOUS MANAGEMENT
SYSTEMS (IN \$ MILLIONS)

Activity	Agri- culture	Forestry	Range- land	Rights- of-way	Urban environ.	Public health	Multi- site
Suppression					2.750		
TOTAL					2.750		

Total resources = \$2,750,000.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

1. NASA's Role

The National Aeronautics and Space Administration is an independent civilian agency of the federal government. The National Aeronautics and Space Act of 1958 provided that space activities be directed toward peaceful purposes for the benefit of all mankind.

The principal statutory functions of NASA are to conduct research for the solution of problems of flight within and outside the Earth's atmosphere and develop, construct, test, and operate aeronautical and space vehicles; conduct activities required for the exploration of space with manned and unmanned vehicles; arrange for the most effective utilization of the scientific and engineering resources of the United States with other nations engaged in aeronautical and space activities for peaceful purposes; and to provide for the widest practicable and appropriate dissemination of information concerning NASA's activities and their results.

Planning, coordination, and control of NASA programs are vested in headquarters. Directors of NASA's field centers and other installations are responsible for execution of NASA's programs, largely through contracts with research, development, and manufacturing enterprises. A broad range of research and development activities is conducted in NASA's installations by government-employed scientists, engineers, and technicians to evaluate new concepts and phenomena and to maintain the compe-

tence required to manage contracts with private enterprises.

NASA has six principal program activities managed by individual Associate Administrators through the following headquarters offices:

- (1) Office of Aeronautics and Space Technology;
- (2) Office of Space Transportation Systems;
- (3) Office of Space Transportation Operations;
- (4) Office of Space Science;
- (5) Office of Space Tracking and Data Systems;
- (6) Office of Space and Terrestrial Applications.

The latter office is responsible for research and development efforts leading to programs providing beneficial applications of space systems, and space-related or derived monitoring, earth dynamics monitoring and forecasting, ocean condition monitoring and forecasting, environmental quality monitoring, weather and climate observation and forecasting, communications, and transfer of technology to operational users. This office is responsible for remote sensing applications and has a true interest in remote monitoring applicable to pest infestations and controls.

NASA uses pesticides and other pest management techniques to protect facilities, personnel, and plant life at its various installations.

2. Legislative Authority and Administrative Action Affecting IPM

NASA has no legislative authority or administrative policy relative to IPM-related activities; however, agency installations have been encouraged to utilize integrated management techniques where possible.

3. NASA Support of Pest Control by Activity and Category

NASA's support of pest control activities for FY 1980 is shown in Table 11.

There are approximately 70 on-site people associated with agency pest control efforts. This will equate to around 15 FTE¹ employees. Commercial pest control support is not covered in these figures.

Research: NASA has no ongoing pest control research.

Technology Transfer: Remote sensing, from either aircraft or spacecraft, can provide synoptic information over large areas for use in pest management programs. Although aerial photography (conventional and infra-red), airborne electro-magnetic scanners, and satellite data are all being used extensively, satellite data are particularly cost effective where repetitive measurements are required.

When insect damage is severe, it can be seen readily by airborne or spaceborne sensors. The Landsat satellite has been used to monitor gypsy moth defoliation of oak trees in eastern Pennsylvania. Vegetation is clearly identified by the satellite's infra-red sensors and insect damage and subsequent recovery of large areas (but not iso-

¹ Full-time equivalent employees.

lated stands) can be monitored to guide pest control programs.

Remotely sensed data can also be helpful in delineating vegetative communities which under known ground covered conditions can become vulnerable to specific pests. Similarly, potential pest breeding habitats can be located using a remote sensor generated definition of ground cover combined with data from other sources; for example, in Louisiana, mosquito breeding habitats in the New Orleans area were defined by identifying vegetation peculiar to frequently flooded areas in the surrounding marshland, thus allowing pest control groups to establish priority areas for spraying and to limit spraying to likely areas.

Finally, remote sensing provides a comprehensive, consistent approach to mapping land cover over large areas, e.g., river basins, counties, or entire states providing one of the central pieces of information needed in storm water runoff in known areas and their impact on water bodies. Landsat data have been used in several states in developing information to satisfy EPA 208 information requirements.

In November 1979, the Administration made a commitment to establish an operational earth resources satellite system to be operated by NOAA, insuring continued availability of satellite data once operational status is reached in the mid-1980's.

(In-house training of NASA personnel working as pesticide applicators is discussed below under *Implementation*).

Implementation: Pest control programs exist at all NASA in-

installations where there are 2,429 buildings (32,571,723 square foot floor coverage) on 133,892 acres of agency owned ground. The programs provide control for a fairly full range of target pests.

The objective of the NASA pesticide program is conservation of the health and well-being of personnel and protection of plants and buildings by effectively and efficiently controlling target pests while minimizing any associated hazard to the environment. The program is an ongoing one; however, it is under continual review and may vary from year to year in accordance with the pests to be controlled, label specifications, pesticide effectiveness, registration restrictions, state and federal agency guidance, and other factors.

Pest control is accomplished by non-chemical methods whenever practical. The persistence of some pests, however, and the impracticality or unavailability of natural or alternate means of control dictate chemical usage as well. Pesticide selection is based on advice from pertinent federal and state agencies and information contained in handbooks and other publications, including those from the U.S. Department of Agriculture.

For several years, proposed pest control projects were submitted annually to NASA headquarters for incorporation into a *Report of Pesticides Used at NASA Installations*. The report included information relative to the pest to be controlled, pesticide to be used (together with the form, strength, rate and technique of application), acreage to be treated, sensitive areas, precautionary measures, monitor-

ing, etc. The collated projects were submitted to the Federal Working Group on Pest Management (FWGPM) for review and for any recommendations deemed necessary to achieve effective and economic pest control while preventing or minimizing undesirable effects to human health, to livestock and crops, to fish, and to wildlife, and to other elements of the environment. After the FWGPM program for reviewing agency plans was curtailed, NASA performed its own inhouse review for 1 year. Due to manpower constraints, continuing the periodic reviews was not possible; however, plans have been made to reinstitute this endeavor.

Pest control operations are performed by civil service employees, on-site contractors, and commercial applicators. On-site pesticide handlers are covered under the agency's occupational physical examination program. Pest control program activities at field installations are reviewed and evaluated by headquarters' personnel during biennial visits.

Applicators of pesticides in the Environmental Protection Agency's restricted use category have been certified by states in which they work; however, inhouse supplemental training has been made available to all personnel associated with pest control activities. Self-instructional training manuals developed by the USDA have been distributed to each field installation. Through an agreement with EPA, a comprehensive training plan geared to various pest control associated disciplines has been developed, course materials have been obtained, and NASA plans to have a pest management consultant provide training for personnel at each installation. Pest management presentations have been given at annual Occupational Medicine and Environmental Meetings so that these personnel

can become better informed of hazards associated with pesticide usage and necessary control measures.

4. Mechanisms of Interagency Coordination and Cooperation

As previously mentioned, NASA cooperated with the FWGPM review panel and had an agreement with EPA to develop a training course. At some installations, pest control support is provided to other agencies which are tenants on NASA property.

TABLE 11

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

ESTIMATED FISCAL YEAR 1980 SUPPORT OF PEST
CONTROL ACTIVITIES IN VARIOUS MANAGEMENT
SYSTEMS (IN \$ MILLIONS) *

Activity	Agri- culture	Forestry	Range- land	Rights- of-way	Urban environ.	Public health	Multi- site
Higher Education					0.010	*	
Suppression					.511	*	
Biological Monitoring	*	*	*			*	<u>1</u> /
TOTAL	*	*	*		0.521	*	

* Level of funding not known; inseparable from other systems.
1/ Landsat satellite monitoring of pest infestation not quantifiable.

Total resources = \$521,000.

NATIONAL SCIENCE FOUNDATION

1. NSF's Role

The National Science Foundation is an independent agency within the executive branch. It supports basic research in all disciplines of science. It reviews and funds, through grants and contracts, unsolicited scientific research proposals, chiefly from U.S. colleges and universities. NSF maintains close ties with other federal agencies engaging in similar research. NSF also supports educational programs at U.S. colleges and universities.

NSF's involvement in pest management has included research and education. It was the lead agency (sharing the funding equally with Environmental Protection Agency) after the first year of the EPA-NSF-USDA comprehensive support for the IPM research project, *The Principles, Strategies, and Tactics of Pest Population Regulation and Control in Major Crop Ecosystems*. The research was conducted chiefly by scientists associated with 23 universities. Conducted from 1972 to 1978, this was the first major national coordinated effort to develop comprehensive IPM systems for crop insect and mite pests. NSF played a key role in this project by stimulating the use of mathematical modeling and systems analysis through which critical ecosystem relationships and interactions were discovered, data voids identified, and research priorities established.

2. Legislative Authority and Administrative Action Affecting IPM

The National Science Foundation Act of 1950, as amended, designates the Foundation as an agency of the federal government to support basic and applied research primarily to academic and nonprofit institutions.

3. NSF Support of Pest Control by Activity and Sector

NSF's support of pest control activities for FY 1980 is shown in Table 12.

Research: NSF supports basic research that contributes to the conceptual framework of IPM and its application. The following NSF program activities are related to IPM: molecular biology and physiology (e.g., mechanisms of insect hormones and pesticides); genetics, biochemistry, and developmental biology (e.g., resistant crop varieties); behavioral science (e.g., host selection by pests); systematic biology (e.g., identification of pests and evolutionary trends); ecology and ecosystems studies (e.g., basic interrelationships between host and pests, analysis of crop-pest-environment); population dynamics; neurobiology and sensory physiology; applied mathematics (modeling); climatology (e.g., weather patterns); and applied science. As noted, NSF was the lead agency of the comprehensive EPA-NSF-USDA supported project in IPM, completed in 1978. The Foundation continues to cooperate with other federal agencies and universities in advancing IPM research.

Technology Transfer: NSF has sponsored several undergraduate pest management training programs as part of its mission to assist in preparing scientists to work on important national problems. The Foundation sponsored an undergraduate program in IPM at three land grant universities (Michigan State University, Cornell University, and Kansas State University), one state university (California State University at

Fresno, and an 1890 college (Tennessee State University at Nashville). The objective was to develop a model interdisciplinary curriculum for B.S. training programs in integrated pest management for adoption by other universities and colleges.

In the area of technology transfer, NSF also supports various conferences and symposia related to pest management. A decade ago, NSF together with the Rockefeller Foundation and USDA supported a conference on "Concepts of Pest Management," the proceedings of which were published the same year. In 1979, together with EPA and USDA, the Foundation also provided funds for a conference on movement of highly mobile insects, held in Raleigh, N.C.; the results have been published in a conference proceedings. A series of books entitled *New Technology of Pest Control* edited by C.B. Huffaker (Director of the EPA-NSF-USDA national IPM projects noted above) is being published by John Wiley and Sons, New York; the books are largely based on the results of the EPA-NSF-USDA supported IPM project.

Implementation: NSF has no programs in implementation.

Assistance: NSF has no programs in assistance.

4. Mechanisms of Interagency Coordination and Cooperation

NSF cooperates with other federal agencies in promoting research and publications derived therefrom. As noted, NSF, EPA, and USDA recently have jointly supported a major IPM research project and a con-

ference on movement of insects. The Foundation will continue to cooperate with other federal agencies to further research on IPM and to disseminate information on concepts and technology on the subject.

TABLE 12

NATIONAL SCIENCE FOUNDATION

ESTIMATED FISCAL YEAR 1980 SUPPORT OF PEST
CONTROL ACTIVITIES IN VARIOUS MANAGEMENT
SYSTEMS (IN \$ MILLIONS) *

Activity	Agri- culture	Forestry	Range- land	Rights- of-way	Urban environ.	Public health	Multi- site
Research	*	*	*	*	*	*	5.300
TOTAL	*	*	*	*	*	*	5.300

* Level of funding not known; inseparable from other systems.
Total resources = \$5,300,000.

TENNESSEE VALLEY AUTHORITY

1. TVA's Role

The Tennessee Valley Authority is a corporate agency of the federal government. It was established by the Tennessee Valley Authority Act of 1933 (48 Stat. 58-59, 16 U.S.C. sec. 831) "to improve the navigability and to provide for the flood control of the Tennessee River; to provide for reforestation and proper use of marginal lands in the Tennessee Valley; to provide for the agricultural and industrial development of said Valley; to provide for national defense by the creation of a corporation for the operation of government properties at and near Muscle Shoals in the State of Alabama; and for other purposes." TVA is governed by a three-member Board of Directors, a General Manager, operational offices, divisions, and branches much the same as commercial corporations. The Tennessee River watershed encompasses 40,910 square miles in seven states; the area includes part of 125 counties with a 1970 population of 3,994,426. A system of 9 mainstream reservoirs and 20 tributary reservoirs impound a total of 638,352 surface acres of water at full pool and create a navigable waterway from the Ohio River near Paducah, Kentucky, to Knoxville, Tennessee, a distance of about 635 miles. The total impounded area has a shoreline of 11,400 miles.

TVA has conducted mosquito control operations in the Tennessee Valley since 1934 when the TVA Board established the Board of Malaria Consultants. Malaria was an important disease in the Valley then and, through the activities of this board, a comprehensive integrated mosquito

control program was outlined and followed as the reservoir system was developed. Other pest control activities evolved as TVA developed its system of electric power plants and power distribution system throughout the Tennessee Valley. Presently the major pest control activities encompass right-of-way clearance and maintenance, control of mosquitoes and other arthropod vectors of disease, pest control on reservations, and aquatic plant management. TVA manages these properties affected by impoundments, reservation properties, and rights-of-way to assure a pest-free environment and to avoid interruption of power throughout its vast distribution system. All available pest control measures are used in an integrated pest management system to accomplish these objectives.

2. Legislative Authority and Administrative Action Affecting IPM

In the opinion of TVA's General Counsel, Section 4(g) of the Tennessee Valley Authority Act of 1933, as amended (16 U.S.C. §831 c(g) (1976)), authorizes the pest control activities conducted by TVA and described in Section 3 below. This section gives TVA such powers as may be necessary and appropriate for the exercise of the powers specifically conferred in it by the Act, such as its specific power to build dams and reservoirs and develop a power system.

TVA has historically supported, both philosophically and operationally, the concept of IPM. The TVA Code outlines in detail the manner in which pest control activities are conducted throughout TVA while operational controls are exercised through a program definition document prepared annually for each program. Operational elements are encouraged

to utilize IPM principles wherever applicable. Pesticides, when used, are those considered most suitable for the intended purpose considering the total environmental effect in the area of use. Selectivity and proper timing of application are prime considerations in all pesticide use.

3. TVA Support of Pest Control by Activity and Sector

TVA's support of pest control activities for FY 1980 is shown in Table 13. An estimated 166 full-time equivalent work years are being expended on the pest control activities.

Research: TVA research on pest control is largely in the area of field operations and technique development. Current activities concern the control of mosquitoes, nuisance aquatic weeds, ticks, and the management of undesirable vegetation on rights-of-way. TVA conducts occasional evaluations of new chemicals when they appear to be promising additions to the TVA pest control program; however, most investigative studies are conducted with registered compounds. Current studies concern optimum timing of pesticide applications and new techniques of application including the use of insect growth regulating chemicals. Competition among aquatic plant species is under investigation as is the effect of parasites and predators on a variety of plant and animal pests. Most research, however, is related to the optimum timing of physical and chemical control measures as they relate to field operations. TVA conducts most research inhouse but also supports universities engaged in research of interest to the TVA program. The agency also participates as a liaison member of the Armed Forces Pest Management Board.

Technology Transfer: Pest control training is conducted on a continuing basis among TVA personnel engaged in control of plant and animal pests. Annual training courses are conducted at the Muscle Shoals, Alabama, facility and at selected sites throughout the Tennessee Valley for personnel engaged in pest control activities. Such training involves recognition of pests, principles of pest control, pesticides, safety, application equipment, operation and calibration, integrated pest management, and laws and regulations. TVA pesticide applicators are certified by the various Valley States in which they work and are recertified tri-annually through attendance at refresher training courses conducted by each state. Additional training is accomplished through extension courses, attendance at the Center for Disease Control (Atlanta), training courses, and professional meetings.

TVA conducts training for non-TVA personnel engaged in pest control through an assistance program to Valley communities upon request. Assistance in initiating vector control programs and aquatic plant management programs in municipalities is viewed as an important adjunct to pest control activities on TVA properties.

Implementation: Mosquito control was the first pest control activity initiated by TVA. Early reservoir construction plans incorporated a variety of physical measures designed to create an environment inhospitable to mosquitoes. Such measures now include the clearing of reservoir margins, cut and fill operations, drainage ditches and diking, and other environmental manipulations.

Aquatic plant management is conducted to ensure a navigable waterway, improve recreational use of the system of reservoirs, and diminish the mosquito breeding habitat.

Rights-of-way are generally shear cut when constructed, and stumps are treated chemically by hand to prevent resprouting. TVA maintains 15,290 miles of rights-of-way throughout its system. Of that total 9,938 miles are wooded and/or require periodic vegetation management; a total of 120,000 acres are so affected.

TVA reservations are permanently retained areas surrounding major installations. Facilities to receive and safeguard visitors are provided as needed where physical conditions permit. Visitor accommodations may include public access roads, parking, boat landing, shelters, outdoor lighting, drinking water, sanitary facilities, reception space, guide and information service, and picnic facilities. Landscape treatment is given to areas of intensive public use, approximately one-fourth of the total 31,601 acres. Reservation properties require intensive care of turf, trees, and ornamental shrubs. Pest control activities are integrated where possible.

A major portion of TVA pest control activities is devoted to pest surveillance activities throughout the Tennessee Valley. Arthropods of medical importance (primarily mosquitoes and ticks) are monitored routinely to determine pest species, location, and stage of development to assure timely control measures. Approximately 500 soil samples are analyzed annually for floodwater mosquito eggs to determine potential trouble spots and define areas which require control measures. Over 200 sampling stations are visited weekly during the mosquito breeding season

to determine the adult mosquito population density and location of areas on the nine mainstream reservoirs which may require some type of treatment. Larval mosquitoes are also surveyed weekly to determine species present, stage of development, and to better time control measures. Tick surveys are conducted routinely at Land Between the Lakes, a huge (16,000-acre) outdoor recreation and environmental education center located between Kentucky Reservoir and Barkley Reservoir in Kentucky. Mosquito surveys are conducted annually on most tributary reservoirs or more frequently if problems arise.

Aquatic weeds in TVA reservoirs are surveyed periodically depending upon the degree of infestation and species present. Aerial photography is used extensively to delineate infestations while surface surveys are conducted to determine ground truth data. Rights-of-way are checked by aerial and ground surveys to determine potential problem areas and to schedule control measures.

Assistance: TVA assists Valley communities in training of municipa; pest control personnel and gives assistance to communities bordering TVA lands in controlling arthropod vectors of disease under emergency conditions.

4. Mechanisms of Interagency Coordination and Cooperation

TVA participates on the Armed Forces Pest Management Board as a liaison member as a means of interagency coordination and cooperation. Cooperative studies have been conducted in the past with such agencies as the Center for Disease Control and the Departments of Defense and Ag-

riculture. A cooperative agreement with the Environmental Protection Agency is being formulated presently. Membership on interagency committees, i.e., the Federal Working Group on Pest Management (now defunct), the Federal Aquatic Plant Management Working Group, the Work Group on Aquatic Weed Control Technology, the Water Resources Council, and other federal and state agencies have proven to be valuable sources of information exchange and have assisted in constantly upgrading TVA's pest control program.

TABLE 13

TENNESSEE VALLEY AUTHORITY

ESTIMATED FISCAL YEAR 1980 SUPPORT OF PEST
CONTROL ACTIVITIES IN VARIOUS MANAGEMENT
SYSTEMS (IN \$ MILLIONS) *

Activity	Agri- culture	Forestry	Range- land	Rights- of-way	Urban environ.	Public health	Multi- site
Research				* <u>1</u> /	* <u>1</u> /		
Suppression				1.902	0.250	0.050	
TOTAL				1.902	.250	.050	

* Level of funding not known; inseparable from other systems.

1/ Some research carried out in conjunction with suppression programs.

Total resources = \$2,202,000.

UNITED STATES POSTAL SERVICE

1. USPS' Role

The USPS is an independent agency within the executive branch responsible for mail delivery. It is directed by the Postmaster General who is appointed by, and sits on, the Board of Governors appointed by the President.

The Postal Service uses pesticides and other pest management techniques to protect employees and customers in some 32,000 postal facilities in the 50 states and U.S. possessions.

2. Legislative Authority and Administrative Action Affecting IPM

There is no legislative authority granted to USPS which directly affects IPM.

Pest control programs in postal facilities are conducted by trained but unlicensed pest controllers. Withholding of licensing was an administrative decision made to insure that restricted pesticides could not be used on Postal premises. Instructions require specific pesticides for target pests.

3. USPS' Support of Pest Control by Activity and Sector

Almost all of USPS' support of pest control for FY 1980, shown in Table 14, involves activities to control pests on Postal Service buildings and grounds. In FY 1980, an estimated 100 full-time equivalent employees engaged in the pest control activities.

Research: USPS has no research mission in pest management but it relies on reports from EPA and Department of Agriculture for information on the subject.

Technology Transfer: Pest control training is conducted locally, at approximately 100 major postal facilities, by USPS personnel who have received professional (contracted) training. A standard, prescribed instructor's and student's text is used. Trainees are then observed closely on-the-job for their assimilation of course material.

Implementation: USPS cooperates with other agencies as requested in control programs of pest/host material being presented for shipment through the mail.

Assistance: USPS is not involved in assistance programs.

4. Mechanisms of Interagency Coordination and Cooperation

Informal liaison is maintained with EPA at the Headquarters level and with Agriculture at the local level to assure compliance with environmental laws and regulations.

TABLE 14

UNITED STATES POSTAL SERVICE

ESTIMATED FISCAL YEAR 1980 SUPPORT OF PEST
CONTROL ACTIVITIES IN VARIOUS MANAGEMENT
SYSTEMS (IN \$ MILLIONS)

Activity	Agri- culture	Forestry	Range- land	Rights- of-way	Urban environ.	Public health	Multi- site
Extension					0.040		
Demonstration					.020		
Suppression					1.900		
Quarantine					.020		
TOTAL					1.980		

Total resources = \$1,980,000.

VETERANS ADMINISTRATION

1. VA's Role

VA is an independent federal agency. It administers laws covering a wide range of benefits for former members and dependents and beneficiaries of deceased former members of the U.S. armed forces. The VA also provides benefits to members of the armed forces and to dependent children of seriously disabled veterans. Of the three major departments which (along with six staff offices) make up the Veterans Administration, two--the Department of Memorial Affairs (DMA) and Department of Medicine and Surgery (DM&S)--are involved in pest control activities.

DMA is responsible for the operation of the National Cemetery System which consists of 109 national cemeteries, 22 soldiers lots, and 7 confederate plots throughout the country.

DMA's pest management programs focus on the pest problems affecting Affairs' facilities which cover more than 9,400 acres; 2,925 acres have been developed into burial areas, at a present value of approximately \$370 million (including buildings and other facilities). Pest management in national cemeteries serves the primary function of protecting facilities and, to a lesser extent, visitors and support personnel. Facility pest control programs stress cleanliness and application of pesticides as needed. DMA's control programs are designed to respond to site specific conditions at each of the cemeteries in a nationwide system.

DM&S forms the major portion of the employee work force and

facilities within the VA. There are 163 separate medical facility managements; all are plagued with pest problems from time to time. Building Management Service at each facility is responsible for managing the pests, and it provides advisory service to outpatient clinics. Each Chief must evaluate the facility's requirements and determine whether those requirements can best be met through a staff pest management person or through a pest management contract. Requirements vary tremendously from facility to facility. Some facilities are high rise buildings in metropolitan areas; others are in rural settings, encompassing many acres, and include such facilities as golf courses, playing fields, ponds, patient gardens, and greenhouses. Many are adjacent to National Cemeteries. DM&S's pest control programs are designed to respond to these varying conditions and are site specific. Their objective is to provide pleasing and environmentally safe facilities for the nation's veterans.

2. Legislative Authority and Administrative Action Affecting IPM

VA has no administrative authority related specifically to IPM. It is the Administration's policy to support the concepts of IPM and Executive Order 11643, which banned the use of specific toxicants on federal lands. Policy is directed by and implementation is monitored by the VA Central Office (137F). DM&S Supplement G43 to MP-3 entitled *Grounds Maintenance Program Guide* provides guidelines for recognizing and controlling pests on cemetery grounds. If a decision to utilize a pesticide is made, cost effectiveness, suitable ecological and/or physiological selectivity against the particular target pest, and documented pesticide con-

trol are required, and IPM is utilized to the maximum extent possible. The pest management plans and operational programs are reviewed by technical support staffs.

3. VA Support of Pest Control by Activity and Sector

VA's support of pest control activities for FY 1980 is shown in Table 15.

Research: DMA research on pest control is carried out at cemeteries in cooperation with local extension services and universities. In addition, funds are available for contract research for investigation of widespread problems. Approximately 90 percent of the research activity in pest control is carried out in the field by VA cemetery personnel in cooperation with extension agents. Basic and applied research is aimed at determining the best combination of pesticides and natural controls for a variety of ground pests. The Technical Support Division of Cemetery Service monitors research activities at cemeteries in order to minimize duplication.

DM&S has no research program in pest management but cooperates with various agencies doing research. The Environmental Care Division (137F) of Building Management Service collaborates with the Armed Forces Pest Management Board, as the agency liaison representative, in identifying research needs.

Technology Transfer: Training is an important aspect of VA's involvement in pest management.

For DMA personnel, training is conducted in the area or state where the cemetery is located. Recertification training is conducted as required by state regulations and requirements. Training manuals are available to personnel in the program through various states for use in preparation for training and certification testing.

DMA requires continuing education and certification at the professional level which exceed the minimal training requirements for pesticide application specified in the Federal Insecticide, Fungicide, and Rodenticide Act, as amended; certification training is also required at the technical level. Certification training and testing are accomplished through the responsible state agency where the cemetery exists. DMA has approximately 51 certified individuals trained at the technical level and approximately 20 noncertified technicians. Professional guidance through Technical Support of Cemetery Service consists of approximately four professionals in the fields of entomology, agronomy, natural resources, forestry, and land management and provides the nucleus for the interdisciplinary IPM systems approach through Cemetery Service, Technical Support. In addition, all facilities have subscriptions to professional publications which contain updated pest management information.

DM&S management personnel and pest controllers, hired into the Building Management Service program, attend an introductory course "Pest Management in Health Care Facilities," conducted by a major university. The course provides the technical foundation necessary to properly manage this program function. Certification training and testing are administered by the responsible state agency nearest the VA facility.

Recertification training is also administered by the state agency. Correspondence courses in basic pest control technology (including IPM) are available from the Academy of Health Sciences, U.S. Army. All DM&S personnel involved in pest control activities are encouraged to take the courses. DM&S has approximately 125 certified applicators and 325 management personnel who have attained various levels of certification. All management personnel have completed the "Pest Management in Health Care Facilities" course. Certifications are required in Categories 3, 7, and 8 of the Federal Insecticide, Fungicide, and Rodenticide Act. Additionally, DM&S maintains an agency membership in the National Pest Control Association from which information about commercial pest control is received.

Implementation: DMA's pest management programs cover about 2,925 acres of developed land and 6,450 acres of undeveloped land valued at about \$370 million. A major portion of the DMA program is devoted to pest suppression activities at the facility level. Elimination of rubbish and trash and general cleanliness coupled with controlled use of pesticides form the management strategy for rodent problems in some areas. Turf insects and disease control, tree and plant material insect control, weed control, algal control, and building pest control programs are typical throughout the country. The DMA programs conform strictly to federal and local regulations. Only certified use of specific products is allowed and contractors may be defaulted for improper use. If cemetery staff are not certified for application of pesticides, then a licensed applicator

must be retained. Federal and local quarantines on plant material is observed in all plantings in national cemeteries. Eradication of pests is closely coordinated and controlled when needed through the careful selection of products and knowledge of biological cycles. The monitoring of pesticide use and accountability are the basis of the pest control reporting system established in Cemetery Service letters. Each cemetery prepares and submits a pest control report for review by pest management professionals in Cemetery Service. The reports are used to identify trends, pesticide use or misuse patterns, and progress of IPM implementation. Annual or bi-annual inspections by trained professionals are a check against poor reporting. The health of each applicator is monitored through periodic physical examinations. Also, records are maintained at all levels on weather, losses due to pests, and types of pesticides being used. Pesticide registration activities are negligible.

DM&S's pest management program covers 178 sites consisting of approximately 17,229 acres of land, 5,000 buildings constituting over 115,000,000 square feet and valued in the billions of dollars; and approximately 170,000 employees, their equipment and subsistence items. An adaptation of Defense's Pest Management reporting system is underway to provide an effective and documented monitoring system. Management Information is currently available from the Automated Management Information System (AMIS) on operational aspects, costs, etc.

Assistance: DMA is not involved in assistance programs, except under emergency situations, for example, as required to curb mosquito outbreaks in areas of military operations.

DM&S is not involved in assistance programs.

4. Mechanisms of Interagency Coordination and Cooperation

Within VA, an Environmental Staff Council consisting of members of the VA Departments and Office of Construction and chaired by the Director of Environmental Affairs (whose office exists at the Assistant Administrator's level) is responsible for coordinating all VA activities related to the environment, including pest control.

The DM&S has the agency liaison representative to the Armed Forces Pest Management Board and shares information with them. Other agencies such as the Army Environmental Hygiene Agency, the Military Entomology Information Center, etc., provide information to the VA upon request.

TABLE 15

VETERANS ADMINISTRATION

ESTIMATED FISCAL YEAR 1980 SUPPORT OF PEST
CONTROL ACTIVITIES IN VARIOUS MANAGEMENT
SYSTEMS (IN \$ MILLIONS)

Activity	Agri- culture	Forestry	Range- land	Rights- of-way	Urban environ.	Public health	Multi- site
Higher Education					0.030		
Suppression		0.008	0.002		2.154		
TOTAL		.008	.002		2.184		

Total resources = \$2,194,000.

MINOR AGENCIES

In addition to the primary agencies above, other federal agencies are involved in various pest control activities. For some, involvement is restricted to the control of pests on lands, facilities, or structures that they own, manage, or lease. Others have minor programs in research, technology transfer, regulation, or assistance that are related to pest control. Though their role is presently small, the following agencies have a potentially important role in advancing IPM.

DEPARTMENT OF LABOR

DOL is a cabinet level department within the executive branch. It administers and enforces statutes benefiting wage earners, improving their working conditions, and providing opportunities for employment.

Presently, DOL's role in pest control related activities is restricted to the implementation of the Occupational Safety and Health Act (OSHA). The DOL, under OSHA, has authority to issue and enforce occupational safety standards for pesticide use in the work environment in areas where other agencies have not prescribed such standards. The DOL and Environmental Protection Agency cooperate to avoid problems of conflict in establishing the standards.

As more IPM systems and delivery systems are developed for the various sectors, the IPM labor force will likely increase, perhaps significantly so. Therefore, DOL does have a potentially important role in

carrying out programs that may eventually impinge on the IPM workers.

DEPARTMENT OF STATE

State is a cabinet-level department within the executive branch, charged with developing and maintaining the foreign policy of the United States. It is primarily concerned with the execution of foreign policy to promote long-range U.S. security and well-being through continuous consultations with other nations. State also negotiates treaties and agreements with foreign nations and speaks for the United States in the United Nations and other international organizations and conferences.

Until September 1, 1979, State played a major role in IPM and related activities through its involvement with Agency for International Development programs, discussed above. However, AID is now administered under the United States International Development Cooperation Agency. Therefore, State's role in IPM and other pest control activities has diminished but it still is potentially significant, especially in fostering international discussions and forums that address pesticide regulations and pest management policies at the international level.

In June 1979, State's National Committee for Man and the Biosphere (NCMB) sponsored an international conference to develop U.S. policy options for reducing the input of pesticides on the global environment. NCMB is State's primary component with responsibilities in sponsorship of conferences, symposia, and other functions that relate to pesticides and pest management.

PEACE CORPS

Peace Corps is a branch of ACTION, an independent government agency. The purpose of the Peace Corps is to promote world peace and friendship by sending skilled U.S. volunteers to countries overseas to provide technical resources and to promote a better understanding between peoples. Peace Corps volunteers may receive some training in pest control, including principles of IPM. However, most all of the volunteers' involvement in foreign pest management programs is under AID programs. In numerous LDC's where AID has USAID missions, the volunteers cooperate on various AID programs, and some of these are related to pest management.

One of the most useful publications on prevention and management of pests of grain in storage in the LDC's was published by C. Lindblad and L. Druben in the United States Action/Peace Corps Program and Training Journal Manual Series (1976, *Small Farm Grain Storage*, Manual Series No. 2, VITA Publ., Manual Series No. 35 E). Through the publication of such "how-to" manuals, technical assistance, and teaching programs, the Peace Corps plays a potentially significant role in advancing IPM in the LDC's.

SMALL BUSINESS ADMINISTRATION

The Small Business Administration (SBA) is an independent agency providing financial training and management and technical assistance and procurement assistance to small business. SBA has no specific legislative or regulatory authority in the pest management field. What

SBA is uniquely capable of contributing, however, is targeted support of small firms engaged in any of the several dimensions of private IPM. SBA has recently notified its regional and field offices to become aware of the needs of firms in IPM related industries and to actively offer support and resources.

MISCELLANEOUS AGENCIES

The Appalachian Regional Commission (ARC) is a federal-state agency made up of the governors of the 13 Appalachian states and the federal co-chair person, an appointee of the President. The agency utilizes federal appropriations to implement economic development plans of each of the 13 states and a coordinated regional approach to common economic development issues and problems. Traditionally, ARC has concentrated on creating employment, maximizing the benefit to the region from the extraction of coal, and the development of certain quality-of-life elements such as availability of adequate health and child development services. ARC presently is not involved in any activities related to pest control. But because of its regional responsibilities to economic development, the agency may eventually play a significant role by advancing economically sound IPM programs in the Appalachian states.

The Department of Energy, with one of its mandated responsibilities being to locate and develop energy efficient technologies, also plays a potentially significant role in advancing IPM techniques that are environmentally sound and energy efficient.

Other agencies of the federal government are being requested

to examine their current programs and mandated responsibilities and to determine if they can contribute in advancing efficient IPM systems in the relevant sectors.