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Title

A comprehensive rodent control for Washington, D.C.

Permalink

<https://escholarship.org/uc/item/66b5c5fc>

Journal

Proceedings of the Vertebrate Pest Conference, 19(19)

ISSN

0507-6773

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Publication Date

2000

DOI

10.5070/V419110123

A COMPREHENSIVE RODENT CONTROL PROGRAM FOR WASHINGTON, D.C.

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ABSTRACT: An effective rodent control program includes a team approach with centralized management and accountability. Environmental factors, the behavior of people, and the capability of organizations (government, businesses, and communities) must be evaluated when a rodent control program is designed. There must be excellent resources for community outreach, regulatory enforcement, and data management. Personnel must have technical skills and the ability to work with people. The program team should include several municipal organizations, each with defined responsibilities and communication structure. The pest control, landscaping, restaurant, and solid waste industries must be integrated into the program. Sustainability, cost-containment, and success ultimately are predicated on diverse community involvement.

KEY WORDS: rodent control, urban planning, IPM, Washington, D.C., Norway rat

Proc. 19th Vertebr. Pest Conf. (T.P. Salmon & A.C. Crabb, Eds.) Published at Univ. of Calif., Davis. 2000.

INTRODUCTION

Urban and suburban rodent problems are increasing nationwide concurrent with greater congestion, aging infrastructure, urban sprawl, and sanitation problems resulting from population density and increasing numbers of restaurants and other food-related industries. At the same time, most cities in the United States have limited technical support and resources for rodent control, as well as little capability for sustaining a proactive (preventive) program (Colvin and Jackson 1999).

Historically in the United States, municipal rodent control has been directed primarily at baiting programs and some degree of environmental management. Often the work has been politically motivated (reactionary) with short-term availability of resources, and thus short-term community benefits. Ideally, a rodent control program would be designed and implemented comprehensively and with a goal of long-term sustainability. However, there rarely has been political commitment to such a goal and thus many municipalities continue to struggle with the issue.

The government of the District of Columbia (i.e., Washington, D.C.) in 1999 made a commitment to develop a comprehensive and sustainable rodent control program. That topic was recognized by the newly-elected mayor as a quality-of-life issue and an indicator of the environmental integrity and public health of the District. It also was considered an important economic topic related to tourism, business, infrastructure, and property values.

The purpose of this paper is to describe the process and key elements for evaluating and designing a large-scale urban rodent control program, using examples from the District of Columbia. The kinds of methods and actions described should provide a model for other municipalities.

PROGRAM STATUS

In the 1960s to 1970s, the District had a relatively comprehensive program for control of Norway rats (*Rattus norvegicus*), with as much as \$1.4 million from federal and District budgets in 1968 alone. As many as 100 personnel were involved and the program was called the "War on Rats." Standard methods for urban surveys

and public education were used. However, federal funding for urban rodent control declined and ended nationwide in the early 1980s, and progressively thereafter the District program (like that in other cities) reverted to a reactionary and limited effort.

In 1983, District agencies were reorganized and the rodent control program was shifted from the Department of Health to the Department of Public Works (DPW). At the same time, elements of rodent control also were established in the Department of Consumer and Regulatory Affairs (DCRA) which had responsibilities for numerous codes and issues on residential and commercial properties but with no specialized skills in rodent control. Within DPW, the program was defined as "Vector Control" and the task of poison baiting was organizationally separated from enforcement and education. The overall trend during the past 20 years was reduction and divergence away from a defined and centralized program. Multiple individuals and groups became necessary to deliver services because of the splintered organizational structure.

By the mid-1990s, the District program had become complaint-driven, inefficient, and piece-meal. Standardized surveys and outreach by Vector Control had been replaced by largely poisoning activities alone. The Education and Enforcement Division in DPW had no education specialists or effective means for enforcement (adjudication of sanitation tickets was occurring in the Department of Motor Vehicles), and less than 20% of the fines were being paid. DPW staff included 15 in Vector Control and 27 in the Education and Enforcement Division. DPW personnel were assigned to public space only, while problems immediately adjacent on private properties had to be referred to DCRA. In 1999, there were 28 DCRA field inspectors; about 10 to 15% of the public complaints that they received related to rats and trash.

Follow-up on inter-agency referrals was limited, and public frustration appeared great concerning agency contact and accountability. Lack of regulatory enforcement, overflowing restaurant refuse, rat-infested landscaping, and conditions in alleys were common problems described by citizens. Daily interaction and

cooperation among the departments involved in rodent control (directly or indirectly) was minimal, undefined, and largely informal. Average response time to public complaints was five days, and there were 3,500 public requests for assistance from Vector Control in the first six months of 1999.

DCRA and DPW were maintaining informal coordination on cleanup of abandoned properties and lots. DCRA estimated that 2,000 abandoned properties needed resolution. DPW also had the Street Construction Branch, responsible for sidewalk repairs, but no contracts to repair sidewalks had been awarded in six years. The Street and Alley Cleaning Division also existed within DPW and had ongoing modest efforts. The Water and Sewer Authority (WASA) had no ongoing rodent control program, catch-basin cleaning at 18-month intervals, and only about 500 feet of sewer reconstruction in the past year.

A new approach to rodent control was warranted based on the existing situation. The intent was to design a coordinated and centralized program for the District that maximized the strengths of various departments, minimized redundancies, and ensured an efficient team approach. The focus would be organizational management and environmental improvements.

PROGRAM DESIGN

Design and assessment of urban rodent control programs typically is centered inappropriately on poison baiting, whereas it actually should be centered first on organization and administration. This means involvement of numerous departments such as Parks and Recreation, Planning and Zoning, Water and Sewer, Housing, and agencies involved with sanitation, construction, infrastructure maintenance, and food establishment licensing and inspection. Ultimate success is predicated on leadership, cooperation, and management. Although several organizations need to participate, there must be a centralized and accountable program core. Accountability must be assured for all program participants, from field staff through department heads, and include job descriptions and written procedures.

A program must have a qualified manager and at times there will need to be specialized or inter-departmental teams. Matrix management of personnel should be used; meaning the program manager has direct authority over all personnel during team events, regardless of home departments. This gives the program manager more ability to control project outcome and be held responsible for project completion.

The organization (extended team) must have a composite of qualified and trained personnel with diverse skills. This includes control methods but also skills in public outreach, urban and landscape design, contract management, scheduling, media relations, computer-based mapping, data management, and law enforcement. The program strategy must recognize economic limitations of government budgets. Early planning and scheduling provide the best opportunity to limit long-term program costs. Start-up costs may initially be high, but they should decline in latter years as the program reaches maintenance status (rather than remaining in a cyclical pattern of ineffective problem solving).

Designing the District program began with a "Rat Summit" hosted by the mayor to bring forward diverse ideas and to establish public support for change. The next steps included: 1) interviews with department heads, middle managers, and field personnel to gather opinions and assess current operations; 2) review of organizational charts and existing work scopes performed by numerous departments; 3) evaluation of communication procedures, personnel management, and inter-departmental relationships; 4) interviews with community and industry representatives (pest control, waste management, restaurants, federal agencies); 5) review of regulations and enforcement procedures with legal personnel; 6) assessment of equipment and technical resources; and 7) field investigations.

ORGANIZATION AND ROLES

A fresh beginning was recommended for the District with new organizations, new inter-departmental relationships, and additional skilled personnel. This included matrix management for inter-departmental teams, long-term work plans, schedules, and the capability to track events.

The recommended organization pulled together the various splintered elements necessary for a sustainable program. The program core would be established in the Environmental Health Administration (EHA) of the Department of Health (Figure 1), where it could function consistent with the mission of a health/regulatory agency. That organizational change also would place rodent control in the same agency as the Food Protection Division, responsible for restaurant inspections, and thus better assure inter-agency teamwork. Importantly, the Department of Health also had in-house adjudicatory and legal services and support related to computer-based operations, public health education, and epidemiology.

RODENT CONTROL PROGRAM

Figure 1. A centralized organization for a municipal rodent control program with diverse involvement.

An additional reason for the organizational shift from DPW to EHA was to place the new program in context of "prevention," as public health issues are managed (rather than "reaction" as many public works activities are implemented). By placement in the Department of Health, the geographic boundaries for the program could be broadened readily beyond public space where DPW responsibilities characteristically are focused.

Within EHA, a Bureau of Community Hygiene would be established with three inter-related Divisions comprising the Program: Rodent Control, Code Enforcement, and Education and Community Outreach (Figure 2). The term "Vector Control" would no longer be used because it does not effectively orient the public to the appropriate agency for rodent problems. Personnel qualifications would include computer skills, biological or community outreach training, and communication skills (including bilingual abilities). Personnel numbers would be: Bureau of Community Hygiene (3)—manager, administrative assistant, and information technology specialist; Rodent Control Division (27)—supervisor, 24 inspectors, and two administrative assistants; Code Enforcement Division (27)—supervisor, 24 officers, and two administrative assistants; and Education and Community Outreach (6)—supervisor, four specialists, and one administrative assistant.

Figure 2. Recommended organization for the Rodent Control Program within the Environmental Health Administration, Department of Health, Washington, D.C.

Rodent Control Inspectors would have full-service capability to conduct standardized surveys, perform education in the field, enforce codes related to rat/mouse problems, work on private and public properties, and conduct trapping/poisoning. They would have regulatory jurisdiction internal/external of commercial properties (non-food establishments), external on residential properties, and in public space. Code Enforcement Officers would have full-service capability to address any outside sanitation problems within their line-of-sight (commercial, residential, restaurant). They would focus on enforcement and monitoring, yet have education capability. The Education Division would prepare the education literature and outreach materials used by the entire Bureau, and focus on community organizing to establish grass-roots neighborhood participation.

Members of the new Bureau of Community Hygiene would be assigned specific geographic areas to manage. Personnel counterparts among other Divisions (including

Food Protection) would be defined, so that team approaches could be used when needed to maximize resources while limiting redundancies.

The DPW organization would remain responsible for the repair, maintenance, and enhancement of the public environment consistent with the mission of a public works agency. A new Division of Community Beautification/Enhancement was recommended in DPW that would consolidate resources and give greater attention to several activities that previously were independent, under-funded, or non-existent (Figure 3). This includes vacant lot cleanups, neighborhood cleanup days, prison/community-service laborers, summer youth corps, resolution of abandoned cars and properties, graffiti and handbill cleanup, and neighborhood beautification events. These activities reflect opportunities for large-scale neighborhood improvements and resolution of problem properties that can degrade program success.

Figure 3. Recommended organization for the Solid Waste Management Administration, Department of Public Works, Washington, D.C.

The Food Protection Division within EHA would continue to inspect and respond to complaints about food establishments. However, they would be trained in rodent control and include grease disposal and the outside restaurant perimeter in their inspections. These inspectors would partner with Code Enforcement Officers and Rodent Control Inspectors as necessary to achieve effective enforcement.

DCRA would continue its broad role in resolving problems related to property codes. However, DCRA would no longer have primary responsibility for rodent problems on private properties other than regulatory enforcement related to dwellings; the new rodent control program would support DCRA in that effort. DCRA would also maintain lists of abandoned properties requiring cleanup, and facilitate their resolution through use of private contractors and cooperation with DPW. DCRA also would help ensure that sanitation, structural details, and rodent control elements were included in the

permitting process for facilities, restaurants, and construction projects.

WASA would have a single point of contact for rodent issues, and procurement of private pest control companies was recommended for sewer baiting and survey. WASA participation also would include help with engineering assessment of sewer systems, smoke tests, and camera surveys to evaluate structural breaks where rat activity was chronic, cleaning of catch basins, and prioritizing system repairs based in part on rat activity (indication of structural decay). Effective communication between WASA and the Food Protection Division (restaurant inspectors) must exist, so that timely enforcement is available when sewer pipes are found clogged by grease from illegal disposal.

The Recreation and Parks Department would procure pest control companies to assist with maintenance, but the primary activity for that agency would be the design of landscaped areas to limit the kinds and density of plantings conducive to rodent activity (Colvin et al. 1996). Field personnel would be trained to recognize locations at risk, such as those near restaurants, and empowered to make changes.

The Nuisance Abatement Task Force exists within the Environmental Crimes Unit of the Police Department. They would continue to assist Code Enforcement Officers associated with the Rodent Control Program. These Police Officers can provide important leadership and support in locations where severe sanitation problems and the potential to encounter crime exist. Code Enforcement Officers would be able to directly communicate with the Environmental Crimes Unit and receive timely support.

The Bureau of Epidemiology would maintain statistics on rodent-borne disease and rat bites, centrally tracking and evaluating those issues. That agency would foster communication with the local medical community and Rodent Control personnel, and also foster a relationship with a local School of Public Health regarding monitoring and research.

About 40% of the properties within the District of Columbia belong to the federal government; thus a partnership would be needed to make the District program sustainable and comprehensive. Technology transfer and a regularly scheduled working group for key program participants would be used to facilitate communication and localized problem solving.

An important part of the overall organization would be representation from several industries: pest control, landscaping, solid waste, restaurants, and property management. In particular, strong partnerships would be needed with community leaders and organizations.

PROGRAM FEATURES

Communication and Teamwork

Achieving cooperation and open communication is one of the most difficult challenges of a rodent control program. Communication capability should include use of radio/phone units by field personnel for contact within and among agencies, regularly scheduled inter-agency meetings with assigned action items, and vehicles for responding to public complaints. A centralized phone number for public complaints can enhance their sorting, tracking, and response. The public must have defined

points of contact, thus helping to reduce the confusion, redundancies, and lack of effective response that can occur when multiple agencies are contacted. Response within 24 hours should be the goal.

A local area network (LAN) system should be established that allows various agencies to track their work using computer databases and remotely access information (e.g., survey results, outstanding violations). Ideally the system would include a link to tax records so that property-owner names and parcel numbers could be easily identified to facilitate notifications and mailings. Every inspector involved in the program, directly or indirectly, should have the ability to view data recorded by inspectors from other departments. An inspector could thus gain a holistic view of a property history and the pattern of violations; this would help ensure that inspectors are effectively coordinating, prioritizing chronic problems, and not overlapping.

Procedures for inter-agency referrals should be written. For example a rodent control inspector, observing a sidewalk in need of repair, should be able to call a specific point of contact in DPW and then enter the referral into an inter-agency database. Department managers should be held accountable to monitor the referrals made to their agency and timely resolution.

Education and Outreach

Education materials must be prepared by specialists, with a marketing style to help inform and motivate. The intent is to change the behavior of people. Ultimately residents and businesses must consider rodent control a community effort and recognize their responsibilities. Education materials and messages must be coordinated rather than piecemeal or bureaucratic. Large typeface text, answers to common questions, simple pictures, multiple languages, and a "how-to" style should be used.

To overcome a past history of problems, the first hurdle is to overcome public skepticism and apathy. The education program must demonstrate leadership and program credibility. A creative education approach must be used to reach a diversity of audiences; schools, churches, business associations, senior citizen groups, and the news media are examples. Policy makers must be included in the outreach effort to help sustain support for the program. Flyers, brochures, storyboards, a school curriculum, a community-organizing packet, and videos must be developed.

Community activists need to be identified and recruited to establish grass-roots participation and self-policing. It is best to begin with key community leaders, then small groups, and progressively larger groups with the support of the community leadership. Activists can help facilitate neighborhood surveys and distribution of education materials, and they must be accepted as part of the team.

Motivational efforts and recognition should be emphasized. This could include awards for successful community cleanup and the posting of inspection scores (a grade) at restaurant entranceways. Similar to a Neighborhood Watch program, an Alley Captain program can be used whereby individuals conduct monthly surveys in their own block and record locations of sanitation problems and rat activity. Information gathered could be

referred to enforcement, health, or DPW agencies when assistance is needed. Alley Captains can help establish local empowerment and track the progress of their own neighborhoods. Greater local participation should result in lower program costs.

Survey and Data Management

Surveys and data management provide intrinsic structure for a program and are used to achieve cost-effective and sustainable results. They keep program personnel focused and allow program elements to be tailored to each neighborhood (urban, suburban, parkland, waterfront). They also are essential for demonstrating to communities and policy-makers that program objectives are being accomplished. A 21st Century program must have personnel skilled in data management, computer-based operations, and mapping (von Wahlde and Colvin 1994).

Door-to-door (systematic) surveys can be performed using a standardized form and procedure, similar to that first prepared by the U.S. Public Health Service (Davis et al. 1977). Survey blocks can be color-coded and mapped based on the percent of premises rat infested: 0 to 2% = blue; 3 to 6% = yellow; 7 to 25% = green; and 26 to 100% = red. The same type of color-coding can be used for the percent of premises with sanitation/harbage problems: 0 to 10% = blue; 11 to 25% = yellow; 26 to 50% = green; and 51 to 100% = red. Survey areas should be prioritized based on environmental conditions, and the goal should be to shift survey blocks to the blue (maintenance) status through education and enforcement.

Databases function as a program's institutional knowledge, and understanding historic events facilitates predictive actions and streamlining of operations. Databases can include surveys, public complaints, baiting (surface, manhole), and enforcement (abatement notices, tickets). Standardized forms should be used and ideally they would be on laptop or handheld computers, so data entry can occur in the field. Databases should be linked to a geographic information system (GIS) so that problem patterns can be discerned, baiting locations tracked, and maps prepared for survey crews and community meetings. Scheduling software should be used to plan and track program events.

Sanitation and Enforcement

Locations with sanitation problems can range from vacant lots and restaurant districts to residential and commercial areas. Rat problems commonly can be found where space is maximized for residences, while space for refuse storage is minimal. The situation is exacerbated where there are tight alleys and mixed land use involving restaurants.

The District has a containerization program (96-gallon heavy-duty plastic cans with wheels) but only in predominately outer residential areas rather than the "inner ring" of the District where congestion is greater. Ideally a containerization program would extend throughout all residential areas of the District, with half-sized cans used in more congested locations. Regulations that allow refuse storage outside in plastic bags (as stand-alone containers) overnight must be eliminated.

In public areas, wrought-iron refuse containers should be used and placed strategically. Crews to collect refuse must be increased concurrent with container installation. Wire mesh containers should be eliminated; solid containers with a domed or "donut" lid must be encouraged. Containers at commercial properties must be rodent-proof, and the use of compactors should be stressed especially where space is limited. Numerous designs exist for commercial containers, and property owners must be informed through education and enforcement to contact their waste management company for an appropriate type.

Refuse collection times ideally would restrict placement of refuse outside overnight in residential areas, and commercial pickup would occur as early in the evening as possible. Timing of refuse pickup, however, can be constrained by traffic congestion, labor agreements, needs for noise control, and the schedule when refuse transfer facilities are open. Other important aspects of a sanitation program include effective street sweeping, adequate equipment and crews for alley and catch basin cleaning (storm drains), resolution of abandoned properties, and "neighborhood cleanup" days (with corporate involvement).

The containment and proper disposal of cooking grease should be a priority. Grease is a commodity and thus, when prices are low, restaurants must pay for it to be removed. Without effective containment and regulatory oversight, grease may be poured down drains into the sewerage system where it can provide a high protein food source for rats (and clog sewers). Some cities require that restaurants keep daily logs of grease generated and commercially collected, and also that grease traps be installed. In the District, 55-gallon barrels saturated with grease on the outside and without tight-fitting lids were typical; grease commonly covered the ground surface in these situations and steam cleaning to effectively remove it was not practiced. A rat-proof shed can be used to contain grease barrels; containers should be secure and free of spillage.

Work schedules for program inspectors and enforcement personnel should include nights and weekends. Sanitation problems commonly are not observable during daytime hours, especially in restaurant districts. Nighttime observations can be key to locating rat activity and feeding sites.

Regulatory enforcement is the ultimate method for changing the behavior of people, and it brings credibility to a program. Citizens can become frustrated and cease to participate in a program when violations by others are allowed to persist. Numerous codes pertain to rodent control, and some may not have recognition as important to the subject. They include construction, plumbing, restaurant operation, abandoned buildings, cleaning of streets and sidewalks, graffiti, littering, refuse containers, refuse storage and disposal, handbills, licensing/permitting, tenant/owner responsibilities, and right-of-entry for inspections. Notice of violation, schedule of fines, and the appeal and hearing process also should be defined by regulations.

A legal task force should holistically review and update codes to ensure adequacy of topics, clarity of terms, enforceable regulations, and consistency and

distribution of enforcement responsibilities among agencies. The task force also should design an abatement notice (Notice of Violation) to be used by Rodent Control Inspectors and a ticket to be used by Code Enforcement Officers. These items must have clear categories of infractions and be easy for residents and business owners to understand and act upon. Either of those legal documents could be used as a warning or actual notice of a fine.

Rodent Control Inspectors would take regulatory actions principally during neighborhood surveys and when responding to complaints. Their regulatory enforcement would typically focus on situations where rodent activity was involved, and they would give up to ten days for an owner to resolve problems (rat activity, harborage, refuse containment). In contrast, Code Enforcement Officers would focus on sanitation issues and could issue an immediate penalty (a parking ticket style). The difference being that a rodent problem takes time to resolve and potentially coordinate among multiple properties. Abatement notices written by Rodent Control Inspectors would involve detailed documentation of conditions and specific recommendations. In any enforcement situation, re-inspection to confirm compliance (or the need for further action) must be part of the process.

Code Enforcement Officers may write numerous tickets daily as they patrol a neighborhood, and thus paperwork must be minimal and simple to complete. Their initial actions in a neighborhood could involve only warning tickets for 1 to 2 months, and these officers are particularly important for sustaining maintenance conditions once the Rodent Inspectors have completed a block program. Initial fines could be \$30 (unacceptable refuse storage), \$50 (harborage), or \$100 (rat activity) for residential properties. Fines on commercial properties could be \$75 (unacceptable refuse storage, harborage) or \$100 (rat activity). Higher amounts up to \$5,000 should be possible depending on events (e.g., illegal dumping).

All personnel involved with enforcement must have cameras and training in evidence collection. All notices and tickets should be entered into a database within 24 hours so that information is available to all participating agencies. Data reports of chronic violators can be used to help target more aggressive enforcement actions.

Citizens should have 21 days to request a hearing to appeal (an abatement notice or ticket) to an Administrative Law Judge in the Department of Health. If a fine is not paid within 21 days, it should be doubled and a warning letter issued at 30 days that states possible actions of: 1) tax bill assessment; 2) collection agency notified; 3) permits and license renewal stopped; and/or 4) criminal complaint to be issued. Restaurant inspectors also should have defined inspection and enforcement procedures and the ability to close (padlock) rat-infested premises. Legislative actions should be considered that make community service (on a DPW cleaning crew) a possible penalty for code violations.

Infrastructure and Urban Planning

The physical environment must be considered during design, construction, and maintenance of urban and suburban infrastructure and landscapes. Architects and engineers must include pest management principles during

design to help prevent problems and future costs to resolve them. Design criteria for rodent control should be provided to design and landscaping firms. Government agencies involved in planning, zoning, and permitting for new construction and facilities should be knowledgeable about physical features conducive to attracting and harboring rodents.

Landscape architects characteristically do not focus on rodent control. Important features include the density and type of plantings, nearby land use and food resources, locations of benches and refuse containers, use of mulch and gravel inspection strips, and limiting solid fencing that extends to the ground surface (Colvin et al. 1996). Landscape drainage pipes were commonly observed as active harborage sites in the District, and their openings should be screened. Landscape architects, property managers, and developers should be part of outreach efforts.

Rodent control should be required for all demolition and major construction projects. This includes survey and baiting prior to site disruptions, monitoring and baiting/trapping throughout the construction period until de-mobilization, and effective sanitation measures and enforcement during construction.

Subsurface infrastructure can provide a labyrinth of habitat for Norway rats. Biologists usually are unfamiliar with these environments and the engineering and construction industry; subsurface rat colonies often are allowed to persist and thus repopulate surface environments. The sewerage system in the District consists of extensive combined sewers in areas such as Adams-Morgan, Georgetown, and Capitol Hill. In other portions of the District, systems have been separated and new storm sewers installed.

Of the 6.7 million linear feet of sanitary/combined sewers in the District, only 26.5% have been installed in the past 50 years; the remainder is 51 to 125 years old. Of the 1.77 million linear feet of storm sewers, 61.6% have been installed within the past 50 years. Only 0.4% of the sanitary/combined system consists of brick or stone materials, which can be highly susceptible materials for rat infestation; however, 77.3% is comprised of vitrified clay pipe which also can be susceptible to rat activity. Within the sanitary/combined system, 77.2% of the pipes are 24 inches or less in diameter (greater potential for rat activity), whereas only 52.2% of the storm sewers are that size. The District sewer system can be described as an older system with the potential for high rat activity in localized situations.

Baiting and Trapping

Rodent killing should be complimentary to other aspects of the control program and a precursor to environmental modifications (e.g., refuse or vacant lot cleanup, sidewalk repairs). Baiting programs should be divided into initial efforts to achieve control and maintenance baiting to prevent re-colonization. Currently, the District principally uses brodifacoum and bromethalin baits and diphacinone tracking powder.

The extent and need for sewer baiting should be determined based on field surveys of representative (high risk) locations using engineering and land use information. Older systems (brick or clay) in residential

areas, particularly sanitary or combined sewer pipes less than 24 inches in diameter (i.e., low flow), would be at most risk. The District also has some larger combined sewers with open-trough sanitary lines within them, and these were known to have rat activity. A sewer-baiting program must be implemented systematically and with excellent record-keeping to have value (Colvin et al. 1998).

Sewer baiting programs and baiting/trapping on government properties (e.g., parks and recreational facilities, buildings) should be contracted to private pest control companies. Detailed specifications and minimum qualification requirements must be used to prevent inappropriate low bidding and help assure that the work is performed. Contract administrators must be trained in quality assurance and provide effective oversight (Colvin et al. 1992).

IMPLEMENTATION

Program implementation is a progressive process and should be performed well, rather than inappropriately rushed. Realistically it can take three years to establish a quality program and five years before sustainable change is achieved and recognized over a large area. Initial priorities should be to acquire public and political support, define the organization and areas of responsibility, establish a sustainable funding base, revise codes and regulations, establish an effective adjudicatory process, recruit and train qualified personnel, and prepare education materials. Communication procedures, computer-based operations, and inter-departmental relationships must also be resolved as part of program start-up.

Field implementation involves establishment of schedules and priorities, team meetings, complaint response capability, and participation through community organizing and outreach. The next steps are surveys, baiting programs (including sewers), code enforcement,

sanitation and environmental improvements, infrastructure repairs and rehabilitation, and urban planning. Analysis of results, program adjustment, and quality assurance monitoring must be ongoing.

ACKNOWLEDGMENTS

Mayor Anthony Williams initiated a new approach to environmental management in the District of Columbia. Mark Greenleaf of the Department of Health facilitated program design in 1999.

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