A COMPUTERIZED DATA BASE AND SIMULATION SYSTEM TO SUPPORT DECISIONS IN THE ALAMEDA COUNTY MOSQUITO ABATEMENT DISTRICT

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The ACMAD has taken the opportunity to reanalyze the computer system with the recent aquistion of a new computer and hard disk system. This has enabled the systems team to expand the computer system to handle many more functions with greater efficiency. The heart of the new system is a Radio Shack TRS 80 Model II computer with an 8 megabyte hard disk storage unit.

Much of the system analysis necessary to build the new system had been accomplished in 1980 when the District installed its first micro-computer. At that time, the following objectives were set for the system (Roberts 1980):

1) To efficiently process data that will measure the effectiveness of the mosquito control program.
2) To efficiently generate required reports.
3) To develop and utilize models to predict levels of mosquitoes and thereby assist in making treatment decisions.
4) To quantify the work performed by the District.
5) To define "high priority" mosquito sources, through cost evaluation and set appropriate work schedules for the physical control program.
6) To measure the insecticide pressure on any given species and avoid resistance problems.
7) To determine the costs of specific program elements and enhance program budgeting.
8) To check current inspection and treatment schedules with those of the past and modify the schedule as required.

These objectives had been met by the old system, but they could not be integrated easily due to the lack of storage space on the floppy disks. Another limitation of disk storage was the inability to build and routinely update a complete data base of mosquito source information. There was simply not enough on-line storage and access for all the mosquito sources in the District. Without adequate on-line storage capacity it was virtually impossible to build and update a data base capable of creating inspections and treatment schedules for all the important mosquito species and to provide the necessary input to system models. Also, users of the old system had to deal with a computer that was not always friendly, sometimes cryptic, and at other times unavailable due to heavy use.

By following a system development process as outlined by Page and Hooper (1979), the system team was able to build a new system better able to meet the District's objectives. System development included the following steps:

1) **System analysis** - general background, organization, structure, document and procedure review, deficiencies, recommendations.
2) **Statement of Objective** - overall purpose, specific objectives, required output, required data, necessary controls, new policies or procedures.
3) **System Design** - scope and boundaries, specific requirements, conceptual design, resource requirements, benefits.
4) **System Specifications** - system description, system flowchart, computer requirements, data management summary, implementation, schedule.
5) **Programming** - narrative description, user instructions, sample input, sample output, test data program listing.
6) **Implementation** - hardware requirements, personnel orientation, training, testing, file conversion, parallel operation.
7) **Evaluation** - documentation review, cost analysis, user acceptance, internal control, deficiencies, recommendations.

The ACMAD systems team consists of the manager and three mosquito control technicians. In initial planning sessions, job assignments were issued in three areas: programming, documentation, and logic. One technician was assigned responsibility in each area and the others assisted. The manager led the group in planning a program schedule. The first task to be accomplished was the upgrading of the old data base which included a list of all known mosquito sources in the District, with information as to ownership, location, source type, size, methods of treatment, hours required to inspect and treat. The information was copied by computer from existing disks, and additional information was gathered from the supervisors and technicians and entered by keyboard. The new hard disk storage unit allowed the District to store all this information in one place, making it possible to add a secondary group of files which are updated daily by the daily records. The secondary files accumulate operational and biological information on each source which can be accessed within a few seconds. The biological data being added to existing source information includes the following:

1) Mosquito species present at source, the species prioritized according to health and pest considerations.
2) Endangered species present at source, such as the red-bellied harvest mouse and the clapper rail.
3) Non-target organisms such as fish, birds, mammals, and invertebrates.
4) Larval predators in sources including fish and invertebrates.
5) Major vegetation types.

The District's computer is now utilized to store all operational data, transmit data from one facility to another, update the before mentioned data base, generate inspection and treatment schedules for *Aedes squamiger*, predict population levels of *Culex pipiens*, generate monthly reports, provides information on inventoried mosquito sources, and is used along with a Daisy wheel printer for word processing. The following projects are now in progress to further upgrade the computer system:

1) Daily inputs are being expanded to include weather, tidal, and insecticide resistance data.
2) Programs are being developed to generate inspections and treatment schedules for all high priority mosquito species.
3) A simulation model is being developed of a freshwater marsh to assist in treatment decisions. A general model is being developed to assist in predicting whether important species of mosquitoes are approaching established thresholds.

The District is in the process of consolidating facilities with the construction of a new office and shop in Hayward. The consolidation will eliminate the need to transfer data by phone. Also, in the plans for the new office are additional terminals to be placed where needed in the building.

The system team found that the initial programming and planning went much quicker than anticipated but an unanticipated amount of time was spent debugging programs. Integration of the programs and procedures with the existing system occurred quickly and smoothly.

Although a considerable amount of time was spent with field personnel going over source information, the time was well spent. The effort has created a data base of mosquito sources, each of which can be modified, created, subdivided, eliminated, or checked in a matter of seconds. The daily cards of employees serve to update source data continually. The District's new data base and simulation system, without doubt, has provided the District's decision makers with a greater amount of readily accessible, current information to assist in their decisions.

REFERENCES CITED

Page, J.R. and H.P. Hopper. 1979. Basics of Information Systems Development. Journal of Systems Management. August, 1979 pp. 12-16.