Proposal to Develop Electronic Data Processing of Public Health Pesticide Applications and Resistance Testing

**Key Personnel**

Christopher M. Barker, Ph.D. (PI)
Bborie Park (Programmer)

**Introduction**

An important feature of the current California vectorborne disease surveillance program (CalSurv) is the development of an electronic data processing system allowing input and management of surveillance-related data, and the availability of analysis tools for use by participating mosquito and vector control agencies (MVCAs). The statewide data processing system is the CalSurv Gateway. It is based on the premise that the surveillance data are the property of the agencies that have produced the data, and the availability of the data to other entities is controlled by a formal CalSurv Data Policy. In practice, anyone other than qualified employees of a participating MVCA wishing to use data owned by that MVCA must go through an application procedure spelled out in the Data Policy, and the application must be approved by a CalSurv Steering Committee only after obtaining permission from individual MVCAs. There has never been a security breach of the CalSurv Gateway, although one individual who was denied a request for data obtained certain summary data by tedious dissection of data from maps intended for the public on the CalSurv website and weekly arbovirus surveillance bulletins. The public website now has been modified to prevent future such acts.

This proposal is to develop a similar electronic data processing system to accommodate data relating to pesticide applications and pesticide resistance testing. This is not an application to develop a system for pesticide resistance testing itself. Other agencies, especially the Vector-Borne Disease Section of the California Department of Public Health, certain regions of MVCAC, and certain individual MVCAs, are currently exploring means of developing a coordinated statewide pesticide resistance program, and this proposal would be involved only to the extent of developing the electronic data processing aspect of such a program. The development and implementation of this aspect of the proposed system would occur only if such a coordinated program materialized unless certain individual MVCAs desired such a data system for their own testing programs.

The underlying premise of an electronic data processing system for pesticide application and resistance testing (PART) would be the same as for the CalSurv Gateway. All data stored centrally would be considered the property of the agency or agencies generating the data and those data will be protected by a strict policy for release of data just as are the CalSurv surveillance data.

There are many reasons for developing an electronic data processing system for pesticide applications and for resistance test results. Some of these reasons are related to statutory requirements for reporting under the National Pollutant Discharge Elimination System (NPDES). However, even if California MVCAs are eventually exempted from most or all of the permitting process, the availability of pesticide application and resistance data, along with data analysis tools similar to those on CalSurv Gateway, will provide MVCAs unprecedented opportunities to evaluate pesticide application effectiveness and to examine long-term trends in control methodology. One extremely promising use of data analysis by MVCA biologists and administrators would be the possibility of correlating...
applications of certain pesticides used in the program with vector abundance and the presence or absence of vectorborne disease indicators. The same types of correlations would be possible with pesticide resistance data.

If California is not successful in gaining an exemption from NPDES, the development of an efficient system of data entry, storage, and analysis becomes even more pressing. At present, the MVCAC NPDES Coalition is utilizing a contractor, URS, for much of the sampling and testing aspects in connection with MVCA NPDES permits. This effort would complement the URS effort, not duplicate it, and we envision working with URS or any future contractors on the IT components of reporting requirements.

The MVCAC Information Technology Committee has circulated several questionnaires to obtain information on the current usage of electronic means of collecting, storing, and analyzing all types of mosquito and vector control operations. Two things stand out in the results. One is the expressed interest on the part of a number of MVCAs in improving their capabilities in area of electronic processing of control program-related data. Another is the fact that a number of respondents continue to rely heavily on manual data entry and data storage using paper forms. Variability among these individual MVCAs raises still another reason for moving forward with an improved uniform, electronic data entry, storage, and analysis system. The latter is simply more efficient in terms of labor costs of all types.

The current program for entry of monthly pesticide reporting satisfies the current requirements of the California Department Pesticide Regulation and the California Agriculture Commissioners. However, the bulk summaries of pesticides used, with no recording of individual treatments with geographic reference does not satisfy the reporting requirement of the California Water Resources Control Board under NPDES. Furthermore, the current online reporting program for monthly pesticide use is of little or no use for detailed analysis by MVCAs for assessment of control program effectiveness.

For the above reasons, the Center for Vectorborne Diseases (CVEC) at the University of California, Davis proposes to develop, host, and maintain an electronic pesticide-related data system (PART) that:

1. Provides an efficient and cost-effective system allowing California Mosquito and Vector Control Agencies (MVCAs) to enter pesticide application and resistance test data, store the data in a secure electronic environment easily accessible to the MVCA entering the data, with the understanding that the data are owned by the MVCA entering the data, and other persons or agencies wishing access to portions of the data may do so only by going through a well-defined data policy request requiring permission from the MVCA owning the data.

2. Includes, over time, special data analysis tools developed in coordination with MVCAs that will enable MVCAs to map and visualize their data as well as conduct statistical analyses such as correlations of pesticide applications and adult mosquito sampling data, pesticide resistance levels and arbovirus indicator levels, and long-term geographic location-specific trends in pesticide resistance.

3. Satisfies the pesticide application reporting requirements of the present NPDES permit. If California is successful in obtaining a complete exemption to the reporting requirements of NPDES, emphasis will be shifted to making the current reporting requirements of the Department of Pesticide Regulation and California Agriculture more efficient and cost-effective, and available to MVCAs for long-term analyses.
**Specific capabilities of the proposed system**

The **Pesticide Application component** must support all activities involved in an individual application. It is expected that this component would provide the following capabilities:

- **Inventory record**
  - Equipment used to apply pesticides
  - Pesticides in stock
  - Tank mixes for blends
- **Source records**
  - Inventory of known areas to be treated more than once with pesticides
  - One-time applications due to nuisance complaints or spot treatments
- **Application of larvicides and/or adulticides**
  - Documentation of each individual application
  - Physical field measurements taken by select representative agencies
  - Recording and tracking of pesticide residue samples from collection to testing, similar to the Gateway’s system for recording and tracking of field mosquito collections and subsequent virus testing
- **Reporting and Analysis**
  - Submission of monthly summary Pesticide Use Reports to County Ag commissioners
  - Annual NPDES reports
  - In-house reports to be developed in consultation with participating agencies
  - Web-based tools for graphical visualization and analysis
- **Data import/export mechanisms**
  - Manual mechanisms using spreadsheets
  - Automated web services to provide communication with local operations software

The **Pesticide Resistance component** will support a cooperative statewide pesticide resistance program. Initially, the component will accommodate data on collection, testing, analysis, and reporting of test results for adult and larval mosquitoes, and it will be designed to accommodate testing of other vectors if a statewide program is so expanded later.

- **Sources**
  - Regularly sampled area for resistant mosquitoes
  - One-time samples
- **Sample collection**
- **Testing by various methods**
- **Analysis and reporting of test results (e.g., LD₅₀)**
- **Mapping of resistance patterns**

A schematic diagram indicating proposed data pathways is shown in Fig. 1 below.
Timeline and Milestones

Completion of the database and software for pesticide application and resistance testing is expected to take a significant amount of time. By breaking the project into manageable components and adapting code from the CalSurv Gateway, critical parts can be completed more quickly. We plan for the Pesticide Application component to be completed before the Pesticide Resistance component because of the universal need for pesticide use reporting compared to resistance testing, which is done by a subset of MVCAs.
Estimated development times:
- 3-4 weeks for designing the database and establishing administrative components
- 6-9 months for Pesticide Application component
- 3-6 months for Pesticide Resistance component

Data Access and Ownership

Like the CalSurv Gateway, data stored in the database underlying this application will be the sole property of the originating agency. Entry of data into the application does not release the originating agency's rights to the data. Access to the data in the application will be partitioned in the same manner as in the CalSurv Gateway (an agency and its users can only see their agency's data, unless the agency and/or user has privileges granted by another agency). It may be worth amending the CalSurv Data Policy to cover, protect, and establish a path for third-party data requests involving pesticide data.

Budget

Total for 16 months during years 2013-2014 = $93,400

- Bborie Park, Programmer IV, 50% time
- Student Programmer, Assistant IV, 50% time (academic year) & 100% time (summer)
- Christopher Barker, Assistant Research Epidemiologist, 5% time (UCD support, no cost to MVCAC)
- Supplies, $5,000 at startup and during FY 2014
  - Computer for student programmer
  - General server infrastructure support

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<td>Park, Bborie</td>
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Benefits (based on standard UC Davis rate structure)

- Barker, Christopher: $5,545
- Park, Bborie: $5,545
- TBH: $59

Total Salary, Wages, Benefits: $22,672

Other Costs

- Supplies: $5,000

Total Other Costs: $5,000

FY 2013 Total: $27,672
### FY 2014 (Jul 2013 - Jun 2014)

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**Benefits (based on standard UC Davis rate structure)**

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**Total Salary, Wages, Benefits:** $60,728

**Other Costs**

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<tr>
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**Total Other Costs:** $5,000

**FY 2014 Total:** $65,728
Appendix. Questions and answers stimulated by MVCAC and agency concerns about the earlier version of this proposal

1. Q. Would this proposal duplicate efforts of the NPDES contractor (URS) in data gathering and analysis?
A. No. Their data are based only on a subset of MVCA samples, and do not involve an integrated electronic data system. Should this proposal be funded, we would coordinate closely with URS or any future contractor to ensure lack of duplication of effort.

2. Q. How would data developed under this system be used by investigators (university or otherwise)?
A. This would entirely be up to the MVCA entering and owning the data. Should a university investigator wish to use some part of the data owned by a MVCA, he or she would have to make a formal request under the electronic data policy, just like anyone else who is not on the staff of that particular MVCA. In practice, we anticipate that most studies would be by MVCA scientists using their own data, and aided by analysis tools built into the system.

3. Q. If California MVCAs get complete exemption from NPDES, would this effort still be worthwhile?
A. Definitely, cost efficiency and availability of data sets that can be analyzed by MVCAs for assessment of program efficiency would be very worthwhile. Having carefully recorded, georeferenced quantitative data will be a first step to relate these operational efforts to surveillance results to ask the question "does mosquito control matter?"

4. Q. Isn’t the proposed cost of this proposal unreasonably high?
A. No. For one thing it covers only a short development time frame and the cost for programming personnel is well below private-industry norms. Since our earlier proposal, we have reduced the budget by approximately $23,000 by arranging for CM Barker’s 5% effort to be funded by UC Davis cost sharing, and we have reduced the total budgeted time for the programming assistant by 1.5 months because the new 16-month budget period does not overlap two full-time summers.

5. Q. Is this a proposal for development of a statewide pesticide resistance program?
A. No. Others are working on a program for the actual testing. This proposal seeks to provide electronic data capability for such a program if it does come into being, or for individual MVCAs that wish to do their own testing, or groups of MVCAs that wish to collaborate to do resistance testing.

6. Q. Is there a danger that groups or individuals opposed to mosquito and vector abatement could demand access to the pesticide database?
A. No. However, under the present California Public Records Act any group can demand to examine data from any public agency. They would not be able to make any such demands of the CalSurv Data
Steward (Bborie Park) because individual MVCAs retain ownership rights and neither the Data Steward nor anyone else at UC Davis owns the data.

7.

Q. Is anyone communicating with the County Ag Commissioners to see if they are planning to upgrade their present system to include more detailed reporting?

A. Not yet. However, if this proposal is funded, there will be considerable dialog between County Ag Commissioners to insure that the reporting program is completely compatible with their present and possible future reporting mechanisms. We expect that this system will help to eliminate many of the errors that have been found in the California Department of Pesticide Regulation (DPR) database and make the data reported at all levels more accurate and useful.

8.

Q. Should all NPDES Coalition members be required to use this system?

A. That decision should be made by Coalition members. We hope that most MVCAs, including Coalition members, would want to use the system based on its potential to save funds by reducing redundant data entry through automated reporting of summaries to County Ag Commissioners, and for its usefulness in assessment of control program effectiveness.

9.

Q. What is the long-range goal of this project for UC Davis and for MVCAC?

A. To continue our mission at UC Davis of supporting member agencies in MVCAC in their use of modern methods of controlling mosquitoes and other vectors, and to document these methods to provide evidence of their soundness, thereby enhancing their credibility. This will help to maintain MVCAC’s role as progressive leaders in the mosquito control community, and for UC, it will continue our contribution to public health in research and development.