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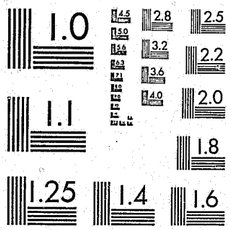

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ANALYSIS OF CRIMINALISTICS LABORATORY OPERATIONS

CRIME LABORATORY PERFORMANCE MEASURES

Prepared by:

Lowell W. Bradford
John W. Clark
Eiichi Kamiya

Prepared for:

The Mitre Corporation
and Law Enforcement Assistance
Administration

18 June 1974

PRC SYSTEMS SCIENCES COMPANY
7600 Old Springhouse Road □ McLean, Virginia 22101 □ (703) 893-1800
1100 Glendon Avenue □ Los Angeles, California 90024 □ (213) 473-1163

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FOREWORD

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ACQUISITIONS

The MITRE Corporation under contract with the National Institute of Law Enforcement and Criminal Justice, the research arm of the Law Enforcement Assistance Administration, is conducting a research program to investigate the law enforcement community's needs for scientific support, the extent to which support is provided by criminalistics operations, the problems in providing that support, and the effectiveness of an improved laboratory system.

In the conduct of this program, MITRE has contracted for the services of two organizations with demonstrated ability in field analysis and forensic science research. Planning Research Corporation/Systems Science Company (PRC/SSC) was asked to characterize the operations of crime laboratories and develop methods to evaluate their performance. CALSPAN was asked to describe the role of criminalistics operations within the criminal justice system and to develop methods for measuring the effectiveness of these operations.

This report, prepared by PRC/SSC, describes the performance measures developed through their study. The issuance of this report does not imply recommendation or approval either by The MITRE Corporation or the National Institute of Law Enforcement and Criminal Justice.

The MITRE Corporation

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FOREWORD

The importance of physical evidence in the investigative and adjudicative aspects of criminal justice is increasing. With large amounts of Federal funds now available to support criminal justice programs, state and local jurisdictions are planning for the establishment of new criminalistics laboratories and expansion of existing ones. Little guidance has been available to assist these jurisdictions in determining their requirements for personnel, equipment, facilities and procedures.

The MITRE Corporation, acting as an agent of the Law Enforcement Assistance Administration (LEAA), awarded PRC Systems Sciences Company a contract to obtain data that would help meet the above need. PRC studied the operations of three crime laboratories serving counties or cities with populations from 500,000 to 2,000,000; developed a conceptual model of crime laboratories and measures of laboratory performance; applied both to the laboratories studied; and recommended improvements in their operations.

Mr. Lowell W. Bradford was the PRC Project Manager for this study and he was assisted by team members Messrs. John W. Clark, Eiichi Kamiya and Richard Stevens and by consultants James E. Halligan, Anthony Longhetti, Douglas Lucas, and Bryan S. Finkle. Mrs. Mary Jane McCabe headed an able team of secretaries who typed the series of reports on this study.

Mr. Joseph Peterson of LEAA and Mr. Fernando Biagi of The MITRE Corporation monitored PRC's work.

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Gratitude is expressed to the staffs and directors of the participating crime laboratories: Messrs. Ed Whittaker, Dade County, Florida; Richard Pfau, Columbus, Ohio; and Duayne Dillon, Contra Costa County, California for their cooperation and assistance in the studies at their respective locations.

A great deal of the conceptual material is the result of state-of-the-art which has been developed through the participation of forensic science contemporaries. The points and ideas of colleagues is so intermingled and intertwined that it is not possible to give specific credit.

It is hoped that the material in this report will prove to be immediately useful to practitioners, planners and administrators and that future research will further develop the state-of-the-art in the planning for and management of criminalistics laboratories.

Richard M. Longmire
Richard M. Longmire
Vice President and
Principal-in-Charge

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I. INTRODUCTION

This part of the report specifies the conceptual performance measures needed to analyze the operations of a criminalistics laboratory and identifies the data elements required to calculate them. These performance measures were designed and developed for two types of users: (1) the laboratory director, in managing the resources of his laboratory, and (2) the analyst or planner, in comparing laboratories or allocating resources among them. Section II of this part of the report specifies the elements of data which must be collected to calculate the recommended performance measures. Section III describes the individual performance measures and the statistical analyses that can be developed from the data. Section IV describes and documents a Crime Laboratory Performance Index Rating (CLPIR) which provides a basis for profile information for any given laboratory operation with respect to its conformance with the achievable state-of-the-art.

In this report the term "performance" is used in the operational sense rather than the evaluative sense. That is, the measures developed are designed to tell the laboratory manager or other interested party, what the laboratory is doing as opposed to assessing the value of what it is doing. The validation of these performance measures is described in Volume Two and is limited to a demonstration of the application of the measures to the three criminalistics laboratories selected for analysis in this study.

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II. DATA ELEMENTS

There are a number of data elements which a criminalistics laboratory must collect, organize and study if it is to effectively measure its performance. Most of the data needed is or can be made available within the laboratory itself. However, it may be necessary to go to local, county or state sources to obtain some of the demographic and crime statistics data needed to calculate the performance measures specified in the next section.

Most of the data elements needed are, or should be, recorded in the laboratory case logs. With the logs as a focal point, the laboratory manager from one source document can obtain most of the performance data he may need. If the data is tabulated and aggregated frequently (i.e., weekly) and case volume is not extraordinarily high, data manipulation can be performed manually. If the caseload is very high or if performance measures requiring detailed cross-tabulations are utilized, computer tabulation of the data may be required.

The following data elements should be collected from laboratory log books:

Laboratory case number.

Each case entering the laboratory should be assigned a unique laboratory case number. If only one case log book is used, a single sequential numbering system should be used. If separate log books are used for each section of the laboratory as recommended in the conceptual model, a separate numbering system with a unique prefix or suffix can be used for each section. In either case, care must be taken to insure that evidence and analysis from cases involving multiple submissions

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can be tied together to avoid double counting in case-specific performance measure calculations. A clear and consistent definition of what constitutes a separate case should be maintained. A case involves the physical evidence obtained from a single incident or crime. Some submitting jurisdictions will consider that all crimes attributable to one suspect constitute a single case; other submitters will consider that each piece of physical evidence constitutes a separate case. It would be desirable for all jurisdictions within a given criminal justice system to use the same consistent definition of a separate case; but regardless of variability in submitter case definitions, a consistent definition of laboratory cases must be maintained if performance measures are to have any comparative value.

Data Received

Each case log entry should include the date the case enters the laboratory. This information permits the calculation of case response time, as well as indicating the submission rate of cases. In cases with evidence submission subsequent to the initial submission, entries should be keyed to the date received for the initial submission.

Submitting Agency

For criminalistics laboratories serving more than one user jurisdiction, a record of the submitting agency and its case number should be made in the appropriate laboratory log. The recording of the submitting agency permits the aggregating of statistical data input and calculation of performance measures on the basis of jurisdictions served. The addition of the submitters case number does not aid in performance

measure calculation per se, but it does provide an audit trail for tracking the case through the operations of the criminal justice system.

Crime Type

The case log should specify the types of incidents or crimes associated with the evidence submitted. The crimes specified should be those specified in UCR statistics. They should be consistent with the penal code of the jurisdiction; ambiguous entries such as "shooting" or "found property" or "serial number" should be avoided. Similarly as in case definition, it would be desirable for comparative purposes if crime types were defined uniformly.

Kind of Evidence

To permit the accumulation of evidence-specific performance measure data, the kind of evidence submitted should be recorded as an integral part of the case log. As suggested in the conceptual model, for future use it may be useful to record the matrix material in which the evidence is submitted as well as the specific evidence to be analyzed. However, the performance measures specified in this report for general application utilize only the specific evidence submitted for analysis.

Laboratory Functional Area

This is a notation of the functional area of laboratory work the evidence involved. If the laboratory is organized functionally and separate log books are maintained for each functional area, as recommended in the conceptual model, this data element is "automatically" recorded by virtue of the specific choice of section and log book into which the case is entered.

Time Expended by Laboratory

Notation of the time expended by the laboratory staff on each case should be made in the log book. This should include separate entries for laboratory time, field time, and witness time. Field time and witness time are recorded in some laboratories in separate records; analysis is facilitated by keeping this information in the case log book. where it can be easily identified with other elements of data for performance measure analysis.

Outcome of Analysis

The case log entry for each major case should include an indication of the outcome of the analysis. That is, whether the analysis (1) assisted the submitter in an affirmative manner, (2) contraindicated the suspicion of the submitter, or (3) was not conclusive. Notation could also be made if an outcome, per se, is not applicable to the analysis such as might be the case in firearms processing or fingerprint processing. Collection of this data element provides insight into the conclusiveness of analyses as related to different types of investigations and specific evidence.

Criminalist Assigned

The case log should identify the laboratory staff member to whom the particular case has been assigned for the purpose of tracking. This entry does not replace the need for a continuous record of the status of cases assigned to each criminalist by his supervisor.

Report Date

The recording of the date that the case report was completed permits measurement of case completion rate, backlog and response

time for laboratory cases. Although the results of an examination are often reported by direct conversation or telephone before the report is written, the completion of a case is represented by the time and date that authentication is applied. Consequently, every laboratory should apply a time-date stamp to authenticated reports as soon as they are available to the submitter. This fixes the data element of completion.

Case Deferral

There will be times when cases submitted for analysis must or should be deferred by the laboratory. For example, if the evidence submitted for analysis is incomplete, or insufficient for conclusive analysis, or if the need for laboratory results is not immediate, a decision may be made to defer analysis of the evidence. In the conceptual model it is recommended that a separate category or file be set up for deferred cases. If such a file is maintained for deferred cases, and they are accounted for separately, many of the ambiguities associated with the measurements of response time and case backlog can be avoided. Provisions should be made in the case logs to indicate that a case has been deferred; and when a deferred case is finally returned to backlog status, a time-date notation of this new status should be made.

Other information may be included in the laboratory case log for other purposes, but the data elements described above are those required for performance measure assessments. Data elements such as laboratory case number, date received, submitting agency, crime type, kind of evidence and laboratory functional area can be obtained

from the case overview information obtained at the time of evidence submission. Other data elements such as time expended by the laboratory staff, outcome of examination, assigned staff member and deferred status can be recorded at a later date from case notes, the final report or from the records of the immediate supervisor. To enable ease of transcribing the data and for possible computer data processing, these data elements can be coded for entry. Sample codes for many of these data elements are contained in the conceptual model.

There are other data elements concerning the allocation of laboratory time resources which cannot feasibly be collected in the case log because they are not necessarily case-specific. To collect this data, some type of individual time sheet, such as the one suggested in the conceptual model is needed. First there is a need for recognition of the difference between time spent directly on evidence analysis, "direct time", and time spent in activities that are not part of the specific case examinations, "indirect time".

Direct Time

This element can be subdivided into time attributable to the accomplishment of each of the laboratory functional areas which is identified in the conceptual model as follows:

Major Cases

- Firearms
- Physiological Fluids
- Questioned Document
- Other Major Cases

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Narcotics and Dangerous Drugs Analysis

Forensic Toxicology

Drinking Driver Evidence Collection

Laboratories not providing full scope of service operations may not include all of the above areas as direct time categories. Laboratories having major responsibilities for other services as part of their operation such as crime scene search, or fingerprint examination, may want to audit as direct time the effort devoted to these activities. It is recognized that direct time would logically include field investigation expended on any given case. However, for purposes of statistical convenience the conceptual model defines "field investigation" as an individual element of indirect time, so that it can be identified separately from the in-laboratory direct time for a given case. If direct time is reported carefully and accurately, there should be substantial agreement between total direct time as reported on the time sheets and case laboratory time as reported in the case logs.

Indirect Time

This includes effort devoted to staff activities not directly associated with in-house laboratory case examination, but of which some is attributable to specific functional areas and some is not:

Witness Services	Professional Meetings
Field Investigation	Management Meetings
Internal Training	General Management
External Training	Sectional Management
Research and Development	Trial Preparation
Public Information	Badge Duty
Methods Testing	Visitors
Clerical Services	Other
Logistics	

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As recommended in the conceptual model, provision should be made on the effort distribution sheets to account for indirect activity time, although not case specific, to functional areas. There are potential cross checks which can be made between time sheet data and case log data. There should be substantial agreement between the sum of "witness time" from the time sheets and "witness time" from the witness log. This list of indirect time elements is not meant to be exhaustive; laboratory managers may find that their interests or laboratory operations will suggest other pertinent categories of indirect time identification.

Budget Data

Certain budget data is useful to the laboratory director in measuring the performance of his operation. He should know the total dollars associated with his laboratory annual budget and the detailed annual costs of personnel, maintenance and operation. In some laboratories, a separate budget is prepared. In others, the budget is integrated with that of a parent department. In either case, budget data should be available for use in developing performance measures.

There are still other data elements useful in developing laboratory performance measures which usually are not obtainable within the laboratory.

Area Demographics

Certain demographic data regarding the laboratory service area would be useful to the individual laboratory director and to outside analysts in comparing the performance of a given laboratory with other laboratories in other geographic areas. The most important and consistently reported demographic variables are:

Population

Population Density

Per Capita Income

Data on these elements can be obtained either locally or from the U.S. Bureau of Census.

Uniform Crime Report (UCR) Data

UCR Data on crimes committed by crime types in the jurisdictions served by the laboratories gives useful information for trend line analysis and inter-laboratory comparisons. This information should be available from the local jurisdictions, individually, or from the county or state, collectively. For some larger jurisdictions the FBI maintains UCR data.

It would be useful if the laboratory could have completed data concerning the disposition of cases in which physical evidence analyzed by the laboratory was utilized or cases in which laboratory witness work resulted in useful user decisions. However, it was determined during the course of this study that it is difficult to collect this type of data in a complete and systematic manner.

The data elements described above are utilized in the development of the performance measures identified in the next section.

III. PERFORMANCE MEASURES

The following performance measures are generically applicable to criminalistics laboratories. They utilize the data elements described in the previous section. There are three types of uses of laboratory performance measures: (1) they are useful to help an individual laboratory director obtain insight and evaluate the operations of his laboratory; and (2) they are useful to a systems analyst in comparing laboratories or groups of laboratories, usually over the same period of time; and (3) they are useful in developing planning guidelines and optimal prediction data.

As stated in the introduction to this report, the term performance measure is used in the operations sense of the word rather than any evaluative sense; and the purposes of the performance measures identified and developed here are to help the manager or analyst determine what the laboratory is doing, and to help him identify the feasible performance alternatives in allocating his resources.

Most of these performance measures can be calculated simply and the data required can be easily extracted manually. Those measures involving more complex cross tabulations of data which would tend to require automated data processing equipment are identified in the text.

Basic Throughput Statistics

The first performance measures identified are the basic laboratory workload throughput statistics. These are: (1) cases received, (2) cases completed, (3) cases in backlog, and (4) cases deferred in any

given time period. These data should be collected bi-weekly or semi-monthly for each of the functional areas specified in the conceptual model for which service is provided by the laboratory. The semi-monthly summaries of these measures can be arrayed in a manager control chart such as that described in the conceptual model to permit visual determination of trends or to highlight potential problems.

For example, if excessive backlog or increases in backlog are observed, this might be accounted for through examination of changes in the number of incoming cases, changes in deferrals, staff illness, vacations or equipment breakdown. If the excessive backlog is in only one functional area, the manager may be able to shift resources to that area; if there is general understaffing, the manager can use his backlog data to predict the need for additional resources in his next budget request.

Workload vs. Crime Type

The number and percentage of completed laboratory cases associated with specific crime-types is a useful crime-specific workload performance measure. Comparison of this data with UCR data for the same period will provide information concerning the proportion of crimes reported which result in the submission of physical evidence for laboratory analysis. Laboratory managers can compare the percentage of cases submitted of various crime-types for previous time periods with the current time period in order to see changes in demand. Other analysts may want to compare several laboratories on the basis of the percentage of cases involving laboratory analysis for specific

crime types. This data could be useful in analysis of characteristics of specific crime-types, as well as analysis of laboratory operations. When this information is connected with user effectiveness, optimization can be applied. Seasonal and secular trends can be observed for these performance measures.

For laboratories serving a multi-jurisdictional area, the workload vs. crime-type data could be further detailed by agency submitting each case, giving some insight into which of its "customers" tend to bring evidence to the laboratory for which types of crimes. If UCR data is available for the individual jurisdictions served by the laboratory, the "cases submitted/crimes reported" ratio described above can be calculated for each agency served. For laboratories serving areas with many jurisdictions, this "case/crime type/agency" cross tabulation might require automatic data processing equipment to provide timely statistical analyses. This performance measure should be calculated on a monthly basis, because UCR data is usually not available at more frequent intervals.

Workload vs. Functional Areas

A functional area-specific array of completed cases is also a useful performance measure. In addition to the basic count of cases completed by functional area, a measure of the percent of cases entering each functional area of the laboratory can be calculated. If the laboratory is organized along functional lines, knowledge of the proportion of cases accruing to each section will facilitate allocation of

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available resources (people, equipment, floor space) among organizational sections. This measure can serve as prediction data for future budget requests for specific resources for sections with increasing workloads. Even if the laboratory is not organized functionally, this workload/functional area performance measure can help the laboratory manager allocate his floor space, equipment, and maintenance and operation budgets for optimal functional area coverage.

Workload vs. Evidence Type

Evidence-specific workload data tabulations will help in identifying the kinds, quantities and proportions of physical evidence flowing through the laboratory. Cross-tabulating the kinds of evidence with the types of crimes gives insight into which types of crimes result in submission of which kinds of physical evidence. It is probably of little value to statistically measure the types of evidence entering the various functional areas because for most kinds of evidence there is usually only one functional area that performs examinations on that evidence (e.g., blood is analyzed in the physiological fluids section, firearms and cartridges in the firearms section, suspected narcotics in the NDDA section, etc.). Knowledge of the kinds and quantities of the specific types of evidence submitted to the laboratory for analysis and the trends associated with their submission can help the manager plan his needs for reagents, supplies, equipment, storage space and evidence-handling procedures. Analysis of the relationship between crime types and physical evidence demand on the laboratory on a nationwide basis could aid in the planning for new laboratories.

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Workload vs. Outcome

Identifying the outcomes associated with the overall workload of the laboratory can give the manager data concerning the results of laboratory operations. The percentage of cases with inconclusive laboratory analysis outcomes can be a function of the quality or inherent difficulties associated with the evidence submitted to the laboratory; but it can also be a function of the work procedures, people and equipment utilized by the laboratory. Cross tabulation of outcome data with crime types and types of evidence can help the manager determine what crimes result in the submission of evidence with high and low payoff potential in terms of conclusive laboratory analysis. Knowledge of potential payoff could improve laboratory efficiency by indicating where case deferral and rejection policies might be changed to cope with the current situation. Comparing successful outcome proportions among functional areas might help identify areas requiring personnel upgrading, training new equipment or new procedures.

Comparing the proportions of successful outcomes for each of the jurisdictions served by the laboratory may give an indication of the relative quality of evidence submissions by each jurisdiction. For example, if evidence from a given agency consistently obtains low determinative rates in analysis, it may be that the laboratory could improve the success rate by training the personnel of that agency in evidence collection and handling.

In addition to workload data, data should be collected concerning time expended in the provision of services. The time of its professional

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staff is the major resource of the laboratory, and maximum efficiency of laboratory operations can be achieved only through proper allocation of this resource.

Performance measures involving time expenditures can be expressed in hours and percent of laboratory direct time. Time expenditure performance measures should be calculated on a bi-weekly or semi-monthly basis to provide inputs to the manager's short term resource allocation decisions.

Time Expended vs. Crime Type

A crime-specific array of time expended in the laboratory provides a measure of the resources applied by the laboratory in combating the various types of crime. Often some of the short-term objectives of a laboratory, or the criminal justice system of which the laboratory is a part, are expressed in terms of an emphasis on a particular type of crime. The laboratory manager must know how he has applied his resources de facto in a crime specific manner to be able to prove to his superiors and himself that his laboratory is doing its part to meet these objectives. Although the time expended in the laboratory on cases involving a given crime type is to some extent a function of cases submitted to the laboratory, a time trend comparison of the time expended with the trends of cases received and outcomes for that type of crime will give some measure of the laboratory effort in meeting a crime-specific objective.

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Time Expended vs. Functional Areas

The manager may also set some of his own internal laboratory objectives in terms of emphasis of resource allocation on specific functional areas. A breakout of time expended by functional area will give him a measure of how well he is meeting these objectives. Time expended by functional area can be calculated from two separate data sources: (1) lab time data by case from the laboratory case logs, and (2) direct time data by individual criminalist as reported on the weekly time sheets. Comparison of measures from these two data sources should give the manager some idea of the accuracy and consistency with which the log and time sheet data are being reported. Additionally, it is possible to tabulate the total of the direct and indirect time, both in hours and percentage, attributable to a given functional area, if the time sheets recommended in the conceptual model are utilized. This statistic gives a more realistic picture of the resources actually being applied to the several functional areas than any other measure.

Time Expended vs. Type of Evidence

Tabulation of time expended for various types of evidence has limited value as a performance measure; but it might prove useful to the laboratory manager in special cases. For example, if the manager were seeking budget information necessary to a decision on procurement of a new piece of equipment that would reduce analysis time for a specific kind of physical evidence, knowledge of the current annual

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expenditure for analysis of this kind of evidence would be a useful item of data. In any event, data needed for such a calculation exists in the log books (if the recommended data elements are maintained), and extraction of the data for such special analyses is feasible.

Time Expended Per Case

It is possible to calculate the average time expended per case for the entire laboratory workload, for specific crime types, for functional areas, for specific types of evidence, and for individual criminalists. Time expenditure per case averages for the total laboratory workload and for specific crime types are of little value as performance measures because of the high variability of laboratory time associated with these categories. However, it may prove useful for the laboratory manager to examine the time expended per case for functional areas, specific types of evidence and individual staff members and to compare changes in these characteristics over time. In calculating these measures, however, care should be taken to use a long enough time span per observation (i.e., six months to one year) to insure that the sample size is large enough to provide statistical relevance to the values calculated; the analyst should take the range and distribution of hours per case into account when comparing the average values for these ratios. A useful way of accounting for the distribution of time per case for a sample or set of observations is to utilize a cumulative distribution graph. Exhibit 1 is an example of a cumulative distribution graph for time per cases for a sample of cases for a hypothetical

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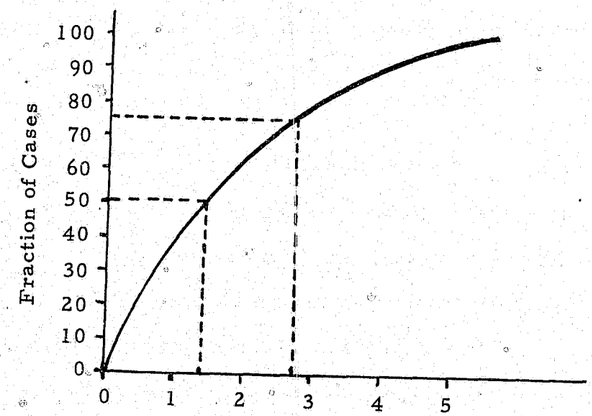

EXHIBIT 1 CUMULATIVE DISTRIBUTION OF TIME EXPENDED PER CASE FOR A HYPOTHETICAL LABORATORY

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functional area or type of evidence within a hypothetical laboratory. This graph is constructed by arraying cases sampled in terms of increasing time to complete, and plotting time per case as a function of the fraction of cases completed for any given interval of time. The graph in Exhibit 1 shows that one half of the cases in the sample were completed in 1.4 hours or less (the median time per case), and three-fourths of the cases were completed within 2.7 hours.

Response Time

Although it is important for the laboratory manager to know how long it takes to perform an analysis, the user of the laboratory is more interested in the expected response time for evidence submitted. In fact, if there were one quantitative performance measure that users of the laboratory could select in assessing the efficiency of the laboratory, it would be response time. Response time as defined for this report is the time, in hours or days, elapsing between the time of evidence submission and the time the laboratory report on the analysis of that evidence is available to the user. Because response time is the major performance measure of interest to laboratory users, the manager of the laboratory should maintain response time data by crime type, by functional area, and by evidence type. Statistically, the pertinent measure is response time per case for the category of interest; the analyst should examine the range of observations and the distribution of response time in using the data. The use of cumulative distribution graphs, as described in the previous section, is also useful here, taking the distribution of response times into account.

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Personnel Time Distributions

The personnel effort distribution sheet data offers the laboratory manager a wealth of information and insight into the manner in which the laboratory staff is spending its time in performing the multiplicity of duties required to produce the services provided. Of particular interest are the amounts and percentages of time spent on direct case-specific activities and on indirect activities. This information is particularly useful to the laboratory manager in planning and forming the basis for his budget submissions. Too often the budget analyst estimates the manpower requirements of an operation such as a crime laboratory without appropriate regard for the amount of indirect time required. The manager can also obtain the direct time versus total laboratory time ratio for functional areas of the laboratory and for subgroups of personnel (such as supervisory staff, professional staff, technicians, etc.). Tabulation of times and time ratios for specific indirect time categories or groups of categories is also useful. For example, a laboratory manager should know how much the time of his staff is devoted to: (a) trial preparation and witness time, (b) training time and (c) badge duty time. As a measure of laboratory quality, he should also know how much staff time is being devoted to research and development effort. From these tabulations he can determine how the time expended in specific areas compares with the times budgeted or planned for those purposes.

Cost Per Case

Performance can also be measured in terms of a cost per man hour for the laboratory as a whole. This ratio is computed simply by

dividing the annual operating budget expenditures for salary, maintenance and operation by the number of man hours paid for on payroll records during a year. Rather than a per case basis, this budget ratio computation should be applied on an hour basis because of general overhead costs which are not attributable to specific evidence or crime types. However, for laboratories which are organized functionally and for which meaningful cost allocations by functional area can be made, it may be feasible to compute an average cost per case for each functional area for salaries, maintenance and operation. This would then result in a different rate of cost per drinking driver or toxicology case. Analysis of cost per case over a period of time may provide the manager with some insight into the efficiency of his operation. Analysts studying the operations of several laboratories may obtain a rough measure of relative efficiencies of those laboratories through use of cost per man-hour or cost per case. Another comparative cost reference index is available by dividing the annual operating costs by the population of the jurisdiction which is provided full service to give a dollar per capita cost.

Demographic Factors

The analyst comparing laboratories may be able to "normalize" all individual laboratory statistics to some extent by applying a demographic factor to analyses. Relationships between workloads and factors such as population, population density and per-capita income should be explored. The limited sample of laboratories observed in this study

precludes the identification of specific or statistically significant relationships among these factors, but statistics concerning demographic variables compared with laboratory workloads for the laboratories studied are included in Volume Two of the report.

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IV. SCORING SYSTEM

A. Introduction

As a part of the problem of performance measure development in a hitherto unexplored subject area, several methods of assessment appear to be logical. The traditional methods of statistical analyses which involve the collection of a set of data elements followed by quantitative analyses to learn such things as shapes and central tendencies of distributions, time trend characteristics and correlative relationships are fundamentally applicable. All of these methods have been explored in the creation of crime laboratory performance measures and developed for application where appropriate. Various characteristics of criminalistics operations can be usefully assessed and examined by these methods.

However, when it comes to the problem of examining the anatomy of a particular crime laboratory operation, an analytical tool of sharp focus is needed to pinpoint aspects of specific operational areas which have a high potential of benefit from management changes. There are essentially three primary characteristics of a crime laboratory operation which can be examined analytically for this purpose. They are controlled by:

1. Resources--the means provided for accomplishing the job in terms of such elements as hierarchial policy, personnel, equipment, facilities and management.
2. Service -- the implementation of resources as demonstrated by the level of service provided in terms of its availability, quantity and timeliness.

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3. Quality -- as evidenced by its ability to meet the technical requirements of the law and its professional validity and credibility to the satisfaction of the basic requirements of the science of identification.

An incisive and critical analysis can be made of his operation by any crime laboratory director, provided that he has a scoring procedure available which will enable him to obtain a profile of his operation consisting of the elements of these characteristics together with indicators to provide comparisons with comparable components of the conceptual model of the achievable state-of-the-art.

In order to accomplish such an operationally specific index rating, a scoring system has been developed. The elements of analysis were selected on the basis of being critically determinative indicators, together with the property of lending themselves to ease of scoring with a minimum of subjectivity. In the categories of resources (Category I) and service (Category II), the total score per item, per element and per category is ten. If the number of scored components is more or less than those specified, the index rating is not affected because all scores are equally weighted and the summary scores result from a division of the total scores by the number of inputs.

The quality factor has been divided into two separate entities which are security (Category III) and analytical quality elements (Category IV). These two independent quality factors are used as multipliers in the scoring system.

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Used in this way, the security and quality ratings become sensitive factors which significantly control the index rating. This is as it should be. It meets the situation of rating a laboratory that has a high output rate with short response time and no backlog, but with a very low standard of quality or a weak security system. The vulnerability of laboratory evidence to inadmissibility rulings increases in direct proportion to lack of security. The highest quality of laboratory findings can be nullified by an inadequate security system which can prevent pertinent evidence from being admitted to consideration by the trier of the fact. Likewise, a large volume of analytical output with complete security has little, if any, value when combined with examination quality which is not credible. The quality factors used as multipliers accomplish this purpose in the index rating.

Consequently, a laboratory with excellent resources and rapid service will receive a low rating number if either the security rating or the quality rating is low. This correctly indexes the performance of the laboratory. When the security and quality factors both approach their maxima, the effects of good resources and service are synergized into maximum performance which is reflected by a high index rating.

Simply stated, the Crime Laboratory Performance Index Rating is accomplished by scoring the items involved in rating the resource and dividing by the number of rated items to obtain an average number index. The same is done with items which give information regarding service production performance. These are then averaged and multiplied by the security and quality factors to give the final index rating which is called Crime Laboratory Performance Index Rating (CLPIR).

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A formal description of the scoring logic is given in Exhibit 6, Description of Scoring Logics, which precedes the instructions for scoring on CLPIR and FACLPIR worksheets.

The scoring system has been devised for the purpose of having a management device which will evaluate crime laboratories and provide a profile of information concerning a particular criminalistics operation. Users of such a system must recognize that it produces information only as accurate as the scope of questions which are raised combined with the capability of the rater to make a scoring judgement. Such a rating system should be as independent of the subjectivity of the rater as possible. Not all of the factors involving laboratory performance lend themselves to such a rating scheme. Nevertheless, as a pioneering effort and being fully aware of the trepidations involved, the first iteration of a scoring system has been developed. There should be no question that it is in the first iteration stage and will need refinements through application and evaluation over a period of time, based on field testing.

Its virtue is that it provides the framework of a tool which can be expanded as much as desired to obtain objective comparisons of any criminalistics operation within the achievable state-of-the-art as expressed in the conceptual model. It can be used immediately without modification to establish baseline data for a crime laboratory operation of any size or scope of service function prior to any perturbations which might be introduced, and again used in an identical manner at the end of a perturbation period to obtain a measure of changes in the laboratory performance profile caused by the changes which are applied. It can be applied to an operation as a whole (CLPIR) or in a modified form applied to the separate functional areas of a laboratory

operation (FACLPIR). The final scoring indices are designated respectively as Crime Laboratory Performance Index Rating (CLPIR) and Functional Area Crime Laboratory Performance Index Rating (FACLPIR).

A master scoring sheet is used to obtain the analysis profile of a given laboratory from which the indices are computed. The profile can be displayed as a bar graph to produce visualized presentations for comparison and contrast. An example is provided in Exhibit 7.

Scoring worksheets (Exhibit 2) are used to develop the scoring details with the assistance of accompanying instructions. From these worksheets, the major scoring elements are transferred to the master worksheet (Exhibit 3) which produces the profile. Computations of ratings for CLPIR and FACLPIR are made as shown in Exhibits 4 and 5.

The scoring system integrates those bits of information that lend themselves to ease of scoring by giving consideration to resources, service to users, security, and quality. The highest possible value of each profile element and category score is ten. The highest possible value of the security factor and the quality factor is one. The highest possible value of the CLPIR and of FACLPIR is one hundred.

The meaning of absolute values of these indices at the present time is not known. Interpretations will have to be derived from future use and experience. Because the indices lend themselves to tailoring to specific situations in which perturbation is planned, the absolute value can be expected to vary because of aspects selected for scoring. The more that performance factors are explored and scored in breadth

and depth, the more the absolute values should approach a true absolute expression of performance differences from the conceptual model. The amount of expansion that can be achieved by introducing additional scoring elements, is limited only by the needs and ingenuity of those who will utilize its capabilities.

Differences between readings of the overall index (CLPIR) for different laboratories may be meaningful for the mid-to-higher portions of the scale (50-100). Differences at the lower end of the scale (0-20) do not appear to be meaningful because all such laboratories require so much improvement. It is important, however, to see how such laboratories would differ if only the security and analytical controls were increased so that these quality factors become one for both. Further, the index should be applied to those elements of a given laboratory which are completely under the control of the laboratory director and that rating used to evaluate the laboratory operation under the imposed constraints (personnel, facilities, equipment, etc.). In a like manner, the index should be applied to those elements controlled by those echelons above the laboratory director to evaluate the support given by higher authority.

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CRIMINALISTICS OPERATIONS
CLPIR SCORING WORKSHEET

	Sub Item Score	Item Score	Element Score	Category Score
I. Resource Rating Category				
A. Policy Element				
1. Place in Government Structure				
2. Level of Accountability Reporting				
3. Consolidation of Resources				
a. DDEC				
b. NDDA				
c. FT				
d. MC				
4. Authority and Responsibility				
a. Documentary Delegation				
b. Internal Redeployment of Personnel				
c. Temporary Help				
d. Budget Expenditure				
5. Support by Users				
a. Budget				
b. Grants				

EXHIBIT 2 CLPIR SCORING WORKSHEET

PRC SSC

CRIMINALISTICS OPERATIONS
CLPIR SCORING WORKSHEET

	Sub Item Score	Item Score	Element Score	Category Score
I. B. Staffing Element				
1. Strength authorized/conceptual				
2. Actual strength/authorized				
3. R & D personnel				
C. Equipment Element				
1. Microscopes				
2. Spectrophotometers				
3. Gas chromatographs				
4. Balances				
5. Cameras and enlargers				
6. Shop tools				
7. Miscellaneous				
D. Facilities Element				
1. Work Areas				
a. Reception area				
b. Evidence receiving area				
c. Interim evidence storage				
d. Blood alcohol analysis				
e. Narcotics and dangerous drugs analysis				

EXHIBIT 2 (cont.)

PRC SSC

CRIMINALISTICS OPERATIONS

CLPIR SCORING WORKSHEET

			Sub Item Score	Item Score	Element Score	Category Score
I.	f.	Forensic toxicology analysis				
	g.	Blood identification				
	h.	Photomicrography				
	i.	Radiography				
	j.	Test firing in water				
	k.	Test firing, horizontal backstop				
	l.	Library				
	m.	Conference room				
	n.	Administrative area				
	o.	Office for director				
	p.	Office for supervisors (10 points x number of sup. offices)				
	q.	Vehicle examination area				
	r.	Storage of laboratory current reagents				
	s.	Mechanical shop				
	t.	Separate secure area for narcotics storage				
	u.	Bulk storage for laboratory resource materials				
	v.	Outside ventilated storage for bulk supplies of acids, solvents and gases				

EXHIBIT 2 (cont.)

PRC SSC

CRIMINALISTICS OPERATIONS

CLPIR SCORING WORKSHEET

			Sub Item Score	Item Score	Element Score	Category Score
	w.	Photographic negative development				
	x.	Photographic print making				
	y.	Demonstrative exhibit production				
	z.	Latent fingerprint examination area				
2.	Facilities Services					
	a.	Deionized water				
	b.	Distilled water				
	c.	Cold water				
	d.	Thermo-regulator mixed water for photo development control				
	e.	Exterior supplied and piped gas supply of Nitrogen				
	f.	Exterior supplied and piped gas supply of oil free chemically dry air				
	g.	Add 10 points for every other type of exterior manifold supplied gas				
	h.	Enclosed fume hoods (4 pts. per hood - limit 12 pts.)				
	i.	220 V. A. C.				

EXHIBIT 2 (cont.)

CRIMINALISTICS OPERATIONS

CLPIR SCORING WORKSHEET

		Sub Item Score	Item Score	Element Score	Category Score
I.	j. Two 30 amp 110 v. circuits per gas chromatograph, equivalent heavy duty equipment (see instruction)				
	k. Acid proof sink sewage lines				
	l. Air temperature control				
E.	Management Control Element				
	1. Standing Operating Procedure				
	a. Attendance				
	b. Causes for Dismissal				
	c. Ethics				
	d. General Operational Policy				
	e. Licenses				
	f. Maintenance				
	g. Mission				
	h. Promotion Policy				
	i. Public Information				
	j. Referee Analysis				
	k. Section Responsibilities				
	l. Security				
	m. Special Staff Responsibilities for supervision				

EXHIBIT 2 (cont.)

CRIMINALISTICS OPERATIONS

CLPIR SCORING WORKSHEET

		Sub Item Score	Item Score	Element Score	Category Score
I.	n. Vacation Policy				
	2. Manuals of Methodology				
	a. Section or unit				
	b. Additional				
	3. Workload Input Information				
	4. Backlog Information				
	5. Witness Activity				
	6. Manager Control Chart				
	7. Effort Distribution				
F.	Firearms Examination Element				
	1. Water recovery tank				
	2. Horizontal Backstop for pattern tests				
	3. Firearms confiscation collection program				
	4. Class Characteristics components file updated from cases and collection:				
	a. Fired cartridge cases				
	b. Fired bullets				
	c. Unfired ammunition				
G.	Personnel Management Element				
	1. Do formal job descriptions exist which accurately describe each position in the laboratory?				
	2. Is a prescribed career ladder in existence?				

EXHIBIT 2 (cont.)

CRIMINALISTICS OPERATIONS

CLPIR SCORING WORKSHEET

			Sub Item Score	Item Score	Element Score	Category Score
I.	3.	Is proficiency testing required for promotion?				
	4.	Do the laboratory staffing and promotion procedures utilize the alternate classification concept (as described in conceptual model)?				
	5.	Does laboratory subsidize continuing formal education of staff members through paid time off for classes or tuition grants?				
	6.	Are merit pay increases available to employees who perform superior work?				
	7.	What is the average tenure among professional staff of the laboratory?				
	8.	Does each member of the professional staff have a baccalaureate degree or equivalent in criminalistics, or basic science such as chemistry, biochemistry, physics, etc.?				
	9.	What is the average of years of laboratory staff working experience?				
H.	Library and Technical Files Element					
	1.	Subject Index File				
		a. Books				
		b. Technical Files				
	2.	Central location for library				
	3.	Library SOP or Manual				
	4.	Journal Subscriptions				

CRIMINALISTICS OPERATIONS

CLPIR SCORING WORKSHEET

			Sub Item Score	Item Score	Element Score	Category Score
I.	I.	Technical Photography Element				
		1. Step tablets in use				
		2. Densitometer in use				
		3. Standard Grey Scale Test Card in use				
		4. H & D curves routinely made				
		5. Negative Material Exposure & Development calibrated for specific enlargers				
		6. UV photography routine				
		7. UV fluorescence routine				
		8. IR fluorescence routine				
		9. IR photography routine				
		10. Radiography routine				
J.	Performance Measure Information Element					
	1.	Laboratory Case Number				
	2.	Date Received				
	3.	Submitting Agency				
	4.	Crime Type				
	5.	Kind of Evidence				
	6.	Laboratory Functional Area				
	7.	Time Expended by Laboratory				
	8.	Outcome of Analysis				
	9.	Criminalist Assigned				
	10.	Report Date				

PRC SSC

CRIMINALISTICS OPERATIONS
CLPIR SCORING WORKSHEET

	Sub Item Score	Item Score	Element Score	Category Score
11. Case Deferral				
12. Effort Distribution				
13. Budget Data				
II. Service and Production Performance Rating Category				
A. Availability Element				
1. Weekends and Holidays				
2. Nights				
B. Response Time Element				
1. DDEC				
2. NDDA				
3. FT				
4. MC				
C. Backlog				
1. DDEC				
2. NDDA				
3. FT				
4. MC				
III. Security Rating Category				
A. Perimeter Security Element				
1. Are all doors alarmed?				
2. Are windows all barred or alarmed?				
3. Are all other possible entrance and exit apertures blocked or alarmed?				

PRC SSC

CRIMINALISTICS OPERATIONS
CLPIR SCORING WORKSHEET

	Sub Item Score	Item Score	Element Score	Category Score
III. 4. Are perimeter doors steel?				
5. Non-removable pins in all perimeter doors?				
6. Dead bolts on all perimeter doors?				
B. Key Control Measures Element				
1. Critical areas limited to personnel on a need to enter basis				
2. Special keys to narcotic and dangerous drug evidence				
3. Special keys to narcotic and dangerous drug pure substance reference collection				
4. Special key to enthanol reagent storage				
5. Key control register				
C. Visitor Control Procedure Element				
1. Register				
2. Badge or Smock				
D. Standing Operating Procedure Element				
1. Explicit Written instructions to Receptionist				
2. Complete Written instructions to Staff				
IV. Quality Rating (Total of 1.00) Category				
A. Test Disciplines Element				
1. DDEC				
2. NDDA				
3. FT				

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CRIMINALISTICS OPERATIONS

CLPIR SCORING WORKSHEET

		Sub Item Score	Item Score	Element Score	Category Score
IV. B.	Major Case Notes and Records Element				
	1. Systematic Overview				
	2. Notes complete with sketches				
	3. Notes include photomicrographs of bullet, cartridge case and tool mark identifications				
	4. Digestive summary and conclusions in notes				
C.	Miscellaneous				
	1. Professional Publications				
	2. Blind Samples				
	3. Planning Estimates				
	4. Work Review				
	a. Director				
	b. Supervisor				
	5. Code of Ethics				
	6. Referee Examinations				
	a. Policy				
	b. Use Facilities				
	c. Use Case Notes				
	7. Professional Meetings				
	8. Interior Training				
	9. Exterior Training				

EXHIBIT 2 (cont.)

PRC/SSC

PROFILE WORKSHEET

Components of Scoring Which Lead to

Computation of Crime Laboratory Performance Index Rating

	Item Score	Element Score	Category Score
I. Resource Rating Category			
A. Policy Element			
B. Staffing Element			
C. Equipment Element			
D. Facilities Element			
E. Management Control Element			
F. Firearms Examination Element			
G. Personnel Management Element			
H. Library and Technical Files Element			
I. Technical Photography Element			
J. Performance Measure Information Element			
II. Service and Production Performance			
A. Availability			
B. Response Time			
1. DDEC			
2. NDDA			
3. FT			
4. MC			

EXHIBIT 3. PROFILE WORKSHEET

PRC/SSC

PROFILE WORKSHEET

Components of Scoring Which Lead to
Computation of Crime Laboratory Performance Index Rating

	Item Score	Element Score	Category Score
II. C. Backlog			
1. DDEC			
2. NDDA			
3. FT			
4. MC			
III. Security Rating (Total of 1.00)			
IV. Quality Rating (Total of 1.00)			
A. Test Disciplines			
B. Major Case Notes and Records			
C. Miscellaneous			
1. Professional Publications			
2. Blind Samples			
3. Planning			
4. Work Review			
5. Code of Ethics			
6. Referee Analysis			
7. Professional Meetings			
8. Interior Training			
9. Exterior Training			

EXHIBIT 3 (cont.)

PRC/SSC

COMPUTATION OF FINAL SCORE ON CRIME LABORATORY
PERFORMANCE INDEX RATING (CLPIR)

I. Resource Category Rating _____

II. Service and Production Category Rating _____

$$\left(\frac{\text{CAT I Rating} + \text{CAT II Rating}}{2}\right) \times 10 \times \text{Security Rating (III)} \times \text{Quality Rating (IV)} = \text{CLPIR}^*$$

*Express to two significant figures

EXHIBIT 4. FINAL CLPIR CALCULATION

PRC/SSC

RATING BY FUNCTIONAL AREAS

TO PROVIDE

FUNCTIONAL AREA CRIME LABORATORY PERFORMANCE
INDEX RATING (FACLPIR)

ELEMENTS

I. C. Equipment Element
D. Facilities Element
II. A. Availability
B. Response Time
E. Backlog
III. Security
IV. Quality

DDEC	NDDA	FT	MC	FP

Computations

$$\frac{10\ (I + II)}{2} \times III \times IV = FACLPIR^{*}$$ For each Functional Area

*(Two significant figures)

EXHIBIT 5. FACLPIR COMPUTATION

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INSTRUCTIONS FOR SCORING

ON

CLPIR AND FACLPIR

WORKSHEETS

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SCORING LOGIC

I. Resource Ratings

A = Score for policy element

N_1 = Total points rated for all questions in a group

T_1 = Total possible points for a group

Items A through J of this section are scored similarly.

II, III. All items in these sections are scored in the same fashion as those in I.

IV. A = Score for test discipline element

p_1 = Total points rated all questions pertaining to DDEC

t_1 = Total possible points for questions in DDEC group

a_1 = Score for DDEC procedure

p_2 = Total points rated all questions pertaining to NDDA work

t_2 = Total possible points for questions in NDDA group

a_2 = Score for NDDA procedure

p_3 = Total points rated all questions pertaining to FT work

t_3 = Total possible points for questions in FT group

a_2 = Score for FT procedure

p_4 = Total points rated all questions pertaining to MC work

t_4 = Total points possible for questions in MC group

a_4 = Score for MC procedure

p_5 = Total points rated all questions pertaining to technical photography

t_5 = Total points possible for questions in photography group

a_5 = Score for photography group

p_6 = Total points rated for all questions pertaining to forensic firearms examinations

t_6 = Total possible points for questions in forensic firearms group

a_6 = Score for forensic firearms group

B and C are scored similarly.

EXHIBIT 6. DESCRIPTION OF SCORING LOGIC

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If there are other specialized areas that need to be included to give coverage to the scoring process, they may be added so that the value of A is determined as follows:

$$A = \frac{1}{n} \sum_{i=1}^{n} \frac{P_i}{t_i}$$

If any questions or elements are not applicable, they are marked NA in the scoring sheets and the total possible points is reduced by the amount of points assigned to the question.

If the scoring information is applicable, but not available during the time of study, indicate by INAV. When preparing the graphical profile, use these indicators as a 100 % bar. Omit the NA and INAV items and elements from computations in numerical scores.

Some scoring items are designed to score more than 10 and the backlog scores may result in negative numbers. However, this can be represented in the profile and causes no difficulties in the final scoring. If no instructions to the contrary are given, all no answers are scored zero.

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INSTRUCTIONS FOR SCORING ELEMENT I-A

I. Resource Rating Category

A. Policy Element

1. Place in Government Structure

Score 10 if completely independent of law enforcement control

8 if under control of federal, state or county prosecutor

5 if under control of chief of police, sheriff, coroner, medical examiner, or chief of federal enforcement agency

2. Level of Accountability Reporting

Score 10 if accountable directly to non-law enforcement elected representative of taxpayer, such as Board of Supervisors, City Council or their Executive Officer

8 if directly accountable to state prosecutor, county prosecutor or to chief of enforcement agency

Note: Subtract 1 from each above rating for each echelon of staff below agency chief to whom criminalistics director is responsible in the organizational structure.

Example: Laboratory director is responsible to captain in charge of service support, who is responsible to the Deputy Chief of Operations, who is responsible to Police Department Chief.

Score = 6

3. Consolidation of Resources

Score NA for laboratories of more than 3,000,000 population. For laboratories serving less than 3,000,000 population, score 2.5 for each functional area as described in the model, i.e., DDEC, NDDA, FT, MC. If other agencies in the county area perform any portion of the services, reduce the rating by the fraction of population served by other agencies.

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4. Authority and Responsibility

Score 10 to item a. if higher authority has given the laboratory director written delegation of responsibility and authority of independent professional and technical supervision, subject only to administrative policy within a given set of resources including prescribed budget, personnel procedure, etc. Score zero if there is no documentation.

Score 10 for Item b. if the laboratory chief can organize and reorganize his staff at any time without higher approval provided that such dispositions are consistent with job descriptions.

Score 10 for Items c. and d. if the laboratory chief can appoint and dismiss temporary help on his own authority and can obligate budgeted funds for the purpose planned without further approval, provided that this is done in accordance with prescribed administrative policy procedures.

Deduct 2 points from each item scored for each point of veto possibility in the chain of higher or lateral authority.

5. Support by Users

Score NA if within an agency which is sole user.
Score the percentage of user agencies who in writing or orally in person at the most recent hearings for the criminalistics budget or grants expressed justification of user demands on the operation. Divide % by 10.

INSTRUCTIONS FOR SCORING ELEMENT I-B

B. Staffing Element

1. Strength Authorized/Conceptual

Determine conceptual strength from staffing guide, Exhibit 7. Divide conceptual strength into authorized strength. Do not count grant funded interim positions or extra help positions which are not permanently budgeted. This number times ten gives the item score for I-B. 1.

POPULATION SERVICED
(in thousands)

POSITIONS	50 (40-60)	100 (80-120)	250 (225-275)			500 (400-600)						1,000 (900-1,100)							2,000 (1,800-2,200)						
	NS	NS	EXEC	CS-I	CS-II	EXEC	DDEC	NDDA	FT	MC	TOTAL	EXEC	DDEC	NDDA	FT	MC	LS	TOTAL	EXEC	DDEC	NDDA	FT	MC	LS	TOTAL
• professional - management																									
Director			1			1					1	1						1	1						1
Operations Supervisor												1						1	1						1
Section Supervisor							½	½	1	1	3		½	½	1	1		3		1	1	1	1		4
• professional - non-management																									
Criminalist I, II, III, IV (Alternate Classification)	1	2		1	1					4	4					9		9					21		21
Forensic Toxicologist					1										3			3				6			6
Forensic Chemist (Instrumental)									1		1						1	1						2	2
• nonprofessional - scientific																									
Forensic Science Technologist III					1		1	1			2														
Forensic Science Technologist I, II (Alternate Classification)		1		1	1		1½	1½	2	1	6		2	1	4	2		9		5	3	8	4		20
Laboratory Assistant						½			1	½	2		½	½	1	1		3		1	1	2	1		5
• administrative - clerical																									
Administrative Assistant																	1	1						1	1
Chief Clerk						6					6						1	1						1	1
Clerical (Typist, Steno, Clerk) Classes	½	1	2														6	6						12	12
Evidence Controller																	1	1						2	2
Sub-totals	1½	4	3	2	4	5	2½	2	5	6½	21	2	4	3	9	13	10	41	2	7	5	17	27	18	76
Laboratory Total	1½	4	9			21						41							76						

LEGEND:

EXEC -- Executive Section
DDEC -- Drinking Driver Evidence Collection Program Section
NDDA -- Narcotics and Dangerous Drugs Analysis Section
FT -- Forensic Toxicology Section
MC -- Major Cases Section
LS -- Logistics Support Section
NS -- Non-Sectional Organization
CS-I -- Combined Major Case and NDDA Sections
CS-II -- Combined DDEC and FT Sections

EXHIBIT 7. STAFFING GUIDE OF CONCEPTUAL MODEL BASED UPON ACCOMPANYING DEMAND MODEL

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2. Actual Strength/Authorized

For this item, count all filled positions no matter how funded and divide by the authorized strength number used in Item I above. This number times 10 gives the item score for I-B.2.

3. R & D Personnel

Score one point for each % of the professional staff time totally committed to R & D during the past 12 months.

To complete element score, add Item 1 and Item 2 scores, divide by two and add Item 3 score. This total gives element score for I-B.

INSTRUCTIONS FOR SCORING ELEMENT I-C

C. Equipment Element

Compute the number of items in each group specified by the conceptual model as listed on the scoring sheet. Divide this number into the number of like items in active use by the laboratory. This number for each group, times ten, gives the item score. The element score is the total of the item scores divided by seven. The items in this element can be expanded to any extent desired to obtain a more detailed evaluation of equipment. Every item of the conceptual equipment list can be considered to be a separate item if need be.

INSTRUCTIONS FOR SCORING ELEMENT I-D

D. Facilities Element

1. Work Areas

Score ten points for each area which is a separately designated and committed work area. The sub-item receives ten points only if used exclusively for the designated function. If used for multiple functions, divide ten by the number of shared functions to obtain the numerical score. If any of the

specified work areas are utilized by crime laboratory personnel but located outside the perimeter of the laboratory itself, score only five points, except for sub-item v. Add the total of points scored and divide by 26 to obtain the score for item I-D, 1. Note exception in score sheet items p. 31.

2. Facilities Services

Score 10 points for each facilities sub-item in full use. Sub-items e., f., g. are to be scored zero unless the gas tank is located outside the laboratory proper. Note instruction at h. on score sheet. Sub-item j. refers to circuits and breakers, not outlets. To score j., count the number of pieces of equipment requiring heavy duty electrical service and multiply by 2. Divide this number into the number of 30 amp. circuits and multiply by 10 to obtain the sub-item score. Sub-item k., score 10 points if all sinks are equipped with acid proof sewage lines. Score zero if not.

Sub-item l., score 10 points if air temperature is designed to be controlled to $\pm 2^{\circ}$ F. Zero otherwise. Total points in Item 2 and divide by twelve to obtain numerical score. for facilities services item.

INSTRUCTIONS FOR SCORING ELEMENT I-E

E. Management Control Element

1. Standing Operating Procedure

Standing operating procedure should be inspected to ascertain whether or not the items listed in the score sheet are properly addressed. Score zero if there is no SOP from director to staff. Score ten for each item covered. The item score for I-E. 1 is obtained by dividing the total sub-item scores by number of sub-items listed.

2. Manuals of Methodology

Score this item by counting the number of functional areas that the scope of laboratory service is expected to include. There should be a manual of methodology item for each functional area. Score one point for each manual pertaining to the overall function of a section or a unit. Beyond this there are specialized methods for various subdivisions of functional areas. Score one point for each method specified in a manual to a maximum of ten points for Item 2. To qualify for other than a zero score, a specified method must include a list of apparatus and the details of procedure, pertinent references, use of control samples, interpretation and reporting and be authenticated and dated by the director as a prescribed method. Count the number of points to a maximum of ten to obtain the item score for I-E.2.

3. Workload Input Information

Score ten points if input workload is summarized at least monthly by functional area. Zero if not.

4. Backlog Information

Score ten points if backlog is summarized in accordance with instructions II-C supra by functional area at least once monthly. Zero if not.

5. Witness Activity

Score ten points if a witness activity log is maintained on a day to day basis.

6. Manager Control Chart

Score ten points if a manager control chart is maintained as described in the conceptual model. Zero if not.

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7. Effort Distribution

Score ten points if effort distribution as guidelined in the conceptual model is recorded and studied in intervals of not more than three months. Zero if not.

The element score is determined by summarizing item scores and dividing by the number of items.

INSTRUCTIONS FOR SCORING ELEMENTS I-F., G., H., I.

F. Firearms Examination Element

G. Personnel Management Element

H. Library and Technical Files Element

I. Technical Photography Element

Score ten points for each "Yes" item or sub-item, and perform a percentage calculation to determine item and element scores except for Items G. 7, G. 9 and H. 4. Score Item G. 7 one point for each year of average tenure and score Item G. 9 one point for each year of average staff experience. Score Item H. 4 by awarding one point per subscription to a maximum of ten and 0.2 point for each additional. To qualify for scored points, subscriptions must be paid for by the parent agency, not the individual employee.

INSTRUCTIONS FOR SCORING ELEMENT I-J

J. Performance Measure Information Element

1. Laboratory Case Number

Score ten points if the laboratory maintains its own set of sequential laboratory numbers for incoming cases. Different logs and sets of numbers can be maintained for each functional area or one master log with one numbering scheme can be utilized.

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2. Date Received

Score ten points if the date received is recorded for each incoming case in the case log.

3. Submitting Agency

Score ten points if the laboratory serves only one submitting agency. If the laboratory serves more than one submitting agency, score ten points if the submitting agency is recorded for each case in the case log(s).

4. Crime Type

Score ten points if the type of crime associated with each laboratory case is recorded in the case log(s).

5. Kind of Evidence

Score ten points if the type(s) of evidence submitted and examined for each case is (are) recorded in the case log(s).

6. Laboratory Functional Area

Score ten points if the laboratory functional area(s) associated with each case is (are) specified in the case log(s).

7. Time Expended by Laboratory

Score ten points if the laboratory maintains a record of the direct laboratory time expended on each case.

8. Outcome Analysis

Score ten points if the laboratory maintains a record of the outcome of the analysis for each case.

9. Criminalist Assigned

Score ten points if name of the criminalist assigned to each case is recorded in the case log(s).

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10. Report Date

Score ten points if the time and date on which the output report is authenticated for release is recorded in the case log for each case.

11. Case Deferral

Score ten points if the laboratory has a case deferral system and maintains a record of deferred cases.

12. Effort Distribution

Score ten points if the laboratory maintains a system for collecting effort distribution in terms of time expended by its staff on laboratory operations as described in the conceptual model.

13. Budget Data

Score ten points if within the laboratory budget, information is maintained on the annual costs of salaries, maintenance and operating expenses and divide into accounts which reflect the total laboratory operation.

INSTRUCTIONS FOR SCORING ELEMENT II-A

II. Service and Production Performance Rating Category

A. Availability Element

1. Weekends and Holidays

If open on weekends and holidays for full service the same as regular workdays, score 10. If closed but full service on standby, score 8. If on standby to do selective emergency work only, score 5. If there is no specified service on these days, score zero.

2. Nights

If 24-hour full service is provided on weekdays, score 10. If closed but full service on standby, score 8. If on standby

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to do selective emergency work only, score 5. If there is no specified service on these days, score zero. If 16-hour full service is regularly provided on any days, score one point for each day of week.

INSTRUCTIONS FOR SCORING ELEMENT II-B

B. Response Time Element

From a study of response time data over a two month continuous period, rate as follows: (Hours are defined as elapsed hours, not working hours. Deferred case response times are measured from the time that a decision is made to remove from deferred status to completion plus the time from receipt to placement in deferred status to completion plus the time from receipt to placement in deferred status. Be sure to exclude periods of specific deferral from response time in each case in which it is marked and categorized as such. See Instruction II-C for definition of completion times.)

1. DDEC

If 50% of case reports are available to the user within 24 hours after laboratory receives the case, score 15. Reduce by 1.5 points for every additional 24 hour period required to include 100% cases.

2. NDDA

If 50% of case reports are available to the user within 30 minutes after receipt by laboratory, score 15. If less than four hours, score 12.5; if within 24 hours, score 10. Deduct 2.5 points from 10 for every twenty-four hour period after the first 24 hours that are required for 95% of the case reports to be ready for the user.

3. FT

Two scorings are necessary: One for comprehensive coroner-medical examiner cases in which multiple tissue samples are

examined and the other for blood and urine samples only. The two scorings must be combined in order to avoid over-weighting the forensic toxicology area. Score as follows:

a. Comprehensive Cases - Score 15 if report available within 24 hours of receipt by laboratory in 95% of cases. Deduct 2 points for each 24-hour period after the first 24 hours.

b. Blood and Urine Sample Cases - Score 15 if results available within four hours of receipt in 50% of cases; score 13 if within eight hours; then if 95% are complete within 24 hours, score 11 and deduct 2 points for each 24 hours thereafter until the date that 95% of cases is completed. Combine by adding a and b together and divide by two.

4. MC

Major Cases are rated 15 if 50% of the cases are in finished report form (authenticated) or have been finally reported orally and so documented within 24 hours of receipt. The following table is used to give the highest possible rating.

TABLE SHOWN ON NEXT PAGE

Counting of cases within the two month period should include only cases finalized in the period, including those completed from receipt in an earlier period. Any cases not closed but received in the two month period are measured in the backlog scoring.

FRACTION OF CASES			
50%	75%	95%	Score
Days			
1			15
2	4	6	11
3	5	7	10
4	7	9	9
5	9	11	8
6	11	14	7
7	13	17	6
8	15	20	5
9	17	24	4
10	19	28	3
11	21	29	2
12	23	30	1
more than 12 days	more than 23 days	more than 30 days	0

EXHIBIT 8. RESPONSE TIME SCORING TABLE

Rate: Sub-item a from 50% column
b from 75% column
c from 95% column

For example: An array of response times per case is made for a laboratory in one day intervals. If 50% of the cases are completed (using the scoring definition of completed) within 5 days but not less than 4, item a is scored 8. If the array shows that the 3/4th case is completed before the end of the 7th day, sub-item b is scored 9, if 95% of the cases after the period are not completed until the 30th day, the sub-item c is scored 1.
The Item 4 score is then:

8 plus 9 plus 1, divided by three which equals 3.3.

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INSTRUCTIONS FOR SCORING ELEMENT II-C

C. Backlog

Backlog is defined as cases received and uncompleted, but not in a deferred status. The status of such cases is that they will be examined in order of priority assigned. Backlog is counted at a specified time per day, or per week or at some other designated time phase point. Cases should be counted as backlog from case logs and the reporting system should be established so that the case logs show the exit time of the report. Exit time should be the time that a report is authenticated and available to the user. All backlog scoring is done in this system by counting uncompleted cases as of 0800 hours on the first and sixteenth days of the month. For any given period of study, the semi-monthly backlogs are added together and divided by the number of periods to obtain the average backlog for the period. Then by functional areas, the scoring is as follows:

1. DDEC

Score Item 1 by eliminating any cases received within 24 hours and divide the number of remaining uncompleted cases by the number of DDEC cases received during the semi-monthly period and multiply the quotient by 10 to obtain the score. Subtract this number from 10 to obtain the backlog score.

2. NDDA 3. FT 4. MC

Score Items 2, 3 and 4 in the same manner for the respective functional areas of laboratory work. If a negative score develops, enter it as such and compute Item II-B (Average Backlog Score) algebraically. If a negative value results in the element score, compute algebraically in determining the category score.

To score Category II, add element ratings together and divide by the number of elements.

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INSTRUCTIONS FOR SCORING ELEMENT III-A

III. Security Rating Category

A. Perimeter Security Element

If the answer is "Yes", score ten points per item.
Score zero if answer is "No".
Add total points, divide by number of items questioned and available for inspection.

B. Key Control Measures Element

If the answer is "Yes", score ten points per item.
Score zero if answer is "No".
Add total points, divide by number of items questioned and available for inspection.

C. Visitor Control Procedure Element

If the answer is "Yes", score ten points per item.
Score zero if answer is "No".
Add total points, divide by number of items questioned and available for inspection.

D. Standing Operating Procedure Element

If the answer is "Yes", score ten points per item.
Score zero if answer is "No".
Add total points, divide by number of items questioned and available for inspection.

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INSTRUCTIONS FOR SCORING ELEMENT IV-A

IV. Quality Rating (Total of 1.00)

A. Test Disciplines

Score Item A. 1 in accordance with the following checklist for breath, blood or urine analyses:

1. DDEC

	Yes	No
a. Are replicate analyses made in every case by using separate samples from the point of beginning of the process. (Breath, blood or urine)		
b. Is a reference or control sample tested and the result printed on each analysis record of a breath alcohol case . (Breath only)		
c. Is a reference standard of alcohol and water prepared from a National Bureau of Standards primary standard for use in calibrating control samples. (Breath, blood or urine)		
d. Are analysts required to be certified or licensed by law, or administrative order. (Breath, blood or urine)		
e. Are analysts tested monthly by blind samples. (Breath, blood or urine)		

To be scored as "Yes", the answer must be yes to all types of tests indicated in parentheses after each question. Score 2 for each yes answer and the total for five questions is the score to be entered at IV-A. 1 of score sheet.

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INSTRUCTIONS FOR SCORING ELEMENT IV-A.2

IV. Quality Rating (Total of 1.00)

A. Test Disciplines

2. NDDA

	Yes	No
a. Are characteristic crystal tests performed when sample size permits.		
b. Are control tests made routinely for comparison of microcrystals.		
c. Is infrared spectrophotometry employed to confirm LSD identifications.		
d. Is ultraviolet spectrophotometry employed as a systematic screening procedure when material is examined of unrecognized dosage form.		

Score 2.5 for each "Yes" answer in questions a. through d.

Are any of the following used for final identification:

e. Color tests.		
f. Thin layer or paper chromatography.		
g. Gas chromatography.		

Subtract 2.5 for each "Yes" answer. Algebraic difference is final score. Enter total at IV-A.2 on score sheet.

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INSTRUCTIONS FOR SCORING ELEMENT IV-A.3

IV. Quality Rating (Total of 1.00)

A. Test Disciplines

3. FT

	Yes	No
a. Determine whether or not reference control samples are run for all quantitative work on gas chromotographic and UV spectrophometry. If yes, score 10 points.		
b. If barbiturates are individualized by GC-MS or IR spectrophometry, score 10. If by GC only, score 5.		

(Exploratory questions in forensic toxicology can be expanded as much as desired to give coverage to any particular operation.)

Total the sub-item scores in "Yes" column and divide by the number of criteria to obtain the score for item IV-A.3, which is entered on the score sheet.

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INSTRUCTIONS FOR SCORING ELEMENT IV-B

IV. Quality Rating (Total of 1.00)

B. Major Case Notes and Records Element

1. Systematic Overview

Determine whether or not major cases are subjected to a systematic overview and problem definition at the time of receival. If so, score 10. Zero otherwise.

2. Notes Complete with Sketches

Examine a fair sample of major case notes to ascertain whether or not they can be followed by another forensic scientist from outside the laboratory to the extent that he can determine what examination and tests were made, the conclusion reached and the basis for the conclusion. He should be able to reexamine the evidence and check the results of all work without being confronted by ambiguity. Score 10 if notes are adequate; zero if not.

3. Notes include photomicrographs of bullet, cartridge case and tool mark identifications.

Determine whether or not notes in firearms and tool mark cases involving identification by comparison microscopy are documented with a photoprint in the notes, which has editorial notes pointing out the points of identity. Score 10 if adequate; zero if not.

4. Digestive Summary and Conclusions in Notes

Determine whether or not major case notes are concluded with a summary which digests the results of examination and indicates the relevance or non-relevance of results and conclusions to the purpose for which the case was accepted on a basis of the original overview. Score 10 if fair sample indicates that this is a uniform modus operandi of case notes; zero if not.

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INSTRUCTIONS FOR SCORING ELEMENT IV-C

IV. Quality Rating (Total of 1.00)

C. Miscellaneous

1. Professional Publications

Give two points for each journal publication, five for each book and one for each parent agency or in-laboratory training or methods manual finalized and published during the last three years. Do not count revision or addenda. Add the points together to obtain score for Item 1. The limit for this score is 10; however, a total score in parenthesis is retained in the profile.

2. Blind Samples

Give one point for each blind sample put into the laboratory system during the past 12 months which was introduced as a quality control sample by the director and of the laboratory staff, known only by the director to be a control sample. Total such points is score for Item 2.

3. Planning Estimates

Examine planning estimates of the situation or annual reports and ascertain whether or not the laboratory manager has forecast growth, predicted workload for the year beyond the budget and recommended the resources necessary to cope with impending problems. Do not count justification data for budget. Score 10 if yes, zero if not.

4. Work Review

Examine a fair sample of major case reports and note files to determine whether or not the laboratory director exerts quality control through review of at least 10% of outgoing reports. Score ten for sub-item a. if yes. Zero if not. Score ten for sub-item b. if a supervisor reviews every major case prior to report release. Zero if not. Add two scores together and divide by two to obtain item score.

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5. Code of Ethics

Determine whether or not there is any current written policy directive which requires laboratory professional level personnel to follow any rules of professional conduct or specified code of ethics. Score ten if yes; zero if no.

6. Referee Examinations

Determine whether or not referee examinations are encouraged by policy. Score sub-item a. if yes, zero if no. Determine whether or not in past experience, referee or defense examiners have been invited to utilize the particular laboratory facilities for such examinations. Score ten if yes, zero if not. If case notes are routinely made available to referee examiners without necessity of court orders, but by prosecutor arrangement, score ten. Score zero otherwise. Total points of sub-items a., b., and c. and divide by three to obtain score for Item 6.

7. Professional Meetings

Determine the fraction of professional staff who attended a forensic science meeting of state or higher level of assemblage during the past 12 months. This fraction times 10 gives the score for Item 7.

To obtain the element IV-C score add the scores of the items and divide by the number of items.

To obtain the quality category score, add the scores of the three elements together and divide by thirty.

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INSTRUCTIONS FOR COMPUTING THE CRIME LABORATORY PERFORMANCE INDEX RATING (CLPIR)

All of the element scores are entered on the Master Worksheet and the category score is obtained by dividing the total of the element scores by the number of elements. Scores of Categories I and II are added together, divided by two and multiplied by ten. This score multiplied by the security rating and quality rating leads to a product which is the CLPIR, which is expressed to two significant figures.

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B. Example of Profile Analyses Application

Applying the scoring system to a theoretical, but typical crime laboratory operation, a laboratory director develops a profile analysis as shown in Exhibit 9 by the bars illustrated as small squares. His CLPIR is computed by adding the component values for a given category and dividing the sum by ten. The results follow:

Category I = 5.7

Category II = 2.7

Category III = 0.35

Category IV = 0.54

from the CLPIR instructions

$$\text{CLPIR} = \frac{(5.7 + 2.7)}{2} \times 10 \times 0.35 \times 0.54 = 7.9$$

He then deduces that by alarming all doors (laboratory is in basement with no windows), blocking air ducts with secure grills, applying visitor control procedures, issuing strict instructions in writing concerning security procedures, changing the lock pins and making new keys and establishing a key register; that he then would conform with the conceptual security model and his security rating would become 1.0.

He also notes that by training his staff in a two hour program and issuing instructions that bring procedures covered by IV.B, C. of the rating procedure to the level described in the conceptual model that the quality rating would be changed to 1.0. He then takes the necessary actions.

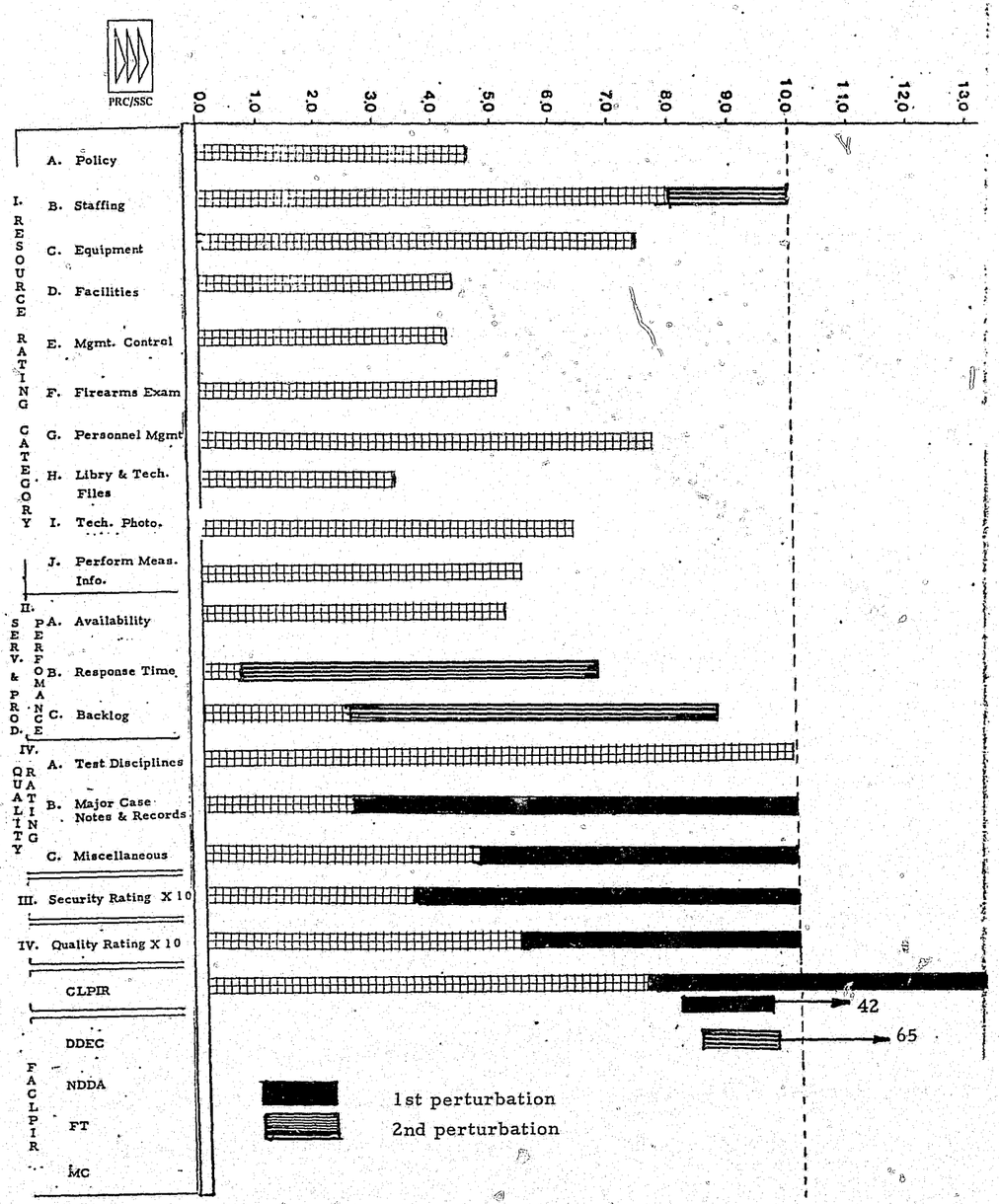

EXHIBIT 9. PROFILE ANALYSIS OF LABORATORY OPERATIONS--EXAMPLE OF APPLICATION

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In Exhibit 9, this second perturbation is shown as a striped bar increment in Categories I and II. The CLPIR scale which is off the chart is indicated to reach 65. When CLPIR values exceed 10, they can be demonstrated on a second scale of CLPIR divided by ten to bring the values into the observable range of the chart.

The laboratory director now systematically examines all other elements of the scoring system to ascertain how he might bring values to the conceptual level. He finds in Category I that elements E., F., H., I., and J. are lucrative areas for improvement which require his own managerial action only with very little, if any cost. With manager controls (E) and performance measure information (J) brought to conceptual levels, he now uses deferrals and optimizes methodology to improve response time and reduce backlog to the minimum possible with existing resources. Beyond this he can institute requests and recommendations which, if implemented, would cause his CLPIR value to approach 100. If not implemented, the CLPIR will reach a limit determined by the policy actions of his parent agency.

This example shows how any crime laboratory can approach a performance level resembling a conceptual model by using the scoring system to identify elements of the laboratory operation which offer optimal opportunity for improvement. The system is independent of the size, organizational structure, workload or population and it can be expanded or adjusted to meet any anomalous situations which are confronted.

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Without inducing any other changes, the CLPIR has changed from 7.9 to 42:

CLIPR $\frac{(5.7 + 2.7)}{2}$ x 10 x 1.0 x 1.0 = 42

This change was brought about by in-house managerial action with a minimum cost in time and material. On the profile chart in EXHIBIT 8 the perturbation is shown as a solid black addition to the appropriate bars. The CLPIR scale goes off the chart and the scale number is indicated to be 42.

The director then looks to other elements which might be changed by appropriate action. He has been receiving complaints from police agencies and prosecutors about long response times and large backlogs. Some of these delays have caused plea bargaining and dismissals of criminal charges which were not in the best interests of THE PEOPLE. Appropriately, the profile shows the service and production category (Cat. II) to have the lowest ratings of any. Intuitively he feels that if staff levels are brought to the conceptual level that this will have the effect of improving response time and reducing backlog. He recommends additions to the staff which are granted and six months later examines the profile again. With no change in workload input and no other scoring changes, he observes that the backlog has been considerably reduced and the response time has improved. The CLPIR is now:

Category I = 6.0

Category II = 7.0

Category III = 1.0

Category IV = 1.0

CLPIR = $\frac{(6.0 + 7.0)}{2}$ x 10 x 1.0 x 1.0 = 65

END