



**Forensic Laboratory Management
Consulting Services**

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**OBSERVATIONS and RECOMMENDATIONS
Final Report
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Introduction

The Office of Chief Medical Examiner (OCME) is an independent subdivision of the New York City Department of Health and Mental Hygiene. The OCME investigates all sudden, violent, or unexpected deaths in New York City, performs pathologic examinations necessary to determine cause and manner of death, identifies decedents, provides for the disposition of unclaimed human remains, and performs forensic anthropology, toxicology and DNA analysis. The OCME's Department of Forensic Biology serves as the forensic DNA laboratory for the City of New York - a geographical jurisdiction of five counties and a population of over 8 million citizens. The OCME houses the country's largest public forensic DNA laboratory, and is a leader in DNA technology and research. The Department of Forensic Biology is staffed by 165 personnel: 154 forensic scientists performing casework (including 51 supervisors and 10 managers), 4 forensic scientists dedicated to full time research and 7 administrative support staff. The NYC OCME Department of Forensic Biology Laboratory will be referred to as Forensic Biology throughout this document for brevity. Forensic Biology performs STR, Y-STR, High Sensitivity, and mitochondrial DNA testing, and processes environmentally challenging and degraded skeletal remains utilizing optimized bone extraction techniques. The laboratory performs DNA testing on nearly every category of crime where probative DNA evidence may be recovered: homicide, sexual assault, property crimes (commercial and residential burglary, vehicle theft), felony assault, weapons cases, arson, and hate crimes. The laboratory has performed DNA testing on over 45,000 criminal cases since its creation in 1990, and has contributed more than 25,000 forensic DNA profiles to CODIS.

In February 2013, the NYC OCME solicited for short-term consultation services to review and evaluate the management and operational structure, quality assurance practices, and administrative policies of its Department of Forensic Biology. The consultation services duties include an analysis of the management and supervisory structure, the methods of communication (both internally and externally with outside criminal justice agencies), current structure, as well as the general operational processes. Another area included in the assessment is the effectiveness and usefulness of the laboratory information management system (LIMS). Recommendations for improvement, such as reporting structure, team development, communication and case turn-around time, are presented.

Sorenson Forensics was selected as the consultant to work with Forensic Biology over a period of six weeks during March and April 2013. The overall goal of the agreement is to perform a thorough review

and assessment of Forensic Biology's current management system manuals and operating procedures, supervision, current operational structure, and processes (including information flow), quality assurance practices, and administrative policies.

Methods

Sorenson Forensics traveled to the Forensic Biology Laboratory on two separate occasions to gather data by conducting interviews, focus groups and performing a lean six sigma exercise and assessment. The first five-day engagement began on March 4, 2013. Timothy Kupferschmid and Christine Dearing interviewed over two-dozen employees and held four focus groups on the topics of: 1) Information Workflow, 2) Communication/Information, 3) Employee Retention and Evaluation, and 4) LIMS. Timothy Kupferschmid visited NYC OCME again on March 18-22, 2013 with Camilla Green. The second visit consisted of additional employee interviews along with a 3 day Lean Six Sigma exercise and assessment involving sixteen employees who represented most of the department's groups/sections.

Altogether, thirty-nine employee interviews were held, thirty-one employees participated in focus groups, and sixteen employees participated in the Lean Six Sigma process. In addition to these in-person activities, we received emails (sometimes more than one) from eighteen different employees who provided feedback that was reviewed and incorporated into this report.

In addition to the on-site assessment and interviews, the Forensic Biology's manuals and protocols were surveyed for compliance to national and international quality and scientific standards. The following were reviewed: Management System Manual, Administrative Manual, CODIS Manual, Evidence and Case Management Manual, Forms Manual, Protocols for Forensic Mitochondrial DNA Analysis, Protocols for Forensic STR Analysis, Quality Assurance/Quality Control Manual, Serology Manual, Training Manual and the OCME Safety Manual. The reader must be aware that the purpose of this consulting assignment was not to evaluate the manuals for adherence to each accreditation standard, but rather to broadly survey the manuals and protocols for sound scientific principles in conjunction with our interviews, focus groups, and direct observation.

This report consists of three major sections: observations, recommendations and appendices to expand on two specific topics, a proposed new management structure and the results of a lean six sigma assessment.

In summary, the forensic science practiced at the Forensic Biology Laboratory is excellent. The laboratory has sound scientific methods and practices and generates high quality and objective case reports. Management at the Forensic Biology Laboratory is weak. The management structure has evolved over time by the rapid growth the laboratory experienced and by circumstance; it was not thoughtfully designed. This haphazard management system, together with some ineffective managers, has led us to this point.

Observations

Stellar Reputation

Reputation is trust an individual or an organization builds with society. The reputation of the Forensic Biology Laboratory is very nearly as important as the quality of work produced by the laboratory. It has influence in determining many things from the believability of testifying scientists to the hiring of qualified staff. Prior to January 2013, the Forensic Biology Laboratory had a superlative reputation not only within the United States but globally as one of the premier forensic DNA laboratory's in the world. This laboratory was known for having progressive methods, outstanding scientists and generated exceptionally high quality of work.

During the consulting services process, we sought to determine if Forensic Biology's positive reputation was damaged by the recent events that directly led to this project. Through the process of employee interviews, focus groups and manual review, we determined that their reputation is well deserved and nothing was uncovered to cause long-term and lasting harm to that stellar reputation.

Sound Scientific Practices

The laboratory's management, quality system and scientific procedures manuals were reviewed as part of this management assessment. An audit of the manuals to verify adherence to the national and

international accreditation standards is beyond the scope of this project. However, each manual was examined to determine if Forensic Biology adheres to sound scientific practices. The internal documents that comprise the management system are structured as follows:

Management System Manual: The Management System Manual is the top tier document in the management system. It provides an overall guide to the management and quality system of the Department. It contains references to other management system documents that have more detailed information.

Scientific Procedures Manuals: These manuals contain current procedures pertaining to the analytical testing of biological specimens. The manuals are: Serology Manual, STR Analysis Manual, Mitochondrial DNA Analysis Manual, and CODIS Manual.

Administrative Manual: This manual contains procedures with laboratory-wide application pertaining to laboratory planning, organization, and documentation.

Quality Assurance/Quality Control Manual: This manual contains procedures pertaining to the Department's quality assurance and quality control activities, for example, proficiency testing, reagent preparation and performance testing, validation, and equipment calibration and maintenance programs.

Evidence and Case Management Manual: This manual contains procedures related to (1) evidence intake, distribution, and return; and (2) case handling, including evidence examination guidelines; handling, evaluation, and troubleshooting of cases which are in progress; report writing and reviews.

Training Manual: The Training Manual details in-house training in the Department.

The Management System Manual and its related manuals are thorough and comprehensive documents that contain all necessary components of operating a high-quality forensic DNA laboratory. The manuals are well written, organized and follows unassailable forensic science and quality principles. We discovered no instances of careless, poor or substandard work performed at the laboratory. Therefore, the scientific processes and quality achieved at the Forensic Biology laboratory are outstanding.

Positive Remarks

During interviews and focus groups, employees enthusiastically and unanimously agreed that Forensic Biology is a place where the work itself is satisfying, inspiring and incredibly important. All employees

are exceptionally proud to say they work at the NYC OCME Department of Forensic Biology. Employees take pride in the fact that the laboratory has a great history of serving the public and that they are engaged in achieving the common good by reporting high quality results to directly help the citizens of New York City. The staff is fully engaged in their jobs and has a genuine interest in improving the Forensic Biology laboratory beyond its current state. All employees had valuable suggestions for improvements.

Most employees conveyed to us that Forensic Biology is a great place to work. Number one on everyone's list was the work itself. The forensic scientists are dedicated to the mission of the laboratory and make positive contributions to the criminal justice system. They are genuinely impressed with the case variety and experience they are receiving in their job. Most staff cites that the credibility, positive reputation and cutting edge research, techniques and processes of the laboratory are very important to them. Staff members enjoy working with their fellow employees. A strong sense of camaraderie has developed and many deep friendships have formed. Higher level staff has enjoyed the promotional opportunities afforded to them as well as the privilege of mentoring others who are energetic to learn. Employees also enjoy working and interacting with other city agencies in New York. Finally, health insurance and other HR benefits, overtime and flexibility of hours are all listed as important and positive aspects of the job.

General Culture

Organizational culture is the collective set of behaviors people exhibit within an organization.

Purposefully, culture is emphasized in this report as it permeates throughout the organization and affects everything from communication to employees' and managers' behaviors. Culture includes the organization values, visions, norms, working language, systems, beliefs and habits. It is also the pattern of such collective behaviors and assumptions that are taught to new organizational members as a way of perceiving, and even thinking and feeling. Organizational culture affects the way people and groups interact with each other, with customers and with stakeholders. Effective organizations strive for a "healthy" culture in order to increase productivity, growth, efficiency and reduce counterproductive behavior and employee turnover. A variety of characteristics describe a healthy culture. Healthy cultures possess high employee involvement, strong internal communications and high levels of productivity.

The culture at the Forensic Biology laboratory is not healthy in several aspects. There exists “managers versus workers” division and “team versus team” division. As discovered through our interviews with employees, it appears that some managers have an air of superiority or are distant. The current “team-based structure” is designed around small groups of criminalists working on specific case types, such as homicide, sexual assault, property crimes, etc. This was not created with any sound scientific basis in mind, and hampers the efficiency of the lab. Regarding the competitive atmosphere between and among teams, each team believes they are performing (pick one) more cases, more samples or more difficult cases. When one team seemingly does more work or more complex work than another team, it breeds resentment between teams. Many managers seem divided, and there is a general lack of overall teamwork. All of this results in several independent fiefdoms who are not working together toward a common mission. Other characteristics of the culture we discovered are that many managers don’t value employee opinions or take employee’s issues seriously. This culture does not encourage scientists from one team to help scientists from another team in times of need.

Some criminalists felt that moving into a large space and being distant from their manager’s offices contributed to poor communication. People who were employed at NYC OCME in the “old building” (520 First Avenue) spoke of that time with words of fond recollection and a shared sense of camaraderie.

Communication

The topic of communication was one of the top concerns identified by employees. We have compiled the communication issues into the following categories: Top Down, Bottom Up, Intra-Departmental, External and Meetings.

Top Down Communication

Employees at all levels acknowledged there are communication issues within Forensic Biology. Many of the older supervisors and managers blame some communication issues on a generation gap. We reject this reasoning. Poor communication is largely due to poor supervisory, leadership and inter-personal skills. There is limited positive feedback communicated to employees.

Important policies changes are sometimes disseminated throughout the organizations by telling a few Criminalists to “spread the word” rather than through proper channels. Managers and supervisors are rarely on the floor where the work is being done, thus they don’t completely understand the situation.

Bottom up Communication

Employees feel their voice is not always heard. Many have made suggestions for improvement, yet they never hear back from managers or supervisors to learn if their suggestion was considered. A suggestion box system was put in place. However, this quickly degraded into an anonymous system to voice general complaints, and managers say feedback is impossible if suggestions are submitted anonymously. Within lower-level Criminalist groups with similar job functions, effective communication does exist. The Criminalist I's and Criminalist II's successfully contact their colleagues to keep the lab running effectively and share ideas for efficiency.

Intra-Departmental Communication

The team structure has contributed to poor laboratory-wide communication because most communication is handled at the team level and because the director is not a strong decision-maker. Furthermore, different trees within the same team have different effectiveness of communication. If branches within teams are not communicating effectively, then it should be no surprise that different teams have completely different experiences of communication. Each team performs their work differently, even though they are operating with the same set of standard operating procedures.

External Communication

Several scientists complained that there is limited communication with their direct customers (NYPD and the DA Office) prior to starting laboratory processing. This critical step for accessing and triaging cases and samples within cases ensures the correct questions are being asked that can be answered by DNA testing. In addition, the Forensic Biology laboratory is a service provider to these agencies and the community as a whole. Effective mechanisms for effective external communication must be further developed.

Meeting Communication and Efficiency

Poor communication within trees happens through all media – email, telephonic, and face-to-face meeting communication. For the most part, meetings do not occur regularly are not well-organized and agendas are not typically used. Thus, the feeling of the staff is that meetings are not a good use of time. We heard repeatedly that the quarterly department-wide meetings are depressing to the scientists. Laboratory members find the productivity numbers depressing because solutions to effectively change the system are not offered. It was also reported to us that during team or department meetings, the leadership does not express gratitude for a good job or for hard work.

Management Team

Forensic Biology managers function within their own silos. They manage their own group's objectives rather than the department's overall success. They want to win even if other groups lose in the process.

Discussion of the management team is separated into four overall themes: behavior, priorities, supervisory skills, management skills. Generally speaking, the management within Forensic Biology is top-heavy. There are many managers and supervisors for the size of this organization.

Behavior

Unprofessional or discourteous behavior by the management team has been reported. Aggressive tone in emails or verbal communications and disrespect for the opinions of others were mentioned. Another example is that managers and supervisors are often distracted in meetings. This behavior is disrespectful to the meeting attendees.

There exists, and it is obvious to many employees, that personality conflicts and animosity exists between some managers. This tension trickles down and affects all staff members. Another poor behavior is that some supervisors openly speak negatively about one of their employees in an open office environment; supervisory issues have no place being discussed with anyone other than the employee and their supervisor in a private setting.

Priorities

Failure to share uniform goals and coherent work plans have resulted in unproductive and changing priorities. Some assistant directors and above are concerned more about productivity numbers and they have lost what is most important in a forensic lab – timely quality reports released to the customers; effective supervision, quality of work product and employee development. Like the majority of forensic DNA laboratories throughout the country, there is enormous pressure to get cases completed in a timely manner. However, this is impossible when priorities continuously change.

Supervisory Skills

Several of the assistant directors and Criminalist IV supervisors are generally (but not universally) poor supervisors. There is a system-wide lack of employee development plans, goal setting and consistent and effective employee feedback mechanisms. Some employees reported that positive feedback was non-existent and negative feedback was often in a public setting and destructive rather than constructive. Further, feedback is not provided on a regular basis.

Management Skills

Individually, there are some very good supervisors and managers on the management team. Collectively, however, their reputation is not as good. The managers do not work together as a cohesive team and tend to be critical of each other. The Deputy Director, Assistant Directors, and Criminalist IVs tend to be out of touch with the operation that occurs within the laboratory. Without that intimate knowledge of laboratory processes, we question how they can be effective leaders. Similarly, upper level employees are not familiar with the Laboratory Information Management System (LIMS). Some have even publicly stated that they have no intention or desire to learn it. That attitude is unacceptable.

Laboratory Director

The Director is universally liked and highly respected as a research forensic scientist by Forensic Biology and the global forensic community at large. We have no doubt that she has tried to be the most effective manager and leader of the laboratory since she was appointed as its director. As director, she is ultimately responsible for all aspects of the laboratory, including its culture, communication, quality, delivery, budgets, safety and morale. Her weakness has been in operations management.

The Director's strengths are passion for the job, respect and compassion for others and humility. Her weaknesses are lack of clarity of vision for the organization, lack of inspiring others, lack of goal setting, lack of confidence, poor administrative skills, and a seeming lack of decision making skills.

Human Resources

Several categories of observations were made regarding personnel and will be summarized under this section titled Human Resources. Retention, salary, promotions, employee evaluations and employee development are discussed here.

Retention

We were provided with data that was gathered by several employees in Forensic Biology regarding the attrition of Criminalists since 2007. Since 2007, sixty (60) Criminalists have left the NYC OCME, averaging 10 per year. About half of the sixty left for another laboratory in the field of forensics, the other half left the field entirely. In 2007, only two Criminalists left the department, but that number has fluctuated between 9 and 14 from 2008 to 2012. The average tenure of Criminalist leaving NYC OCME was just over three years from 2007 to 2010. However, in 2011 the median experience a Criminalist who left their position was 4.5 years and in 2012 the median experience was 5.6 years.

This type of brain drain is expensive in terms of experience, historical organizational knowledge, job-specific knowledge, and the cost of training to replace an employee. In our opinion, a forensic DNA analyst needs about three years of training and experience to be fully knowledgeable and independent in their job. There are no definitive studies that have reported the costs of re-hiring and training a forensic DNA analyst, but a low estimate is at least a quarter of a million dollars over three years. This cost includes cost of salary of the trainee, cost of salary (ies) of the trainers, cost of reagents/supplies/consumables, lost productivity from the trainers not performing casework, and etcetera.

Furthermore, attrition has a highly negative effect the productivity of the laboratory and on the morale of those who choose to stay. Causes of this attrition and resulting low morale is often attributed to the upper level supervisors and managers.

Salary

The same group of employees that provided the retention data performed a salary survey. While this was an unscientific survey, it is illustrative of the salary crisis facing the Forensic Biology laboratory. According to their study, Forensic Biology has the second lowest salary (adjusted for cost of living) out of a survey of 60 laboratories located across the United States.

When an experienced Criminalist can work in a neighboring city, county or state for higher pay and equal responsibility, it is easy to see why there is an attrition problem. Compounding this effect is the fact that there are no step increases for employees. A newly hired Criminalist I earns exactly the same as a Criminalist I who has been with the laboratory for six years. Another inequitable practice contributing to attrition and low morale is that an evidence technician that requires only a high school diploma earns more than a Criminalist I that requires a bachelor's degree in a natural science. These two positions work side-by-side in the same building. This situation must be rectified.

Promotions

The single most important thing that managers should do is hire the right people and promote the best of those that have been hired. The promotion process at NYC OCME consists of a promotion committee whose membership was selected by those who volunteered. In fact, the committee chair is a research scientist who does not work in forensic DNA casework. Furthermore, open solicitations are announced

to gather comments on the candidate. This practice invites bias and is not an objective method for evaluation.

Employee Evaluation Process

The evaluation process serves a number of important purposes for both employees and supervisors. Evaluations provide employees with feedback on their work quality, performance, behavior, strengths, and most importantly to learn how to improve and enhance performance. Some groups at the lab, such as the Homicide and Sex Crimes Team (HSC), provide effective yearly employee evaluations. Other groups, such as Hybrid, have not consistently performed employee evaluations. The evaluation system at NYC OCME calls for yearly formal employee evaluations. Feedback, however, should be performed throughout the year. Regular, timely and effective feedback is also lacking with most supervisors. Evaluations help remove the guesswork by letting employees know how well they are doing and steps they can take for improvement.

Employee Development

A well-thought-out employee development plan provides employees with opportunities and clear direction on how to increase their skills and advance their careers. Employee development plans are not hard to construct, but should not be done without forethought. There are common steps managers should take to ensure the employees' plans are concise and valuable for all parties. First, objectives for employees must be aligned with the mission of the organization. Next, speak to each employee individually to know their skill level and career aspirations. Decide what skills the employee and the laboratory needs and then create an action plan. Developmental programs should include a combination of activities such as formal training, independent reading and coaching / mentoring. Finally, and most importantly, apply the new skills in the workplace.

Laboratory Information Management System

The LIMS went live in the summer of 2012 and has been operational for approximately eight months in the laboratory. All LIMS, regardless of manufacturer, are exasperating to implement and generally cause production to slow temporarily while laboratory staff becomes accustomed to the new system.

This is also true in Forensic Biology. It is functioning better today than during the first months of roll-out. A primary advantage of the LIMS is that cases are now simply and quickly visible whereas in the past staff could spend countless hours tracking down the paper file. Case tracking is facilitated with LIMS. Cases are easier to read because hand-written notes are no longer recorded. A paper report can be generated with the push of a button and copying, filing and highlighting tasks of old paper reports has been eliminated saving hours of time for each batch of cases processed. The LIMS also forces scientists to use only quality controlled reagents in processing, whereas before it was a manual system.

LIMS is not without its problems or its detractors. Seemingly simple tasks now require multiple click-through on-screen pages. Some processes are slowed considerably by LIMS, by as much as taking twice as long compared to pre-LIMS operations. This is unacceptable and needs dedicated resources to rectify. Due to the complexity of the LIMS, the rollout was slow as the system was designed and re-designed repeatedly. As such, there were considerable gaps between the training of scientists and the go-live date. LIMS has had a problem crashing multiple times each day. This has been reduced to 1-2 times per week, sometimes more often, but is still unacceptably high. The movement of the system to servers on the internet cloud should help this problem. It is unclear whether the new servers will solve the speed of the system. Staff are constantly waiting, refreshing and saving the system before they can move forward. Finally, there is limited ability for in-house IT staff or forensic scientists to make changes to the program. This results in costly and time consuming enhancements and changes that must be performed by the provider.

Recommendations

Recommendation 1 – Leadership

Leadership must change, and a new management team with appropriate management skills should be appointed. The following two recommendations address in more detail suggested changes to the leadership and management structure. A training schedule and mentoring program should be established to further develop the current leadership staff and to groom future supervisors and managers.

Recommendation 2 – Organization Structure

The assistant directors would report directly to the director in a task-based reorganization.

Recommendation 3 – Change Management

Implement a large-scale change-management process, ideally Lean Six Sigma (LSS). LSS projects have been successfully implemented in both public and private ASCLD/LAB-*International* accredited facilities across the county. LSS projects are always successful at reducing the turn-around time, increasing productivity, and improving morale in each location.

During our on-site evaluation, we performed a lean six sigma assessment. Please see Appendix A for the results of this assessment.

Recommendation 4 – Salary & Retention

Achieve salary increases and step raises for all employees. New salary increases and the establishment of step raises are extremely difficult, but not impossible, to achieve in government organizations. Considerable effort must be made to effect salary change. Forensic Biology scientists are underpaid relative to their cost of living, as demonstrated in the salary survey presented above. A livable wage is an absolute requirement for any employee in any industry. Many employees in Forensic Biology feel, and we agree, that they are not compensated a livable wage for their skill and education level. A prime example is that the evidence technician position requires only a high school diploma are paid higher than the Criminalist I position that requires a bachelor's degree in a natural science.

Our focus group came up with the following suggestions for improved employee retention. They are categorized into three categories: easy and inexpensive, low cost, and high cost.

Simple and Inexpensive

Any kind of creative scheduling is viewed as a positive by employees. Ideas include compressed schedules, part-time shifts, dual shifts, and job sharing. We would also like to see the building desk/office plan redesigned so entire teams, including managers, are co-located together. They felt that this would allow for better internal communication and team camaraderie. Improved laboratory culture is another area that employees felt strongly about. Culture changes include improved leadership, accountability for supervisors and managers, and better communication. Department-wide compressed schedules, if implemented correctly and within the new lean six sigma production schedule, will have a positive effect on morale.

As evidenced by the focus group, salary is important to employee satisfaction, but there are other important factors. Both culture change and redesigning the office space (Recommendation 7) will correlate positively for employee retention and satisfaction.

Low Cost

Employees commonly feel that small low cost perks can go a long way in helping them feel valued. Employees need to feel valued and appreciated. There are thousands of low cost ways to achieve this.

High Cost

High cost items primarily have to do with pay and employee perks. Salary increases, step raises, better transportation options/coverage, and a student loan repayment plan after a certain number of years of service have been met are all possibilities.

Recommendation 5– Employee Evaluations and Development Plans

Employers who place precedence and emphasis on Employee Evaluations and Development Plans inherently show they appreciate and value their workforce. To be successful in this area, Evaluations and Development Plans must be a priority and take place at regularly scheduled times.

Employee Evaluations: It is critical that employees receive evaluations at least annually and with quarterly updates in one-on-one meetings with their immediate supervisor. Employees should receive regular feedback throughout the year and should never be surprised by an evaluation or rating received. Standard metrics should also be used for all employees at the same grade level across the organization. Managers and Supervisors need to be held accountable for writing and delivering employee evaluations in a timely manner. A standard process and calendar should be put into place for the annual review process.

Development Plans. Employees feel valued and empowered when career plans have been created with specific action items they can work on to prepare them for their next desired position. Employees should be the owner and driver of their own development plan. However, the employer needs to provide a framework and guidelines for this process. The employee and his/her manager need to collaborate to make sure the appropriate tasks and activities are identified. Development plans should be updated at least yearly and revisited and updated by the employee and manager together on a more regular basis. Open and honest feedback between the employee and manager must accompany the development planning process.

360 Degree Evaluations for Supervisors and Managers. A 360 Degree Evaluation is a tool that collects and provides feedback on an individual's work performance from a variety of sources. Surveys are developed to gather feedback from a manager's subordinates, peer group, and direct supervisor. The manager being evaluated will also do a self assessment. All surveys are then evaluated, numbers are crunched, and a comprehensive report is provided to the Manager. The Manager is given a chance to review and absorb the feedback. The Manager and his/her direct supervisor then work together to devise specific improvement areas to incorporate into their development plan. The key to a 360 Degree Evaluation process is to hold participants accountable for making positive changes based on the feedback they receive.

We feel that these tools are necessary to generate a culture change within Forensic Biology that can transform employee morale and address some of the management issues that employees are disgruntled with.

Recommendation 6 -Laboratory Information Management System

The LIMS implementation process has been challenging, however, we strongly recommend that Forensic Biology stays the course and continues to work with the program. There are several recommendations to improve the overall system going forward. Below is a list of recommendations that, if implemented, will considerably improve LIMS.

Standardization. LIMS use must be standardized throughout the laboratory. A concerted effort must be made to improve the QA/QC process and update the standard operating procedures to reflect the LIMS processes. The training group must immediately begin to incorporate LIMS into the training of new employees. Live demos and training modules must be delivered to all LIMS users for when significant changes are made to LIMS. All supervisors must be trained in the use of LIMS so that they can monitor if the LIMS is being used consistently between analysts.

IT Support. The hiring of an in-house Java programmer should be prioritized. Their salary should be quickly recouped by not having to hire outside providers to make changes.

Employee and Industry Support. Create a robust suggestion system and a LIMS user committee to develop and prioritize future enhancements. In addition, start a forensic laboratory users group with other laboratories to discover best practices. With today's video conference capabilities, this could be a very cost effective approach.

Recommendation 7 – Office Space

Redesign office space. When it comes to enabling vital behaviors, improving oneself and gaining assistance from others are two of the three primary sources. The third source for increasing capability is the effect of the external environment on our behavior. Within organizations, collaboration and personal interaction is enormously important. Distance keeps people from routinely interacting. The Thirteenth Floor is the home of the managers. They rarely venture to their employees desks and laboratory space. When people casually bump into others at work, they ask questions, share ideas and come up to inventive solutions to problems. Physical barriers like distance and different floors kill chances of people collaborating. Our recommendation is to move the employees who join the new teams to physically sit next to one another, including the supervisors and managers. Barriers will be broken and one of the “us versus them” divisions will disappear.

Recommendation 8 – Technical Reviews

All interpreting analysts must conduct technical reviews. During the course of our interviews and evaluation of the organizational chart, we were concerned how the technical review process occurs at Forensic Biology. The current process is that Criminalist II and Criminalist III positions are qualified to analyze data and write reports. Then Criminalist IVs or assistant directors perform the technical review. From a scientific perspective, if a staff member is qualified to analyze data, sign a report, and testify to those results, they are also qualified to perform technical reviews of their colleagues, regardless of their “rank” in the organization and should be empowered to do so. This would provide less experienced forensic scientists greater breadth and depth of cases scrutinized, and over time quality will increase.

Recommendation 9 – Project Management

Forensic Biology will benefit from stronger methodical project management practices. Examples include the LIMS rollout, completed validations, and projects within the Research and Development group. Major phases of project planning are initiating, planning and design, executing, monitoring, control and closing. All these phases would have benefited the LIMS rollout. In addition, adherence to project management practices could potentially help Research and Development and Validations to deliver more new technology on a regular basis.

Project Management practices generally increase the quality of the end product and go hand-in-hand with enhanced effectiveness. Key managers should be trained in project management skills to provide them with the tools to effectively and efficiently marshal their projects.

Recommendation 10 – Redesign Promotion System

Promotions, like hiring, are one of the most important jobs of managers. It should be given that level of priority. Candidates submit applications for promotion to a promotion committee chair that is currently a research scientist who does not work forensic DNA cases. The rest of the committee is composed of volunteers. The promotion is based on written tests and recommendations that are open to all supervisors and managers. Their complete body of work at Forensic Biology is not considered.

The promotion process should be as thorough as the hiring process. Internal supervisors and peers should be confidentially interviewed, if the candidate has a working relationship with external customers then they should be questioned, and there should be an interview with a panel of hiring supervisors. A written test, if deemed necessary, should also be administered.

Following the promotion process, the applicants who were not promoted should receive individual feedback about their participation in the process. This feedback should include sincere positive feedback on their strengths as well as specific items to better prepare them for future opportunities.

Additionally, an effort should be made to create a senior scientist position. This position would not be a supervisory position. The purpose of this title would be to reward and promote analysts for their casework experience. The current promotion structure is that all Criminalist IIIs, Criminalist IVs and Assistant Directors are supervisors. As mentioned previously, there are too many supervisors in the Forensic Biology laboratory. There are highly skilled scientists working at the laboratory that may not want to, or be effective at, supervising people, but deserve a promotion. Under this new system, scientists can be rewarded for their technical skills and experience.

Recommendation 11 – Accountability, Tools and Techniques

In order to help facilitate the necessary behavior change among the managers at Forensic Biology, there are some tools and techniques that should be used to assist in creating an environment of accountability. During our evaluation, we found that a pathway for documenting corrective actions relating to the laboratory is clearly defined. This is a requirement for accreditation. However, a pathway for documenting corrective action for personnel was not as clear. Developing an employee

corrective action plan should be a priority. The plan should include a standardized pathway of steps that need to be taken to address the problem and a follow-up schedule to ensure the remediation was successful. A disciplined and robust corrective action plan would have prevented or at least minimized the SKM incident.

Recommendation 12 – Management Development Program

Implement an ongoing Management Development Program. We feel this is critical to initiate and sustain positive culture change at the management level. Topics for this program should be selected by the Director to reinforce desired management behaviors/improvements. A management development program properly implemented will build stronger unity and group effectiveness at the management level through team building experiences. This process would be a good forum for the Director to instill the values he/she is driving throughout the organization.

Specific courses or topics must be part of the Management Development Program and must be aimed at areas needing the greatest improvement. Topics such as coaching and developing employees, teamwork, leadership versus management, ownership for department goals, giving and receiving feedback, guiding disagreements or conflicts into productive communication, recruiting and retaining employees, time management and information delivery are recommended. Feedback from 360 Degree Evaluations can also be used to select courses that will benefit the management team.

Appendix A

Lean Six Sigma Assessment Report

Laboratory Lean Six SigmaSM Assessment

Lean Six Sigma Black Belt Timothy Kupferschmid and Cami Green from Sorenson Forensics met with a project team from OCME consisting of fourteen scientists (see Appendix A for names, titles and groups of employees). The purpose of the evaluation was to teach introductory principles of Lean Manufacturing and Six Sigma process improvement, use Lean Six Sigma tools to measure the major aspects of the current state of three groups of the laboratory (Hybrid, Property Crimes and Homicide and Sex Crimes), and to evaluate the current situation in terms of value added activities and non-value added activities from a customer's point of view. Major concepts taught and discussed were change and change management, the eight types of waste, six sigma quality and process capability, critical to quality (CTQ), voice of the customer (VOC), theory of constraints (TOC), the DMAIC process, takt time, and mapping tools including spaghetti charts, process maps, SIPOC maps and value stream maps. The team from Sorenson Forensics led the discussion of the project team about the current state process flow of evidentiary items through the laboratory. Finally, the tactics and activities of an improvement strategy were discussed, such as: visual scoreboards and production boards, creating flow, constraint management and standard work.

Assessment Methodology

The project team gathered on Monday, Wednesday and Friday (March 18, 20, 22, 2013). The methodological approach applied by Sorenson Forensics is called Laboratory Lean Six SigmaSM. Laboratory Lean Six SigmaSM is the unique combination of Lean Thinking and Six Sigma process improvement as applied to forensic laboratories to form a thorough and comprehensive approach to quality improvement, process improvement and the elimination of waste to produce a remarkably efficient and quality driven process.

Introducing Lean Thinking. Lean thinking focuses on enhancing value for the customer by improving and smoothing the process flow and eliminating waste. Lean thinking has been around since Henry Ford's first production line, but it has been developed and refined by the Toyota Production System. Toyota took Henry Ford's original idea of high volume/low variety and applied it to high variety/low volume processes. It is called "lean" not because it slashes costs or because processes are stripped to the bone, but because it reduces the timeline from when a customer places an order (or submits a piece of evidence) to when the customer receives the product (evidence return or final disposition). It does this primarily by eliminating or reducing non-value added waste. In summary, Lean is:

- A methodology to understand process value from the viewpoint of the customer and eliminate waste – those activities that don't add value.
- A methodology to increase throughput and create a continuous flow of value-adding activities without adding additional resources.

Introducing Six Sigma. Six Sigma is a systematic approach to improvement. Six Sigma focuses on the customer and other key stakeholders. Six Sigma calls for a change of thinking, in fact it requires a complete cultural change, which is why it cannot be implemented immediately, but over time by working through a number of steps and processes. When Jack Welch, former CEO of General Electric, introduced Six Sigma to his company, he understood this cultural change: "We are going to shift the paradigm from fixing products to fixing and developing processes, so they produce nothing but perfection or close to it." In summary, Six Sigma is:

- A rigorous performance improvement approach
- A customer-focused, data-driven methodology to understanding process variation and process capability

- Supports ISO/IEC 17025:2005 quality systems through superior management processes, tools and sustainability controls

Lean and Six Sigma together are complimentary – eliminating variation, defects and waste while creating continuous, value-add flow. This approach can be used in any industry from toaster manufacturers to service providers such as law offices. Some special considerations for forensic laboratories include our unique accreditation and documentation requirements, our unique raw material (evidentiary items) and our unique customer requirements. This project’s emphasis is on ensuring that process re-engineering identifies workflow changes that generate measurable performance improvements and that the constraints of forensic scientists, processes, machines and technology are assessed.

The combination of Lean thinking and Six Sigma variation reduction, when merged together, forms seven guiding principles. The principles are (1) focus on the customer, (2) identify and understand how the work gets done, (3) manage, improve and smooth the process flow, (4) remove non-value added steps and waste, (5) manage by fact and reduce variation, (6) involve and equip the people in the process, and (7) undertake improvement activity in a systematic way.

DMAIC Methodology. DMAIC is the acronym that describes the seventh principal. It is a systematic improvement framework, to make dramatic efficiency improvements. DMAIC stands for Define, Measure, Analyze, Improve and Control.

- DEFINE: Setting project goals and boundaries based on organization’s goals, customer needs and the processes that need to be improved
 - Output: Project Charter and Business Case
- MEASURE: Use data from current processes to establish a performance baseline
 - Output: Process Mapping, Identification of Value Add and Non-Value Add activities.
- ANALYZE: Hypothesis testing of the Root Cause(s); begin to design the improved process
 - Output: Validated Root Cause(s) and “Future State” Process Maps
- IMPROVE: Develop, implement and evaluate the solutions targeted at the verified root cause(s).
 - Output: Test and Learn to confirm the solution produces performance that meets the target

- **CONTROL:** Make sure the problem stays fixed and the new processes can be further improved over time
 - Output: Process Management Plan; Control Charts/Dashboard

As the reader can deduce, the Control phase is the most important phase in the process. The lack of a “control” phase is why many other management / process improvement methods have failed to achieve their promised results. TQM (Total Quality Management), Process Mapping, Re-Engineering, Change Management are a few of the “flavor of the day” business tools. None of these methods had a “control” phase, which can be thought of as a wedge to keep bolder from rolling down the hill after you have spend countless hours pushing it up there. The control phase ensures that the improvements’ gained are maintained.

Summary of Assessment and Results

The LSS assessment taught and implemented a few of the tools from the Define and Measure Phases of the DMAIC process, including: Project Charter, SIPOC Map, Process Map and Value Stream Map.

Customer Demands, Concerns and Constraints

An important first step of any improvement project is to define the problem in terms that the customer feels. A concise description of the issues that need to be addressed by a problem solving team should be created before they try to solve the problem. These descriptions serve to focus the attention of the project team and provide a means to know if you are “winning” the game of improvement.

The project team believes each **Customer** of the laboratory wants:

- A Timely Process (exact time frame to be defined)
- 100% Quality Results
- 100% On-Time Delivery (results delivered when they are promised)

The project team believes that **Concerns and Constraints** of the current system are:

- Communication, both internal and external
- Group dynamics

- Attitude problems
- Rush cases
- Lack of standardization
- Number of items processed
- Excessive reviews
- Triaging cases
- Case submission policy
- Need strong representation to stakeholders
- Training in both the lab and software
- Efficiency in data collection
- Daily workflow
- Accountability
- Workload
- Structure to research

SIPOC Map

SIPOC stands for suppliers, inputs, process, outputs and customers. SIPOCs are worked backwards starting with the customer. The SIPOC model identifies your customers and the outputs they need. The process portion of the SIPOC map is the process map created during the Measure Phase. The inputs are listed. Inputs include supplies, computers, forms, equipment and personnel. Finally, suppliers are the sources for all of the inputs. In the laboratory's case, some customers (police officers) are also the suppliers of the raw material (bulk evidence). Below is the laboratory's SIPOC Map:

Suppliers	Inputs	Process	Outputs	Customers
Crime Scene	Reagents	Evidence Sign-in	Report	NYPD
Detectives	Supplies	Evidence Examination	Case File	DA
ABI	Evidence	Serology	CODIS profiles	US Attorney
Qiagen	Case Informatin	Extraction	DNA Hits	Medical Examiners
Vendors	Instruments	Quantification	Testimony	Defense Attorneys
Liaison Unit	Technical Leader	Amplification		Fire Marshall
ADAs	SOPs	Electrophoresis		FBI
Researchers	Staff	Analysis		
	Computers	Report Writing		
	LIMS	Technical Review		
	Validation Team	Administrative Review		

The Opportunity

The NYC OCME Forensic Biology Department is a “target-rich” environment for Laboratory Lean Six SigmaSM deployment. Some of the major aspects of the laboratory that will be improved by implementing a targeted Laboratory Lean Six SigmaSM project are:

- Perform a full “Measure Phase” of the processes to learn the exact cycle times, inventory levels, queue times and value added activities are located. The cycle times, inventory levels and queue times in the value stream map (above) are approximations.
- Examine all areas of the laboratory, including HSC, Hybrid, PC, QA, Training, mtDNA, Administrative Support, Exemplar, Research and Development
- Simplify, streamline and standardize process steps throughout the entire organization
- Improvement of flow of work, people and information throughout the laboratory
- Implement visual controls to measure quality, delivery, safety and morale
- Improve predictability of operations
- Reduce impact of new hires and potential turnover
- Define long term strategy for operations efficiency improvements

Laboratory Lean Six SigmaSM creates a culture of continuous improvement. Continuous improvement can be defined as the outcome of one-thousand little things done the right way. Building a culture of improvement is a transformation process all organizations can benefit from. But not all organizations that can, do. To successfully build a culture of continuous improvement, leaders must clearly understand their new roles in and responsibilities to the changing organization. They can do this by continually fostering new behaviors that ensure people are engaged and always remain focused on achieving defined business objectives. Only through joint optimization of people and technology can today’s leader achieve excellence in technical performance while promoting quality in people’s work lives, and help the enterprise accomplish its goals, move toward its vision, and satisfy its stakeholders.

Of course, there are other process improvement systems that may be considered, but we have seen LSS implemented in numerous labs with very good results.