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Laboratory Analysis: An Operational Audit Technique

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How laboratory analysis serves the auditor in evaluating program performance.

As an environment changes, professions functioning in that environment must likewise change or face extinction. The failure to recognize and then to adapt to environmental change, it is recognized, can mitigate a profession's significance, impact adversely on its viability, and render it ineffective. Professions associated with the sciences, with politics and the law, with education, and with the arts have all had to be sensitive to such changes. As a profession, auditing has responded well to the changes that have occured in its environment.

Auditing has expanded as time has required from the attest function it once exclusively carried out to the operational mode it currently occupies. As has been required, the standards and techniques the profession once relied upon have been modified to accommodate its new dimensions. Laboratory analysis is one of the many techniques adopted for use by GAO auditors in their still-developing roles.

Auditing Metamorphosis

The history of auditing reflects the emergence of a profession initially aimed at assuring the integrity of fiscal transactions. Attesting to the veracity and accuracy of financial data was of paramount concern to the early auditor. With the growth of business and a corresponding increase in the size of government, the attest role expanded. Laws and statutes were enacted mandating the performance of specific type audits in the interests of both the taxpayer and the entrepreneur. Manage-

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ment, seeing the benefits that attest audits accrued to those outside the organization, initiated the development of an audit system from within. The "internal audit" like its counterpart focused on attesting to management about financial accountability and compliance with law, regulation, and policy. Unlike its predecessor, however, it was conceived as a continuing rather than an *ad hoc* process.

Over the last century, society has undergone quantum changes. Technological development, which can only be described as phenomenal, has taken and continues to take place. The taxpayer and shareholder universes have grown substantially, both in size and consciousness. And, the immediate social impact of even the most minor decisions have all combined to significantly influence management's actions. Management's needs and the needs of those to whom management is responsible have had to therefore be met with more than opinions on fiscal accountability and legal compliance. Operational auditing and the review of nonfinancial matters emerged as a means for meeting those needs.

Today's auditor has assumed totally new and wholly different responsibilities. Today's auditor is now very concerned with examining and reviewing the organization's non-financial policies, procedures, and operating functions.

Today's auditor now must render opinions on the organization's operating health and identify operating problems affecting its fiscal viability. Today's auditor now must determine the extent to which an organization is accomplishing its goals.

Finding an answer to the broadest of all possible questions, "Are organizational programs meeting the objectives set out for them and, if not, why?" has become the *raison d'etre* of today's operational auditor.

Auditing Standards Modified and Techniques Changed

Traditional auditing standards and techniques, used in the attest function, were found to be less than fully adequate for the operational auditor. While they continued to serve and serve well indeed, they were, however, particularly suited to financial auditing.

Total reliance on a detailed knowledge of accounting principles and on the standards and techniques generated by accounting practitioners to assure compliance with these principles was once enough. More was needed, however, both in standards and techniques to cope with the auditor's entrance into operational areas.

GAO Wrote New Standards

In 1972 the U.S. General Accounting Office issued a set of auditing standards. These standards were designed for auditing governmental organizations, programs, activities, and functions. Its format was similar to "Statements on Auditing Procedure No. 33" issued by the Committee on Auditing Procedures of the American Institute of Certified Public Accountants.

An important distinguishing characteristic of the GAO standards was the assumption that the audit was an integral part of the accountability process. Specifically, the GAO standards required that the audit provide an un-

biased evaluation as to how well public officials carried out their responsibilities. The GAO standards urged, depending on the ultimate use of the audit results, that audit scope encompass a determination as to whether program objectives were being effectively achieved.

Today's public officials are responsible for a plethora of activities. The numbers and different types of governmental programs stagger one's imagination. They range quite literally from A to Z. With the influence of these standards on audits of this wide variety of governmental activities, the need to develop new audit techniques grew. Different ways to analyze, measure, and evaluate within this ever-broadening range of operational areas had to be devised. More creative measurement techniques had to be sought out and used.

Audit Techniques Were Developed

The auditor's movement from the attest role in the fiscal arena to operations measurement and evaluation was a visible one. It quite obviously required the development of new and different methods and techniques.

Both GAO and AICPA standards required the auditor to develop adequate professional proficiency in obtaining sufficient, competent, and relevant evidence as a basis for opinions, judgments, conclusions, and recommendations. The GAO standards, in demanding that proficiency, subtly insisted that the traditional body of auditing techniques be enlarged to accommodate the auditor's expanded responsibilities.

The Profession Responded

Auditors, both within and outside of government, responded to the need for change. Audit institutions initiated programs to enlarge the perspectives of their members. Individual practitioners engaged in activities designed to expand their horizons. Concentrated exposure to disciplines auditors heretofore were relatively unconcerned about was recognized as requisite for success in operational auditing. The ability of the auditor to select and then to utilize appropriate measurement tools was acknowledged as the key to positive achievement in program evaluation.

The Laboratory and the Audit

Most auditors experienced no difficulty in confronting fairly familiar business disciplines. Procurement, marketing, personnel administration, inventory management, and other such areas were easily mastered. Knowledge acquired and skills developed during the days of fiscal and compliance audits were effectively utilized in the auditor's new role. The principles of more esoteric subject matter like statistics, computer technology, operations research, and systems analysis were quickly understood and pressed into use during operational audit efforts.

As the business school-trained auditor moved into operational and program areas further and further removed from fiscal activities, the need to use techniques of yet another genre emerged. The operational auditor began to recognize that those same decision making tools used by program participants now had to be used by the auditor if informed opinions on the relative success of programs could be rendered. For example, if activities like a kindergarten to eighth-grade education program, a

phase of prison management, or an element of a public assistance were to be looked at, it followed that pedagogical, penological, and sociological measurement standards had to be used.

The use of the physical sciences then became an obvious answer to the question as to how Federal programs involving issues such as shellfish sanitation, lead poison control, salmonella contamination, and coal mine safety could be measured. The thistle tube, microscope, and bunsen burner were counted among the new audit tools. Mechanical, chemical, and biological testing, with results expressed in parts per million, decimals, pounds per square inch, and British thermal units as well as in dollars and cents, began to provide the GAO auditor with support for conclusions and recommendations in operational and program areas.

The Laboratory Can Be Used Effectively

Is it really practicable for auditors to use the laboratory as an audit tool? Let's take a look at how it has been used by GAO auditors in the recent past.

Lead poisoning of children is regarded as a common, very devastating malady resulting from repeated exposure to lead-laden conditions. The Federal government supports far-reaching programs to control such conditions.

GAO auditors, to measure the extent to which lead-hazards were being controlled, needed to know whether paint containing high lead levels was available for sale, was being used on federally assisted building projects, or was applied to any federally financed housing.[1]

After a briefing by local health department inspectors, and arranging to use local and Federal facilities and personnel, field work was initiated. GAO auditors visited Federal construction sites and filled laboratory jars with paint samples. They visited retail outlets and bought suspiciously labeled paint. They visited residential, federally financed housing, and were permitted to carefully remove paint chips from ceilings, walls, and woodwork. The samples were then delivered to Federal and local laboratories where auditor-directed, technician-executed tests for lead were carried out.

The results showed the auditors that recommended safe limits of lead had been exceeded. Paint being applied to federally associated properties contained lead in excess of 0.5 percent, and paint was being retailed which contained lead in excess of 0.7 percent.

Shellfish are harvested in their natural state and consumed, frequently uncooked, as a regular dietary supplement. The National Shellfish Sanitation Program has as its basic objective the prevention of illness by assuring that shellfish consumed in the United States are not carriers of viral hepatitis, typhoid, polio, gastroenteritis, and other, sometimes fatal, diseases. Whether the program was enjoying success could be measured by the purity of the water from which marketed shellfish is taken and the quality of the shellfish available to the consumer.

[1] A survey of lead poison control activities performed by the New York regional office covered these particular areas.

After conferring with Federal and State program officials, GAO auditors attempted program measurement by assessing the sanitary conditions of both the shellfish and the water. Arrangements were made with the Federal and State agencies to use laboratory facilities, test equipment, a boat, and technicians. Under the auditor's direction, both shellfish and water samples were taken from harvesting areas. In addition, shellfish samples were obtained by the auditors from retail food establishments and processing plants.

Shellfish samples collected from processing plants showed that fecal coliform and plate counts[2] exceeded safe limits. Tests also showed that some of the shellfish samples contained excessive amounts of cadmium, as well as chlordane, DDE [3] and other pesticides. Tests of water samples taken from shellfish growing areas indicated that safe coliform limits were exceeded.[4]

Drinking water, safe from biological and chemical pollutants, has become of nationwide concern. From 1961 to 1970 there were 46,000 reported cases of illness and some 20 deaths, all attributable to contaminated drinking water sources.

GAO performed a review to determine whether Federal and State programs were adequate for insuring that acceptable quality drinking water supplies were available. GAO looked at bottled water as one source of supply. Retail outlets in five States were visited by GAO and samples of bottled water were purchased. The samples were then taken to a Federal agency where tests for arsenic, sulfates, iron, copper, flouride, chloride, manganese, and dissolved solids were performed. Analyses for bacteria counts were also made.

The results of the testing showed high bacteria counts (up to 1.9 million microorganisms per milliliter) and showed also that recommended chemical standards for substances, i.e., solids, chloride, manganese, arsenic, and fluoride were being exceeded. Dissolved solids exceeded standards in one test by as much as 3,256 milligrams per liter.[5]

About two million documented salmonellosis cases occur annually in the United States. This disease may be caused by any one of the approximately 1,300 types of salmonella bacteria often found in raw meat and poultry. It can cause severe illness and sometimes death. GAO examined the salmonella contamination problem to determine if the Department of Health, Education and Welfare and the Department of Agriculture could improve efforts to reduce its incidence.

The extent of actual salmonella contamination at the retail level was unknown. Therefore, GAO obtained samples of meat and poultry from auditor-selected retail stores in each of

[2] Fecal coliform is bacteria which indicates the presence of fecal pollution and other harmful bacteria. Plate count is the total bacteria present.

[3] DDE is a degradation of dichloro-diphenyl-trichloro-ethane (DDT).

[4] GAO report to the Congress, "Protecting the Consumer from Potentially Harmful Shellfish (Clams, Mussels, and Oysters)" (B-164031(2), Mar. 29, 1973).

[5] GAO report to the Congress, "Improved Federal and State Programs Needed to Insure The Purity and Safety of Drinking Water In The United States (B-166506, Nov. 15, 1973).

10 metropolitan areas.[6] GAO auditors directed the purchase of some two hundred samples by Federal inspectors, 100 each of raw meat and poultry. The samples were packaged by the inspectors to preserve their condition and shipped immediately to a Federal laboratory. At the laboratory the samples were tested for salmonella contamination.

The laboratory analysis detected salmonella in about 17 percent of all the samples and determined that more than 30 percent of one sample class was contaminated. One sample class tested completely negative, viz., without salmonella.[7]

Respirable coal mine dust may cause a type of pneumoconiosis known as "black lung" disease. Since 1970 coal mine operators have been required to operate dust sampling programs to determine the extent of respirable dust in the coal mines so that dangerous dust levels can be avoided.

GAO observed that a significant number of mine dust sample results showed respirable dust concentrations of 0.1 milligrams per cubic meter of air. While below the Federal standard of 2.0 milligrams, their unusual uniformity was indicative of questionable dust sampling.

GAO decided to take dust samples from selected mines to explore the probability of getting samples with 0.1 milligram dust concentrations. To test, GAO visited 14 mines and, using standard dust-measuring equipment,[8] took dust samples at each of the mines. A total of 25 individual dust samples were collected under diverse conditions.

The samples were then sent by the auditors to a laboratory for weighing to determine the possibility of getting consistent results reflecting 0.1 milligram dust concentrations. Weighing revealed that coal dust levels ranged from 0.1 milligrams to more than 2.0 milligrams. Only two of the 25 samples showed 0.1. The latter two dust samples, however, were taken not from deep inside a mine but from an area contiguous with one of the 14 mines visited.

The use of the laboratory analysis can be an effective technique if not a very essential one. Without it GAO auditors may not have been able to render an opinion, based on sufficient, relevant, and competent evidence—something the GAO standards require—as to whether desired program results were being achieved. Whether programs were effective for controlling lead hazards, unsanitary drinking water, contaminated meat and poultry, dangerous mine conditions, and unsafe shellfish could not have been as confidently determined without the use of the laboratory as an aid.

Cautions To Be Observed

As with any technique, the use of the laboratory is not a panacea and can be fraught with hazards. The auditor who selects the technique to help make a determination, demonstrate a point, or support a conclusion or recommendation,

[6] About 23 percent of the Nation's population resided in those areas.

[7] GAO report to the Congress, "Salmonella In Raw Meat And Poultry: An Assessment Of The Problem" (B-164031(2) July 22, 1974).

[8] A mechanical device manufactured specifically for the purpose of collecting airborne coal dust.

must do so with more than just usual care. There are a few special cautions the auditor must be certain to observe:

- Knowledge not belonging to the auditor is being utilized.
- Independence is being compromised.
- The technician may not be relied upon as the sole means of measurement.

Using Someone Else's Knowledge

During the fiscal audit and audits for accountability, the auditor works in a very familiar environment. Accounting and related subjects are the forte of the business school graduate auditor. Quite naturally, traditional auditing, particularly in related business areas, draws upon the knowledge the auditor garnered in school as well as through previous work experiences. In using laboratory techniques, albeit directed and controlled, the auditor must rely upon the knowledge and experience of someone who is not likely to be an auditor, more likely not trained to audit, and not necessarily functioning with the needs of the GAO auditor in mind. The auditor must be aware of this and be prepared to cope with any eventualities that may arise because of it.

Independence May Be Compromised

Unless the auditor is a biologist or chemist, or unless there is one on the staff and accessible, someone else will have to perform the auditor's laboratory tests. GAO standards, in discussing independence, observe that management interference with the selection of audit procedures might impair independence, In the reviews discussed above, the GAO auditors selected the tests to be performed, developed and controlled the drawing of the samples, monitored the execution of the tests, and critically evaluated test results. They also relied upon non-GAO personnel to perform the tests.

While past experience has shown that such reliance has generally been justified, the auditor should continue to take precautions necessary to preserve independence. Reluctant agency personnel and questionable test results should prompt the auditor to explore other test facilities. (Some of the testing mentioned above was divided between local and Federal laboratories.)

The Technique Should Not Be The Sole Means of Measurement

Laboratory testing is simply a means available to the auditor in discharging the audit responsibility. It should be used as much as other means of analysis—economic, sociologic, mathematic—are used and always in conjunction with other audit techniques.

The results of the biological or chemical analysis must be complemented by the traditional reviews of records, of systems, and of internal controls which, in each of the instances discussed here, would be the cognizant agency's procedures for systematic and reliable testing. Likewise, people continue to be a source of essential information. Nothing should be ignored in favor of the laboratory analysis; the GAO auditor should use all available tools.