INTRODUCTION

The program for this National Conference has been devoted to a rather detailed recounting of the problems facing our country in the waste handling and disposal area and to presentations that should give some cause to hope that we do have available the technological manpower and production capabilities to deal effectively with these problems. The incentive to take action is most certainly there and certainly the funds needed to apply available solutions will be found eventually. In fact, in view of the alternatives, there can be only a question of "when," not "if."

I am sure that the average citizen thinks primarily in terms of a public service department or private service firm in connection with waste disposal and incineration. Even the probably more sophisticated public official or industrial executive may think in terms of public or private services, with the added knowledge that various firms marketing waste handling and disposal equipment provide a source of information and advice. The purpose of my presentation is to call attention to an independent source of technical and professional services available to those concerned with the design, installation, and operation of incineration plants and to comment on how to make the best use of this source of professional advice.

More than 200 firms affiliated with Consulting Engineers Council list in their qualifications waste disposal, handling, and incineration capabilities. There are, in addition, many firms and individuals not affiliated with CEC who also have experience and qualifications in this field of practice. Indeed, with the continued growth of interest in solving our air-pollution, water-pollution, and waste-disposal environmental problems, many consulting firms have expanded capabilities in these fields of practice in recent years, and we are confident that more will be available in future.

A brief review of the services that are available from independent consulting engineers shows that they range from preliminary evaluation of waste disposal and incineration requirements through design and construction management to the operation of the finished plant.

Although many consulting engineering firms have experience and capabilities in the design of incinerators and attendant facilities, it should be clearly understood that professional registration and engagement in engineering practice does not signify professional competence in all fields of engineering. In fact, the profession is highly specialized, as is the case with the practice of law or medicine. With the continuing expansion of technology in all areas, the individual design professional is increasingly obliged to concentrate his efforts in relatively narrow specialties, and thus it is that a qualified specialist must be found for the design of waste disposal facilities, highways, airports, and so forth.

In fact, the majority of today's complex projects require the combined talents and efforts of a team of design specialists. This design team may include landscape architects, professional planners, mechanical engineers, electrical engineers, civil engineers, structural engineers, and even specialists in
vibration control, corrosion, color, acoustics, traffic, and many other fields. These specialties can, for the most part, be provided by a single firm, although it may be necessary to join forces for specific projects with other firms or individuals.

Technically, the professional engineering registration laws in most states permit the individual to offer services in rather broadly defined areas, such as "civil engineering" or "mechanical engineering". The true professional will not undertake assignments for which he, personally, or his firm are not qualified. The client also has the protection of checking with previous clients whose names will be provided as references for similar undertakings. In addition, the professional societies seek actively to discourage the individual from undertaking assignments for which he is not qualified, and they will act on complaints received to this effect.

The value of retaining a fully independent consulting engineer is most readily apparent at the initial consideration stage. Having no other consideration than to bring professional experience and knowledge to the client's problems, the consulting engineering firm can begin with an impartial analysis of alternative solutions to any problem. Having no sales, manufacturing, or construction interests, the independent consultant will approach the problem of waste disposal and incineration with a completely open mind as to methods, plant, and equipment most suitable and economical for the job. The consulting engineer also concerns himself with alternative site recommendations, transportation requirements, operating manpower, local laws and ordinances, and community relations, all of which influence final decisions. The consulting engineer of today is probably as much concerned and involved with economics as with technical and professional expertise. This concern means that he must be prepared to weigh many alternative factors in connection with choosing a site, selecting materials and equipment, anticipating construction costs, and evaluating the total net costs of any given project to the owner, including costs of operation, depreciation, taxation, etc.

Once the basic decisions have been made, the consulting engineer is also equipped to assist in obtaining the financing necessary to execute a project. His preliminary studies will provide the basic information needed to secure borrowed funds, bond financing, federal aid (if applicable), or funds from whatever other sources may be contemplated.

He is also obliged to carefully consider all pertinent local zoning regulations, building code requirements, and air-and water-pollution control requirements. Only after the consideration of all of the foregoing factors does the consulting engineer function in the manner pictured most frequently, i.e., in the production of plans and specifications. Here, the consulting engineer must bring into play the professional expertise of a team of professionals, usually planners, draftsmen, technicians, computer operators, economists, landscape architects, and, of course, professional engineers. This team receives a constant input of technical information necessary to the complete design of an incinerator plant and all of its appurtenances. The heart of the installation will, of course, be the combustion chamber and its service equipment. The consulting engineer keeps abreast of what is available from all major manufacturers of this type of equipment, and his independence of choice enables him to make recommendations that will be in the best overall interests of the client. Specialists will design the access roadways, handling equipment, foundations, the shell surrounding the assembled equipment, and all other service facilities, hopefully including appropriate landscape treatment in the interests of our national beautification program.

The responsibility of the consulting engineer seldom stops with the completion of design, however. If requested by the client, he is prepared to handle the bidding phase of the project, including the issuance of invitations for bids, the evaluation of bids received, and recommendations as to the selection of contractors. A most important facet of the consulting engineer's services is management during construction to insure compliance with plans, specifications and intent of the contract documents. Even with the completion of construction, the consulting engineer continues his responsibilities and interest. The finished plant must function as intended, and the professional designer is best equipped to advise on plant startup and operation. Periodic investigations and advice will probably be required throughout the life of the installation. Many consulting engineering firms are also equipped to train operating personnel and to make recommendations on the overall operations of what should be regarded as a complete system, including administration, management, collection and handling of waste materials, disposal of residue, and service rate structures.
**SELECTION FACTORS**

Turning to the actual selection of a consulting engineer or consulting engineering firm, the prospective client is faced with a difficult task in evaluating technical and professional competence, judgment, and expertise. As noted previously, many consulting firms have capabilities in this field of practice and can provide a record of successful accomplishments. It is safe to say that no firm is “best” for the design of any given project or installation, and it is probably desirable that a client should have several sources of professional services among which to choose.

Factors to be considered include the firm’s past record of accomplishment, successful completion of similar projects, personnel available to handle the project, geographical location, management capabilities, availability of special consultants, and availability of the firm’s resources and manpower at any particular time.

The most logical starting point is contact with several consulting engineering firms to request expressions of interest and the provision of basic information, usually available in the form of firm brochures. Supplementary information can be obtained once initial investigation produces interest on both sides. This may be in the form of information with regard to specialized firm personnel and consultants, recent projects undertaken, and availability at the time needed. Previous clients may also be contacted.

Four or five firms may be found to have the qualifications and experience needed for a given project. Representatives of these firms should be interviewed personally and asked to make definite expressions of interest in undertaking the project. It is often worthwhile to request general proposals in writing, outlining the approach that would be taken to the problem, the staff that would be assigned, and the scope of services that would be provided. Time for initiation and completion of engineering functions should also be stipulated in these preliminary proposals.

These interviews and proposals will form the basis for making a tentative selection. Based on the information provided and definite expressions of interest, one of the firms under consideration should be selected, and detailed discussions including the fee should be scheduled. It should be noted that professional compensation should be discussed only after selection on the basis of qualifications and availability; in selecting a professional engineer, as with a physician or attorney, the initial selection should not be made on the basis of price.

If you are selecting the best qualified professional service organization, you are automatically basing your selection on factors that cannot be measured precisely in terms of dollars and cents. Considering that the services to be provided by the professional consultant cannot be precisely defined and quantified in advance, it should be readily apparent that competitively priced bidding has no place in the selection of a professional service consultant.

Public agencies utilizing consulting engineering services often appoint regular selection and negotiation committees to undertake evaluation and selection, and many industrial firms do also. Needless to say, this selection, particularly in smaller organizations, can be undertaken by a qualified individual or an ad hoc committee. Detailed selection criteria and procedural recommendations are available from national, state, and local professional societies, and these organizations can also provide prevailing fee schedule information and specific recommendations including lists of firms with certain qualifications, assistance in setting up and conducting interviews, and so forth. It is entirely possible that the firm selected and the client will not be able to reach agreement on professional fees. Two courses of action are open to the client faced with this problem. First, negotiations with the firm first selected may be terminated and one of the other firms initially under consideration can be contacted. If this is done, this second firm should be advised that negotiations were broken off with the first firm prior to initiating discussion. If this second round of negotiations also leads to an impasse, it is possible that the target fee set by the client is unrealistic, or the scope and description of services may be inadequate.

The alternative to opening negotiations with a second firm is redefinition of the scope of services, which may not have been clearly understood in the first instance. Although fee schedules published by various professional societies, percentage of construction costs, and other rules of thumb all provide some general guidance. It should be clearly understood that each engineering assignment is a case unto itself and must be individually evaluated and priced according to the professional judgement of those concerned. Happily, in most cases professional compensation adequate to the assignment is negotiated without undue difficulty. Most clients realize that they will be best served by engineering of the
highest possible quality—usually far less than 10 percent of the total project cost—which will produce the most economical and satisfactory construction and equipment—the other ninety percent plus of the project cost.

**ALTERNATIVE SOURCES OF ADVICE**

There are many alternative sources of professional advice and design services. This paper has attempted to outline the services available from engineers in private practice, the advantages of utilizing a completely independent professional engineering firm, and the procedures recommended by the professional societies for selecting and negotiating with such a firm.

It would be unfair and pointless to argue that only an independent consulting engineer in private practice possesses experience and knowledge in the design, construction, and operation of waste disposal and incinerator facilities. Many manufacturers of the handling and combustion equipment, which form a major part of any installation, have devoted years of research and development effort to producing their product. In addition, many large design/construction firms have specialized capabilities in this field. Both offer alternative sources of advice and recommendations, and many large, successful installations pay tribute to their capabilities. However, two important points should be recognized and evaluated by anyone considering waste disposal and incineration problems. First, although it may not be separately identified and invoiced, the engineering incidental to the solution of any waste disposal problem must be paid for. Whether or not this engineering is separately identified and charged to the client, the total cost of the finished product must cover planning and design costs. Secondly, "free engineering" by a manufacturer or contractor presupposes the purchase of equipment and/or construction services as the solution to any given problem.

Contrasted to this procedure, the retention of a completely independent consulting engineer provides the client with one basic and very important additional service, i.e., the consideration of all possible alternative solutions to any given problem. It is entirely possible that your independent professional engineer will find several possible solutions, all of which will have equal weight in his consideration because he has no particular product or equipment preference and because he does not derive profit from the sale of machinery, equipment, construction, or other services.

Probably the most practicable and advantageous arrangement for all concerned is a close working relationship among and between the independent design professional, manufacturers, and contractors, with the independent professional representing the client's interest at all times. The independent designer does not work in a vacuum and maintains regular liaison with manufacturers, contractors, trade associations, professional societies, and other sources of technical information, information on material and wage rates, and all of the other data necessary to remain current in a rapidly changing world.

**COMPETITIVE SELECTION**

It would be reasonable to assume that the engineering profession has firmly established the principles of selection and negotiation on the basis of qualifications and availability, rather than price. However, as with so many other things, we are faced with continuous change and the application of pressures from other sources. There is, first, a natural tendency to follow the lead of patterns established for the procurement of most other goods and services, these being obtained for the most part on a competitive-priced basis. Both private and public organizations engaged primarily in buying and selling on a competitive-price basis are naturally inclined to apply the competitive-bid principle to professional engineering and other services. This can be successfully countered with a demonstration that professional engineering service, unlike construction services and manufactured items, cannot be precisely specified by the purchaser so as to permit the establishment of exact costs in advance. A consulting engineering firm is retained to provide services that cannot be defined in nature or scope in advance, and this defeats the application of competitive price selection.

Of even greater concern, however, is a recent trend at the federal government level toward insisting upon competitive-price selection of professional architects and engineers. This trend was given impetus by a 1967 finding of the General Accounting Office to the effect that existing laws do not, in fact, permit noncompetitive procurement of goods and services. This opinion by the Comptroller General has been widely misunderstood. As a part of a general review of Federal agency procurement policies and
procedures, the Comptroller General found that those agencies utilizing professional services were, in most cases, following the selection and negotiation procedures advocated by the professional societies without specific authorization under the law to make exceptions to the general competitive-priced selection rule. The GAO report simply pointed out to the Congress that technical violations of existing laws were occurring as a result. It was left to the Congress to decide upon enforcement of existing laws or the enactment of legislation that would permit exemption of professional services.

Most federal agencies agree with the principles of selection on the basis of qualifications and experience and, having found no indication of strict enforcement by other agencies of the government, most have continued to negotiate as before. The professional societies have requested Congressional review of the situation and enactment of legislation that would firmly establish noncompetitive selection procedures as a prerogative of the administrative agencies. However, we are faced with many other more urgent demands upon the time of the Congress, and no action has been taken to date. Thus, we are confronted with a peculiar and ludicrous situation. We are apparently negotiating contracts in a manner not permitted by law, with usual agreement on both sides that noncompetitive selection is in the best interest of the client, the public, and the profession. We are apparently negotiating contracts in a manner not permitted by law, with usual agreement on both sides that noncompetitive selection is in the best interest of the client, the public, and the profession. So far, little or no effort has been made to enforce strictly what the Comptroller has declared to be the law of the land, and Congress has evidenced little interest in changing this situation.

Efforts are continuing to change this through enactment of appropriate legislation. It is important that this be accomplished, inasmuch as the Comptroller General’s report is cited by many as evidence that competitive priced proposals should be required and that not all federal agencies by any means are inclined to follow the procedures established and advocated by the professional societies. This is particularly true of many of the newer agencies, and we are faced with a rising number of requests from these organizations, backed by the GAO findings.

The professional societies have joined forces to seek a permanent solution to this problem, and we would welcome the support of all concerned.

CONCLUSIONS

The relationship between the client (or owner) and the professional engineer or consulting firm is entirely professional in nature. The engineer is duty bound at all times to represent the client’s interest as though they were his own, and he must further treat the relationship as entirely confidential in nature. These considerations assure the client of protection in terms of the most suitable and economic end result, whatever the project may be.

It is important that the consulting engineer be selected on the basis of his qualifications and experience. Although the cost of engineering services must be regarded as important by the client, it should be recognized that the selection of an engineer cannot and should not be conditioned primarily on price. The quality of engineering, which will represent less than ten percent of most project total costs, will determine the costs of construction – the other 90 to 95 percent. This should be reason enough to obtain the best possible assistance in the way of design services.

It is also vital that the consulting engineer be selected and brought into the picture at the earliest possible moment – while the project is still “just a gleam in the eye” is best. Initial decisions on location, type of facility, process equipment, and so forth should be made with the advice and assistance of your professional consultant. All too often the consulting engineer is presented with a set of commitments and decisions that might better have awaited his advice and that may restrict adversely his professional judgements.

The engineering profession is well equipped to participate in solving environmental problems. Individual engineers and consulting firms provide a tremendous reservoir of professional experience and capabilities, and they stand ready to work with those responsible for meeting the challenge of a livable environment.