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THE U.S. ENVIRONMENTAL MARKETPLACE

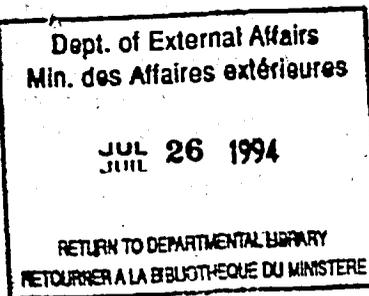
A Guide for
Canadian Consulting Engineers

April 1993

Penetrating the U.S. Environmental Market: Prospects and Strategies for Canadian Consulting Engineers

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Executive Summary

Executive Summary

Objectives of the Study

In 1992, External Affairs and International Trade Canada (EAITC)¹ chose to fund two studies examining "prospects and strategies in the U.S. market for the Canadian environmental consulting engineering sector". The first study focussed on the Eastern Seaboard region, although most of the information in the report was (and is) of relevance to Canadian firms in all regions. The first document, published in February 1992, has been very well-received by the country's engineering consulting and environmental community and has been distributed to some 900 Canadian firms.

Because the initial version of the work was so well-received, EAITC chose to undertake this second study with an enhanced focus on public sector opportunities, liability considerations, western U.S. opportunities, and other subjects. This second report then builds considerably upon the information contained in the first report. The majority of the information in both reports is of relevance to the U.S. environmental market in general - the market is simply too vast and the opportunities too immense to make any detailed study of particular states, cities or industry sectors. The onus is on individual Canadian firms to use the techniques and sources described in the document to identify the opportunities that best suit their capabilities.

This document is to serve primarily as a guide to Canadian firms who are less experienced in the U.S. market, as opposed to larger firms who may already be highly active in the market. Small and medium sized Canadian environmental engineering firms should thus find the information in the report to be particularly useful. Some aspects of the work might also be of interest to other engineering disciplines, as well as to academics, environmental equipment producers, construction firms, and others.

The management consulting firm of Ernst & Young² was selected to conduct the assignment. Ernst & Young benefitted from the guidance of an advisory committee representing EAITC, Industry, Science and Technology Canada (ISTC), and the Association of Consulting Engineers of Canada. The findings and information contained in the report are based upon a review of existing

¹ The project has been conducted in close consultation with the Association of Consulting Engineers of Canada (ACEC) and with Industry, Science and Technology Canada (ISTC).

² Additional information may be obtained from Paul Stothart in the Ottawa office of Ernst & Young Management Consultants at (613) 232-1511.

documents, as well as over 100 interviews with manufacturers, utilities, engineers, governments, and other organizations in Canada and the United States.

The specific objectives of this study are to provide Canadian firms with insight in the following areas of the U.S. environmental market:

- market size and growth;
- important market characteristics and trends;
- techniques through which relevant contacts and potential clients can be identified;
- relevant licensing and legislative issues;
- major hindrances, inconveniences, and legislated barriers facing potential entrants;
- strategies of other Canadian firms in the American market;
- the views of U.S. organizations in terms of their buying process, awareness of Canadian capabilities, and openness to partnership;
- options regarding acquisition or joint venturing as a means of entering the market; and
- relevant trade shows, trade journals, seminars, associations, companies and government information sources.

Conclusions

Discussions and research undertaken during this assignment suggest that Canadian engineering firms can benefit from U.S. market activity in a number of ways, including:

- a market diversification which reduces dependence on a single marketplace;
- an exposure to new technologies, new financing concepts and evolving trends;
- a first-hand knowledge of the strategies of potential future competition;
- an enhanced access to more ideas and broader skills;
- an increased level of revenues and profit;
- an extended life for the firm's service concepts;
- a better utilization of company personnel, facilities and overheads.

Each of the above general benefits serves to enhance the overall competitiveness of the Canadian firm and to help it prepare for the increased competition coming to the Canadian market.

In the specific case of the United States environmental market, the data on market size and growth vary, although in all instances these data and projections are substantial. The U.S. environmental market is large and offers considerable potential for qualified Canadian firms. The environmental market encompasses some \$130 billion in annual spending and grew by approximately 11 percent in 1991. It is projected that environmental spending will rise from current levels of around 1.8 percent of GDP to almost 3 percent of GDP in 2000. As well, future environmental market opportunities in Mexico, South America and other regions may be more attainable for Canadian firms with U.S. market exposure and/or with U.S. alliances.

The link which many argue exists between environmental standards and international competitiveness is gaining increased exposure in the United States. The view that tough environmental standards and enforcement will in the long-term generate more internationally competitive companies suggests that nations should encourage the development of strong, active environmental industries and standards. As this view takes hold, the market for relevant Canadian environmental expertise will continue to expand.

The recent election of the Clinton/Gore ticket will also represent a boost for environmental activity in the United States. While budgetary spending may not increase in any substantial amount, sources that we have interviewed suggest that trust will increase between Congress, the Administration and the Environmental Protection Agency and that momentum will grow. It is also probable that legislation will move forward in a more timely manner.

While the market is attractive, it is important that Canadian firms also note that strong competition already exists in the U.S. market. In order to enjoy long-term success, Canadian firms must be aware of (and emphasize) their areas of expertise and develop U.S. contacts accordingly. The main text of the report indicates numerous documents, approaches, and strategies that can be followed in developing such contacts.

Main Text

Table 1: The U.S. Environmental Market (1991)

| Polluted Media | Amount (\$US bil) | Share (%) |
|-----------------------|------------------------------|----------------------|
| Air | 33 | 25 |
| Water and Wastewater | 42 | 32 |
| Solid Waste | 33 | 25 |
| Toxic Waste | 23 | 18 |
| Total Market | 130 | 100 |

Source: NETAC

| Sector | Amount (\$US bil) | Share (%) |
|-----------------------------|------------------------------|----------------------|
| Industrial/Commercial Firms | 78 | 60 |
| Municipal Governments | 29 | 22 |
| Federal Government | 19 | 15 |
| State Governments | 4 | 3 |
| Total Market | 130 | 100 |

Source: WA Lorenz

The \$130 billion market is divided roughly 60 percent private and 40 percent public

About 40 percent is capital investment and 60 percent is operating costs

Section One: Market Overview

1.1 Market Overview

The market information in this section is derived from many documents, studies and interviews. Among others, the NETAC¹ is one good source of statistics and segmented market information that has been drawn upon.

The United States is a collection of regional markets of significant wealth and population. There are 41 metropolitan areas in the U.S. which have populations exceeding one million people, compared to only three in Canada. Five of the nine geographic divisions in the United States have populations exceeding that of Canada as a whole, while the remaining four divisions each exceed one-half of Canada's total population. Some thirty percent of the American population resides in the states which border Canada.²

In the environmental area, the United States market totals some \$130 billion in 1991 spending. As indicated in Table 1, this market encompasses about \$33 billion in air-related activities, \$42 billion in the water and wastewater sector³, \$33 billion in solid waste, and \$23 billion in hazardous waste activities.

The market is divided approximately 60 percent private sector spending and 40 percent public sector spending. Approximately 40 percent of the total environmental spending is on capital investment (plant and equipment replacement and expansion) while the remainder is on operating costs (operation, research and maintenance of pollution abatement processes).

Table 2 presents findings and statistics from a number of individual market studies that have been conducted during the past five years covering various aspects of the U.S. environmental market.

¹ The National Environmental Technology Applications Corporation is a non-profit corporation affiliated with the University of Pittsburgh and funded through a combination of industry, government and foundations.

² The Eastern Seaboard region, potentially of interest to Ontario, Quebec and Atlantic firms, consists of 16 states and represents a population of 90 million people. Based on its share of total manufacturers' pollution abatement capital/operating spending, it is estimated that the region generates an annual environmental market of \$30-40 billion. This region was discussed in more detail in an earlier report focussing on the Eastern Seaboard market.

³ There are some inconsistencies from one information source to another. For example, environmental market consultant, W.A. Lorenz, places the 1991 water and wastewater market at \$52 billion and the combined hazardous/solid waste market at \$45 billion compared to \$42 billion and \$56 billion respectively for NETAC information. The differences are due to overlaps between the various fields. That is, some wastewater aspects may be hazardous, some solid waste aspects may be hazardous and so on.

Table 2: Selected U.S. Environmental Market Studies/Statistics

- Recycling will account for 43 percent of plastic packaging waste disposal in 2002 versus 1988 levels of 1 percent.
- 36 percent of all solid waste will be managed in landfills in 2002 versus 96 percent in 1988.
- Recycling markets will grow at 13 percent and waste-to-energy markets at 11 percent annually through 1994.
- The market for inorganic membranes for use in industry, biotechnology and other environmental areas, is projected to grow at 33 percent annually through 2000.
- Air cleaners (12 percent) and trash compactors (8 percent) rank among the fastest growing "household appliances".
- The 1992 demand for air pollution abatement equipment is roughly \$25 million for mechanical collectors, \$35 million for solvent recovery, \$40 million for wet scrubbers, \$160 million for flue gas desulfurization, \$100 million for electrostatic precipitators, \$135 million for oxidation systems, and \$195 million for fabric filters.
- Municipal wastewater treatment capital expenditures will total around \$2.8 billion in 1995, with three-times this amount being directed toward operations and maintenance. Engineering (\$240 million), equipment (\$370 million), instruments (\$65 million), construction (\$1.7 billion), and materials (\$490 million) are the main capital items.
- Electric utilities (\$1.2 billion) and industrial facilities (\$4.5 billion) also project sizeable capital spending in 1995 for wastewater treatment.
- The U.S. government expects \$60 billion to be spent by 2000 in order to meet the requirements of the Clean Water Act amendments of 1987.
- Wastewater facilities in the U.S. require \$10 billion in annual work, while potable water treatment facilities require \$4 billion annually.
- The American market for industrial air filters exceeds \$500 million annually.
- The medical waste management market will increase from \$1.5 billion in 1991 to \$5 billion in 1994.
- The annual U.S. market for environmental software is estimated at \$US 5 billion.
- The underground storage tank removal and cleanup market will grow at 30 percent annually through 1995.
- The American water purification equipment and services market will approach \$8 billion in 1990, while the water management chemical market will exceed \$2 billion.
- Annual water supply expenditure budgets amount to \$100-150 billion. The Associated General Contractors estimate American water supply infrastructure needs of \$139 billion by the year 2000.
- Real spending on public sewer systems in the U.S. increases at about 3-4 percent annually and currently totals \$13 billion. The AGC estimates that \$508 billion is required by the year 2000 on wastewater treatment infrastructure.
- Public spending for solid waste disposal amounts to \$7 billion annually (versus \$600 million in Canada).
- Expenditures on air pollution abatement from mobile sources (cars, trucks) totalled \$20 billion in North America in 1985. A further \$18 billion was spent on air pollution abatement from stationary sources (industrial, public).

Source: a 1990 Ernst & Young literature search of environmental market studies. Note that the statistics may not correspond exactly (with other information in the report) as they reflect individual studies done at different times in recent years.

The conclusion which runs through many of the studies, not surprisingly, is that environmental markets are sizeable and rapidly growing.

The U.S. market is growing at a rapid pace - most indications suggest an annual market growth of approximately 11 percent overall, with growth in most market segments ranging from 10-20 percent.

Table 3 presents the growth rate by environmental industry segment, as sourced from the Environmental Business Journal. The Table also indicates the share of the \$130 billion market that is accounted for by each segment of activity.

Table 3: Segmentation and Growth of Market (1991)

| Segment | Share of Market (%) | Annual Growth (1991) (%) |
|---------------------------------------|---------------------|--------------------------|
| Solid Waste Management | 22 | 8 |
| Resource Recovery | 13 | 15 |
| Water Infrastructure | 11 | 10 |
| Hazardous Waste Management | 10 | 14 |
| Water Utilities | 9 | 4 |
| Environmental Consulting ⁴ | 9 | 16 |
| Waste Management Equipment | 7 | 12 |
| Air Pollution Control | 4 | 16 |
| Asbestos Abatement | 3 | 4 |
| Analytical Services | 2 | 14 |
| Instrument Manufacturing | 1 | 10 |
| Environmental Energy Sources | 1 | 8 |
| Other | 8 | 10 |
| <i>Total</i> | <i>100</i> | <i>11</i> |

It is projected that, by the Year 2000, approximately 3 percent of the U.S. GDP will be spent on environmental matters, compared to a current level of 1.8 percent.

⁴ The U.S. market for all types of engineering services totals approximately \$45 billion annually. About 95 percent of this market is captured by domestic firms. Foreign firms generally gain business through local offices or alliances.

1.2 Environmental Market Characteristics

This section presents some seventeen characteristics of the American environmental community that we believe are of relevance to Canadian firms.

1) Legislation is the Driver

As in Canada, legislation is the driving force behind the market. The Clean Air Act revisions of November 1990, for instance, are expected to generate \$25-35 billion in annual spending as organizations attempt to adhere to its requirements. Public pressure is also a driving force (particularly in consumer goods and resource industries) and tends to be more advanced in the United States than in Canada.

2) Companies Rarely Exceed Requirements

Companies tend to adhere to, though not exceed, requirements. American companies face substantial earnings pressure from shareholders and spending on environmental areas, particularly those with little immediate financial benefit, tends to be grudging. Packaging an offer/proposal in terms of payback period is thus a useful technique for environmental firms.

3) The U.S. is a Leader in the Environment

The U.S. is viewed in some circles as a lagging environmental nation. Perceived slowness in acid rain or global warming responses may have contributed to this impression.

In practice, the U.S. is among the leading environmental nations in the world. As a percentage of GDP, for example, the United States spends more on pollution control (1.67 percent) than Germany (1.52), Finland (1.32), Netherlands (1.26), the U.K. (1.25), France (1.10) and Norway (0.82), according to information provided by NETAC.

4) The Market is Difficult to Predict

The U.S. environmental market is volatile and it is consequently quite difficult to predict market size and targets. In general, legislators and enforcement agencies tend to establish ambitious targets that slip as the target dates approach. Some have suggested that this is "part and parcel" of the environmental scene and that the EPA, to take one major organization, has never met an original target deadline.

5) State Governments are Important

The State governments are the prime enforcement agencies. In some cases, state governments establish more ambitious targets than the minimums set by the federal EPA. However, it has been suggested that environmental enforcement by state governments tends to lag during tough economic periods. Even in periods of economic growth, the absolute number of polluted sites and emitting sources generally outweigh the enforcement capabilities and resources of the state in question, thus making enforcement a challenging task.

As in Canada, individual state governments are also responsible for the licensing of engineers. While many states have reciprocal engineering accreditation arrangements, there is only one such arrangement with Canada (New Brunswick and Maine). To conduct U.S. work, Canadian engineers must either write and pass the two-step accreditation process⁵ or enter arrangements with local firms to handle the "stamping" of all work in the given state.

6) Enforcement is Increasing

The EPA is substantially increasing its enforcement capabilities. One-quarter of all EPA civil penalties ever collected were obtained during 1990. Fines imposed in 1990 totalled \$US 91 million, and will likely continue to increase as the EPA augments its enforcement efforts. The EPA spends about \$60 million annually on enforcement and employs over 600 people in this regard. It is estimated that the EPA will have 200 criminal investigators by 1995 compared to fewer than 50 in 1990.

7) Public Opinion can be Misleading

As in Canada, the sentiments of "the people leading the politicians on environmental issues" is often expressed. Yet, it is likely that such claims are worth a closer examination. For example, non-point source pollution is a major problem in the United States. Do-it-yourself auto mechanics, for instance, dump the equivalent of 16 Exxon Valdez oil spills into American sewers and dumpsites each year! This is not a characteristic of an environmentally sensitive public.

⁵ In the U.S., the "EIT" exam is written shortly after graduation and covers a range of engineering disciplines. Approximately three years later an engineering "business practices" exam is written. The latter generally does not pose problems for Canadians, although the former does present problems for those Canadian engineers who are several years past graduation. There are centres in Canada where the EIT exam can be written. Canadian firms entering the U.S. market should have their younger engineers write these exams.

In addition, poll results show that 68 percent of Americans feel that the loss of habitat for an individual bird species is more important than the needs of a large logging company. Yet, probing closer, one finds that 75 percent of respondents favour logging jobs over habitat protection.

The inference to be drawn from such polls appears to be that people are in favour of the environment provided it affects someone else's job or wallet. In relaxing enforcement during recessionary times, state governments are merely reflecting these priorities.

8) Quality and Service are Increasingly Important

As in many other sectors today, quality and service (before and after the sale) is important and will become increasingly so in the U.S. environmental engineering sector. Following up on a client's satisfaction with prior projects is one increasingly common practice, both of staying abreast of future work and improving one's own level of quality and service.

9) Process Improvement is being emphasized as the Preferred Solution

There is an increasing American emphasis on process improvements, rather than end-of-line improvements, as the optimal environmental solution. As stated by President George Bush in 1989, "For too long, we've focused on cleanup and penalties after the damage is done. It's time to reorient ourselves using technologies and processes that reduce or prevent pollution - to stop it before it starts". As stated by the General Accounting Office in 1992, "there is a new focus on teaching companies the advantage of using different processes and inputs at the source as a way to reduce the use of toxic substances. The logic behind this idea is that it is easier to reduce the inputs than to have to clean up the resultant output". In addition, process improvements can often address "cross-media" problems where water, air and solid pollution problems can be addressed simultaneously through smarter processes.

This trend seems to be confirmed in manufacturers' capital spending statistics where the portion of total air abatement spending on production process (versus end-of-line) has increased from 27 percent in 1988 to 29 percent in 1990, and the portion of water abatement spending on production process has increased from 17 percent to 22 percent during the same period. This is discussed further in Section Four.

This clearly places a greater emphasis upon environmental engineering as the key solution. One recent example of an environmentally beneficial process improvement is that of Northern Telecom's elimination of the need for CFC solvents in its printed circuit board production process. Pre-treatment of inputs (source control) and improving of processes is high priority in all

environmental areas. This will be reflected both through changes to existing industrial facilities and through building new industrial facilities containing environmentally-advanced processes.

10) The Legal Community is Everywhere

There is a more active legal involvement in the U.S. environmental sector than in the Canadian community. Among other factors, this stems from the greater profile of liability questions in the U.S., as well as from the policies of the government which emphasize private-sector solutions to problems. For instance, there is a substantial amount of "credit trading" in the U.S. community - this often requires legal firms to facilitate the process.

The high legal involvement is perhaps best illustrated by the Superfund - a federally funded program established in 1980 to clean up hazardous waste sites. From its searches of 420 hazardous sites, the EPA has identified 14,000 "potentially responsible parties". We are aware of one (unsubstantiated) estimate that 55 percent of all Superfund spending since its inception in 1980 has been directed toward legal fees. A full decade after the establishment of the Superfund, fewer than five percent of the National Priority List of sites have been fully cleaned up - the majority of effort has unfortunately been directed at determining who is responsible, to what degree, over what time period, and other legalities.

11) Academic Institutions are Important

Academic institutions are also actively involved in the U.S. environmental community. Large volumes of EPA and DOD contracts, for example, are channelled through universities. As well, there is a considerable degree of joint environmental work being conducted between universities and business.

12) Electric Utilities are a Potential Opportunity

Electric utilities are more likely to have private equity than are utilities in Canada. They are, therefore, less bound to political considerations such as favouring local suppliers. American utilities are also much more reliant upon coal generated power and have contributed substantially to the Acid Rain problem in Canada and the United States. These utilities face substantial pressures from recent revisions to the Clean Air Act.

There are some 33 privately-owned utilities in the United States which each spend over \$200,000 annually on environmental areas. On average, 60 percent of this spending is on air pollution control, 30 percent on water pollution control and 10 percent on solid waste management. The

amount directed toward air pollution control will increase in future years, as utilities become increasingly pressured by the requirements of the Clean Air Act.

13) Competition is Strong

Competition in many environmental areas is intense. The American engineering community, for example, encompasses some 5200 firms in the American Consulting Engineers Council and 675 firms in the Academy of Environmental Engineers. The challenge faced by Canadian firms is illustrated by the fact that one firm, Lockheed, has a current database of 450 qualified contractors in the various environmental technologies. Penetrating regional and industrial markets will therefore not be easy for Canadian engineers and, according to Canadian firms in the market, will require a serious effort for 2-3 years.

14) There is Substantial Government-Industry Interaction

There is a high degree of government-industry interaction in the U.S. environmental community. This interaction is mainly in two areas. First, American legislators and policies place a very high reliance upon industry suggestions, technologies and initiatives. Second, there is a trend toward the privatization of infrastructure-related developments, as city and county governments attempt to find funding for road-tunnel, sewage and water treatment projects.

15) Permit Trading is Increasing

Related to the above point is the fact that private sector solutions to environmental problems are arising. The idea of tradeable permits, for instance, appears to be gathering momentum.

It is generally agreed that trading permits in pollution is an effective way to reduce both pollution levels and the costs of compliance. If instituted properly, a market for permits could develop that would reward clean factories and enable them to sell their permits to others at a market-set price. Questions of how to administer, monitor, and enforce trades will likely have to be addressed before efficient markets develop. For example, according to the General Accounting Office, many communities fear that the Clean Water Act lacks specific authority for trading and that this could result in legal challenges to projects that do develop.

16) Defence Contractors are Moving In

Many American defence contractors are making substantial shifts into the environmental area. According to varying sources, it is unlikely that the so-called "peace dividend" will actually be transferred from DOD to other environmental departments. A more likely scenario is that DOD will

become actively involved in environmental clean-ups and that defence contractors will receive contracts to "undo" much of the environmental damage caused at munitions sites, defence depots and other facilities during previous decades.

The Department of Defense will play an increasing role in the environmental area. One source, for example, estimates that 300 research contracts will be awarded in the "next six months" to examine the question of disposing of bombs, ordinance, and chemical weapons.

Within the EPA, as well, defence firms are enjoying success in environmental areas. Litton and Lockheed both rank among the EPA's 20 largest contractors.

17) Banks are Cautious

Environmental liability is an increasing concern for the banking community. The banking lobby has recently won a Superfund liability exemption for banks who become owners of land due to mortgage foreclosure. Though this ruling has solved some problems, the banking association has adopted a policy that loan requests for building or purchasing industrial lands must be accompanied by an environmental assessment and that any site that does not pass the assessment will not be acceptable collateral. As stated by one interviewee, "it's a Catch-22 situation in that a company needs money to clean up a site but the banks will not lend money to contaminated sites. This is starting to have an impact on the economy because the real estate market and economic activity is slowing even further."

1.3 Environmental Market Trends

The U.S. environmental market is expanding at substantial rates - most studies suggest growth of 10-20 percent annually. Many of the interviews that we have conducted have suggested that further environmental advances will flow from the priorities of the new Presidential team of Bill Clinton and Al Gore. While there may not be additional funding, these sources suggest that there will be a closer, more understanding relationship between the EPA, the Congress and the Administration.

Within the U.S. sector, there also appear to be areas which offer particular potential. Based on a range of information sources consulted during this study, it is our view that the following environmental activities, in no particular order, will be "hot" in the United States during the next five years.

1) Non-Point Source Water Pollution

As discussed in the EPA News⁶, " the task of controlling NPS pollution is in many respects more difficult than controlling pollution from point sources, and requires different control strategies". According to the EPA, nonpoint-source pollution is the main reason lakes and rivers fail to meet clean water standards for fishing, swimming and drinking. This is clearly a growing concern in the United States.

For example, 50-70 percent of impaired or threatened surface waters are affected by NPS pollution from agricultural activities. Pollutants carried by runoff from streets, commercial and industrial sites, and parking lots affect 5-15 percent of surface waters. An estimated 10 percent of surface waters are adversely affected by acid drainage from abandoned mines, by pollution from mill tailings and mining waste piles, and by pollution from improperly sealed oil and gas wells. Engineering projects involving dams and reservoirs cause an increase in sediment deposits that adversely affects aquatic life and that affect around 5-15 percent of all U.S. surface waters.

Among specific NPS-related anecdotes are the following:

- It is estimated that five tons of soil erode off each acre of farmland in the US each year, carrying fertilizers, herbicides, and insecticides into the nation's waterways.
- The EPA estimates that do-it-yourself auto mechanics annually send 180 million gallons of used motor oil down storm drains or to landfills, and eventually into drinking water sources and other water bodies. This is the equivalent of more than 16 *Exxon Valdez* oil spills.
- One thousand miles of storm drains collect runoff from the streets of Los Angeles, dumping it directly into coastal bays. It is estimated, for instance, that the 1989 rainfall of eight inches washed 150 thousand pounds of lead, 500 thousand pounds of zinc, and 11 thousand pounds of cadmium into the Santa Monica Bay.

The control of NPS pollution requires finding technical solutions to managing storm-water runoff and minimizing migration of pollutants into rivers, lakes and ground water. The U.S. Congress is addressing non-point source problems through allowing grants to states under the Clean Water Act to be used for either NPS program development or implementation. As well, State Revolving Funds capitalized by the Environmental Protection Agency may be applied to implementation of NPS programs. In addition, many states are financing their own NPS control programs.

⁶ November/December, 1991 issue.

2) Indoor Air Pollution

Indoor Air Pollution has acquired a fairly high profile during recent years. A 1991 report to the U.S. Senate⁷, entitled *Indoor Air Pollution - A Growing Problem*, concluded that considerable research must be conducted concerning sources and materials that emit harmful indoor air pollutants. As well, control strategies for biological pollutants such as molds and bacteria must be developed.

3) Environmental Audits

Environmental audits (or preacquisition site assessments or PSAs) have become an important market area for engineering and science consulting firms. This stems from concerns regarding the acquisition of contaminated property and its associated liability.

4) Operation and Maintenance Services

Operation and maintenance services in the environmental areas are also becoming increasingly important as firms contract outside parties to provide these ongoing services.

5) Solid Waste Handling

The storage, transportation, treatment and disposal of waste (especially solid waste) receives a very high priority in virtually all regions. Recent court rulings prohibiting inter-state barriers to transported waste will further enhance the waste handling market.

6) Water

The recycling and reuse of water will remain a high priority for decades to come. For example, the management and cleanup of contaminated groundwater and sewer overflow control are important priorities at the municipal level. Water desalination will receive increased public and private profile in coming years. The industrial wastewater treatment market also offers particularly strong market potential, where clients will essentially be purchasing solutions to existing problems. Minimizing water usage and maximizing its recycled portion is a priority in all regions and sectors.

⁷ Reports submitted to the U.S. Congress are available from the General Accounting Office (GAO) in Gaithersburg, Maryland through telephoning (202) 275-6241. Such reports are free of charge and generally cover a wide range of social, economic, legislative, and cultural areas.

7) Clean Air Act Spin-offs

The Clean Air Act amendments will pressure a number of industries, with the automotive industry near the top of this list. For example, some 22 cities have to reach levels of 30 percent of their fleet vehicles being "clean" (no emissions) by the Year 2000. This will heighten a trend toward clean fuels such as hydrogen and electricity.

In another development relating to the CAA, continuous emissions monitors can be called for by the EPA for certain industrial facilities. It is expected that this form of instantaneous monitoring will become the industry standard for all facilities enforced under the Clean Air Act.

8) Assessing Health Risks

Currently the federal government has no structure in place to assess the costs versus the health risks associated with cleanups. Given the massive costs to be incurred and the government's debt burden, it is inevitable that this issue will become a greater priority. As such, the EPA's Science Advisory Board recommended in late-1990 that the EPA's program priorities be better aligned with health and environmental risks.

With regard to the Superfund, for example, a combination of three factors will result in an increased attention being paid to cost/benefit analyses, to setting health priorities, and to researching more affordable solutions. First, many private businesses have been hit with high costs for cleanup. Second, the federal government is resisting a continued sinking of billions of additional dollars into an activity with such minimal results. Third, government imposed deadlines are passing unfulfilled.

9) Bioremediation

The field of bioremediation advanced considerably through successful work on the Exxon Valdez oil spill. The EPA's Administrator, William Reilly, has also touted the merits of bioremediation. One estimate suggests that bioremediation could save up to 65 percent of the \$250 billion estimated pricetag of cleaning up organic contaminants over the next fifteen years. On one Superfund project in Texas, the EPA concluded that \$50 million spent on bioremediation would clean up the industrial waste better than \$120 million spent on incineration, while also "shaving a few years off the schedule and leaving no incineration ash to cope with". One study estimates that the current U.S. bioremediation annual market of \$20-50 million will increase to \$200 million by 1996.

Section Two: Liability and Legislative Considerations

2.1 Important Environmental Legislation

It is a very difficult task to keep abreast of all existing and emerging environmental legislation in the United States. For example, some 500 environmental bills were introduced into Congress in 1990 alone.

The following paragraphs provide a brief overview of major legislation affecting most industries. More comprehensive reviews can be obtained from the Environmental Protection Agency, as discussed in Section Nine. Given the volume of federal and state laws, Canadian firms should ensure that any local partner has a strong knowledge of the legislation (and enforcement officials) that is driving the market.

Federal - The Environmental Protection Agency

The Environmental Protection Agency was formed in 1970 to consolidate 15 components from five government departments into one independent agency. The EPA implements programs to cover fourteen major laws passed by Congress, namely:

- Clean Air Act;
- Clean Water Act;
- Comprehensive Environmental Response Compensation and Liability Act ("Superfund");
- Resource Conservation and Recovery Act;
- Safe Drinking Water Act;
- Emergency Planning and Community Right-to-Know Act;
- Federal Insecticide, Fungicide and Rodenticide Act;
- Toxic Substances Control Act;
- Marine Protection, Research and Sanctuaries Act;
- Uranium Mill Tailings Radiation Control Act;
- Indoor Radon Abatement Act;
- Ocean Dumping Ban Act;
- Coastal Zone Management Act;
- Pollution Prevention Act.

The EPA conducts both general policy and goal setting as well as the writing of technical industry and chemical standards. About 65 percent of the agency's employees are located in ten regional offices and work directly with state and local governments and other groups to implement the nation's environmental laws and regulations. The remaining employees work in a policy, research, or enforcement role in Washington, D.C. or at facilities in Colorado, North Carolina and

Michigan. The EPA directs significant efforts in the research area toward identifying and testing treatment technologies for different types of hazardous wastes.

The first four Acts listed above are those that are most generally applicable to U.S. companies. They are briefly summarized below.

Clean Air Act

- passed in 1955;
- early focus on vehicle pollution;
- numerous amendments (1960, 63, 67, 70, 77, 90) broadened scope;
- each state develops implementation plans;
- *maximum achievable control technology* must be implemented, meaning the kinds of technologies being used by the top 12 percent of industries;
- recent acid rain (SO₂) commitments;
- toxic emissions, alternative fuels, input/source, indoor air pollution, and clean vehicles are among the priorities.

Clean Water Act

- passed in 1956;
- initial focus on building sewage plants;
- numerous amendments (1961, 65, 66, 70, 72, 77, 87) broadened scope;
- if EPA find state standards inadequate, it can set the standards;
- industry must comply with the stricter of the two standards;
- *best practicable control technology currently available* must be implemented;
- future focus on toxics, oil spills, storm overflow, pollution at source, recycling, and agricultural runoff.

Resource Conservation and Recovery Act

- origins in 1965;
- initial focus on garbage and burning;
- subsequent amendments broadened it to dumps, hazardous waste, medical waste;
- future focus on contaminated sediment, solid waste storage and disposal, hazardous waste;
- requires that the *best demonstrated available technology* be implemented.

CERCLA (Superfund)

- 1978 Love Canal incident raised awareness in hazardous waste areas;
- led to CERCLA in 1980;
- authorizes funds for cleanup of abandoned waste sites;
- Act enlarged and strengthened in 1986;
- entrants need legal and bureaucratic awareness;
- underground tanks, impact assessment, groundwater contamination, site assessment;
- particular focus on developing new technologies to treat hazardous waste.

None of these four acts contain explicit "Buy America" barriers that would preclude Canadian firms from participating in the U.S. market.

State Governments

State governments also enact environmental laws and regulations and have regulatory agencies mandated to enforce the laws. Some states, such as California, are very progressive. Indeed, in some cases, California is writing air regulations and standards that will likely eventually be adopted by the federal government. California is also currently training new staff to in turn consult with and train the variety of states who wish to follow California's policy leads in different areas.

Traditional State areas of responsibility include the management of municipal solid waste and medical waste and land use controls. States may also enact statutes/regulations that are similar to, or more stringent than, federal laws. They may not enact less stringent requirements.

In practice, many state governments also regulate such areas as pesticides, hazardous materials transportation, oil tank spill prevention, community right-to-know, safe drinking water standards, and floodplain management. They regulate these areas through receiving delegation authority, and corresponding grants, from the federal government. To illustrate one example, 25 states have accepted authority to regulate industry under the Occupational Safety and Health Act. Under the federal Water Pollution Control Act, 39 states have been authorized to issue discharge permits. As indicated above, state programs must be consistent with or exceed minimum federal requirements. The state and local entities receive about \$US 530 million in grants from the federal government to help in the implementation and enforcement of environmental laws.

States may also choose to offer incentives, funding programs, and other policies to encourage environmental progress in a given area. For example, following a federal law on used oil, Minnesota imposed an auto title transfer fee to fund a used oil abatement program, New Jersey proposed additional language in the federally-mandated labelling requirement, and a number of states defined used oil as a hazardous waste.

There are areas of legislation where compliance requirements are led exclusively by the EPA. Under the Toxic Substances Control Act, for example, the EPA does *not* have the power to authorize states to implement/enforce the chemical registration program.

Permits

Specific compliance requirements are enforced through permits issued by the responsible federal or state agency. Typical industrial facilities require permits governing a number of areas, including: characteristics of raw material stream, emission limitations, design standards, contingency planning, labeling and shipping requirements, treatment efficiency, and notification. A permit

grants a pollution-generating facility the permission to operate in a particular manner. The RCRA, for example, requires treatment, storage and disposal permits for facilities generating hazardous waste. Air pollution control permits restrict emissions of certain pollutants. Solid waste permits, generally handled by state agencies, guide the handling, treatment and disposal of municipal and industrial waste.

Local Governments

County governments receive transfers from higher governments to enforce legislation, although the margin of coverage is generally quite tight. Counties can pass their own ordinances, although, for funding reasons, this is done in only a handful of cases. For example, Santa Clara (Silicon Valley) has enacted a toxic gas ordinance due to the specific industrial nature of the industry located in the region.

American municipalities are not actively involved in enforcement, although water plants are owned by municipalities and are generally regulated by them.

2.2 The Liability Issue

Many of the interviews during this study have indicated that manufacturers and other purchasers are concerned with the liability question. To what extent can Canadian firms be found liable for environmental problems and/or engineering errors? How much insurance do firms generally have? What are the trends in the liability area? And so on.

Liability is a high-profile issue in the United States. For instance, a few years ago a selection of environmental companies withdrew from the hazardous waste area until certain liability matters were addressed.

From a potential client's perspective, the engineer supplying a service must be adequately covered to accommodate any potential liability problems. From the Canadian engineer's perspective, our view is that adequate insurance and extreme caution will ensure that questions of liability can be accommodated.

Avoiding Liability

In general liability areas, engineers in the United States can be held liable for damages resulting from overly-optimistic cost estimates. These damages are allotted amongst the various liable

Table 4: Insurance Costs, US Engineering Firms

| <i>Insurance Trends, 1985 - 1990, All Firms</i> | | | | | |
|---|--|--------------------------------------|-------------|---|--------------|
| <i>Year</i> | <i>Insurance Cost As Percent of Billings</i> | <i>Percentage of Firms Uninsured</i> | <i>DPIC</i> | <i>Percent of Firms Insured By: CNA</i> | <i>Other</i> |
| 1990..... | 3.98% | 21.6% | 36% | 24% | 17% |
| 1989..... | 4.21 | 19 | 38 | 24 | 19 |
| 1988..... | 4.50 | 21 | 35 | 27 | 17 |
| 1987..... | 5.07 | 24 | 33 | 28 | 15 |
| 1986..... | 4.11 | 19 | 34 | 27 | 20 |
| 1985..... | 2.87 | 13 | 37 | 19 | 31 |

| <i>1990 Information, by Firm Size</i> | | | | | |
|---------------------------------------|-------|-----|-----|-----|-----|
| <i>Number of Employees</i> | | | | | |
| 1-5..... | 6.25% | 43% | 28% | 19% | 10% |
| 6-10..... | 4.52 | 22 | 37 | 22 | 18 |
| 11-25..... | 3.69 | 14 | 42 | 25 | 19 |
| 26-100..... | 2.82 | 10 | 42 | 26 | 22 |
| 101-500..... | 2.18 | 2 | 25 | 34 | 38 |
| Over 500..... | 1.38 | 9 | 9 | 23 | 59 |

| <i>1990 Information, by Firm Discipline</i> | | | | | |
|---|-------|-----|-----|-----|-----|
| | | | | | |
| Structural..... | 6.82% | 16% | 53% | 10% | 21% |
| Mech/Elec..... | 3.43 | 12 | 39 | 33 | 16 |
| Civil..... | 3.50 | 26 | 32 | 25 | 17 |
| Arch/Eng..... | 3.10 | 11 | 40 | 28 | 21 |
| Geotech..... | 3.23 | 33 | 0 | 3 | 64 |
| Other..... | 3.46 | 44 | 25 | 17 | 15 |

| <i>Deductibles, by Firm Size, 1990</i> | | | | | |
|--|------------------------|-------------------------|--------------------------|---------------------------|-----------------------|
| <i>Number of Employees</i> | <i>\$3,000 Or Less</i> | <i>\$3,001-\$10,000</i> | <i>\$10,001-\$25,000</i> | <i>\$25,001-\$100,000</i> | <i>Over \$100,000</i> |
| 1-5..... | 70% | 24% | 6% | 0% | 0% |
| 6-10..... | 39 | 35 | 24 | 2 | 0 |
| 11-25..... | 14 | 23 | 51 | 11 | 1 |
| 26-100..... | 1 | 8 | 42 | 46 | 3 |
| 101-500..... | 0 | 0 | 3 | 54 | 41 |
| Over 500..... | 0 | 0 | 0 | 11 | 89 |

| <i>Deductibles, 1985 - 1990, All Firms</i> | | | | | |
|--|-----|-----|-----|-----|----|
| <i>Year</i> | | | | | |
| 1990..... | 25% | 19% | 30% | 19% | 5% |
| 1989..... | 23 | 24 | 29 | 19 | 5 |
| 1988..... | 24 | 25 | 28 | 18 | 5 |
| 1987..... | 27 | 25 | 28 | 17 | 3 |
| 1986..... | 28 | 31 | 23 | 15 | 3 |
| 1985..... | 30 | 36 | 21 | 11 | 2 |

| <i>Limits of Coverage, by Firm Size, 1990</i> | | | | | | |
|---|------------------------|----------------------------|----------------------------|--------------------------------|--------------------------------|-------------------|
| <i>Number of Employees</i> | <i>Under \$250,000</i> | <i>\$250,000-\$499,999</i> | <i>\$500,000-\$999,999</i> | <i>\$1,000,000-\$2,499,999</i> | <i>\$2,500,000-\$9,999,999</i> | <i>Over \$10M</i> |
| 1-5..... | 15% | 40% | 27% | 18% | 0% | 0% |
| 6-10..... | 7 | 34 | 36 | 22 | 0 | 0 |
| 11-25..... | 2 | 20 | 30 | 47 | 1 | 0 |
| 26-100..... | 1 | 4 | 14 | 80 | 1 | 0 |
| 101-500..... | 0 | 0 | 0 | 71 | 28 | 1 |
| Over 500..... | 0 | 0 | 6 | 24 | 59 | 12 |

| <i>Limits of Coverage, All Firms, 1985-1990</i> | | | | | | |
|---|----|-----|-----|-----|----|----|
| <i>Year</i> | | | | | | |
| 1990..... | 5% | 20% | 24% | 45% | 4% | 0% |
| 1989..... | 6 | 23 | 25 | 42 | 4 | 0 |
| 1988..... | 7 | 26 | 22 | 41 | 4 | 0 |
| 1987..... | 8 | 25 | 23 | 40 | 3 | 1 |
| 1986..... | 7 | 23 | 24 | 41 | 4 | 1 |
| 1985..... | 8 | 20 | 22 | 42 | 6 | 2 |

Source: American Consulting Engineers

parties. In the engineering community, deviations (from the cost estimate) of around 10 percent are probably acceptable, while deviations in excess of 33 percent will probably result in liability. The grey area between these two levels may result in liability judgements depending on the legitimacy of the engineer's legal case.

According to one source, in addressing the cost liability issue, engineers must obviously be extremely cautious in their cost preparations. This entails checking cost estimates with various sub-contractors and suppliers, reviewing actual costs of earlier projects, and maintaining records identifying the sources of all information reviewed. The precise project scope must be described, and any client requests and changes to this scope should be confirmed in writing. Where possible, contract language should also include a clause similar to "the only person who may rely upon an engineer's cost estimate is the client". Other recommended steps in this regard include: files of all documents should be maintained; approximate costs should be quoted where possible; written contracts or letters of agreement for small projects should be obtained detailing the services to be performed; construction procedures should be observed where possible; and close client contact should be maintained.

Insurance Costs for Engineers

Table 4 presents information from the journal *American Consulting Engineer* pertaining to engineering liability trends, deductibles and coverage. It indicates, for instance, that insurance costs represent about 4 percent of the average engineering firm's billings (and range from 1.4 percent for large U.S. firms to 6.3 percent for small firms). Small firms generally have deductibles of less than \$5000 and coverage limits in the \$250,000 to \$1 million range, while large firms have deductibles exceeding \$100,000 and coverage limits in the \$1-10 million range.

It is estimated by one Canadian consulat official that "normal client practice" in the U.S. requires \$1-3 million in liability insurance for any contractor on an environmental site.

Environmental Enforcement Capabilities are Increasing

It should be noted that environmental enforcement is increasing throughout the United States. Fines imposed in 1990 by the EPA totalled \$US 91 million - these will continue to increase as the EPA augments its enforcement efforts. Over one-half of all EPA fines levied in its history have occurred during the past three years. It is estimated that the EPA will have 200 criminal investigators by 1995 compared to fewer than 50 in 1990. Fines of up to \$25,000 per day, and jail terms up to two years, are among the arsenal which EPA has at its disposition. Felonies of knowingly releasing hazardous pollutants can be punished by up to 15 years in jail. Even minor

violations in areas such as record keeping and reporting can receive field citation penalties of up to \$5000 per day. To spread its reach, the EPA can award up to \$10 thousand to anyone furnishing information leading to a criminal conviction or judicial penalty.

There is some debate in the U.S. regarding whether environmental audits should provide grounds for subsequent criminal prosecution. While the legislative history suggests that audit results would normally not be used in a criminal prosecution - if remedial action is taken promptly - it is likely that civil and administrative enforcement may result from information discovered through audits.

Superfund Liability Concerns

There are various statistics pertaining to the Superfund, not always consistent in magnitude, although always consistent in the message. Namely that the fund designed to clean up old toxic-waste sites has been a disaster.

A recent study by the Rand Institute, for example, suggests that 88 cents of every dollar spent by insurers on sites in 1989 went to cover legal fees and the like, rather than on dealing with dumps and remediation. From its searches of 420 hazardous sites, the EPA has identified 14 thousand "potentially responsible parties". Sorting out these PRPs and allocating costs to the guilty parties entails substantial cost - both in time and money. A full decade after the establishment of the Superfund, fewer than 5 percent of the National Priority List of 1240 sites (expanding at 100 per year) have been fully cleaned up. The average site is taking 6-8 years from the time it is first investigated until the time cleanup is completed - the average cost is \$26 million.

The delays in most environmental projects stem from the confusion regarding which party will be paying for a cleanup. There is general agreement that the party responsible for the waste pays to clean it up. However, the debate over liability continues. Some argue that local governments who haul household garbage to Superfund sites should share in the cost of cleaning them up. The banking community has objected to being held liable through their holding title, as lenders, to contaminated property. A recent ruling (July, 1992) in Los Angeles, for example, stipulated that the state which licensed a pollution-generating site should bear 75-85 percent of the ultimate remediation liability. The ruling pleased industry and displeased the California government which claimed that because it was acting as a regulator, it should have blanket protection from liability. Rulings such as these are made and appealed frequently - each shapes the future of who should pay for such cleanups although each also introduces substantial delays into the system.

Liability Concerns are Being Addressed

There are a number of criticisms being voiced stating that the U.S. legal system has failed to deliver economic solutions to the equitable resolution of environmental disputes. In response, a number of shifts are occurring that are of relevance to this study.

- First, the federal government has begun to introduce liability limitations into new legislation.
- Second, disputing parties are increasingly turning to the more timely and economical option of mediation as a method of resolving disputes.
- Third, pressure is increasingly being applied to rectify situations such as the Superfund where excessively high legal costs and paper shuffling has greatly reduced its effectiveness and timeliness. For example, insurance firms are suggesting that Superfund be supported through a surtax on commercial and industrial insurance premiums and that liability be repealed for "old" sites.
- Fourth, an emphasis upon negotiation, mediation, and pre-court settlements means that less than 10 percent of liability disputes are settled by court award (according to the American Consulting Engineers Council's annual liability survey).

One Canadian firm described the liability question as "maybe not as risky as we perceive", stating that new insurance programs have been introduced during the past 1-2 years offering environmental insurance for professionals at reasonable prices. A state government official also suggested that "she knows the liability issue scares many companies but personally, she has not seen a reduction in bidders due to this uncertainty". Another official in the hazardous waste department of a municipality expressed the view that "the courts have shown that environmental consultants are pretty well protected so long as there is no negligence".

As well, the number of insurance claims has decreased dramatically in the past year because of the reasons stated above.

A specific example of this was discussed in the July 23rd, 1992 issue of *Environmental Week*. The Empire Fire and Marine Insurance Company has recently unveiled a comprehensive, cost-effective environmental lender liability insurance policy for small banks. The policy is aimed at a banking industry that had been becoming increasingly concerned with potential liabilities for cleaning up hazardous waste at Superfund or other polluted sites acquired through loan defaults. One motivation for the new policy is the fact that new American Society for Testing and Materials screening analysis requirements will be much cheaper, will not require an engineer on site, and will substantially reduce the lender assessment and application fees.

Section Three: Market Components

3.1 Air Pollution Control

The Air Pollution Control segment can be divided into mobile sources and stationary sources. Mobile sources, mainly vehicles, account for 65 percent of air pollution control expenditures.

The category of stationary sources is felt to offer the most significant opportunity. This segment encompasses some 26 thousand industrial and utility facilities which each emit more than 100 annual tons of air pollutants annually. The recent amendments to the Clean Air Act, which come increasingly into play until their full implementation in 2005, are expected to generate \$25-35 billion in annual spending as organizations attempt to adhere to its requirements.¹

While virtually all industry sectors will be affected, the majority of air pollution control spending will take place, in descending order, within the petroleum and coal, primary metal, chemical, paper, transportation and food industries. Main problem areas include air toxins, acid rain, greenhouse gases, incineration emissions, factory emissions, and clean coal development. Markets for scrubbers, oxidation systems, air monitoring services, and related areas will grow at 20 percent for several years.

3.2 Water and Wastewater Treatment

The Water and Wastewater Management field can be divided into two segments, namely:

- the treatment of wastewater; and
- the development of drinking water supplies.

The annual spending levels on water and wastewater treatment are segmented approximately 20 percent on private capital spending, 24 percent on private operating spending, 32 percent on government capital spending, and 24 percent on government operating spending.

¹ Paul Protney, an American economist, estimates that the costs of the 1990 Clean Air Act may be \$29-36 billion a year, in exchange for benefits of \$6-25 billion. The difference rests in legal fees, costs of delay, and other inefficiencies.

Wastewater

The treatment of wastewater, on the municipal side is of lesser interest to most Canadian firms. In total, there are 15 thousand municipal sewage treatment facilities in the United States, with a further five thousand to be built over the next 20 years. These are generally handled by local, well-established engineering firms.

The industrial wastewater market encompasses 300 thousand manufacturing plants, of which an estimated 30 percent are felt to be of sufficient size to interest engineering firms and other environmental suppliers. It is likely that private industries will be increasingly called upon to treat their own wastewater before it goes into publicly-owned treatment works.

There will be substantial sums spent on sewer overflow systems, waste treatment technologies, waste minimization and pollution prevention technologies during the next decade. This may be of interest to Canadian firms with appropriate expertise.

Water

The annual U.S. market for water utilities is around \$12 billion with annual growth of 4 percent. This market encompasses municipal water treatment utilities, large private water companies and small private water companies. The large private firms generally belong to one association (National Association of Water Companies) and have funds to finance equipment purchases, waterworks improvements, technology development, and the like.

3.3 Solid Waste Management

The Solid Waste Management segment accounts for \$33 billion annually and addresses such problem areas as land use and abuse, industrial recycling, and solid waste combustion. It can be divided into two segments, namely waste collection and transportation (two-thirds of the market) and landfill operations.

The number of solid waste disposal sites in the U.S. is declining rapidly, from 20 thousand in the mid-1970s to a projected figure of 1800 in the Year 2010. As existing landfills become filled and as new sites have increased difficulty securing community approval, the need for waste reduction technologies is becoming critically important. Landfill is expected to decline from handling 76 percent of municipal solid waste in 1988 to 46 percent in 2000. (See Table 2)

In its place, recycling, resource recovery, and waste-to-energy programs and technologies will be widespread, forced by rising disposal costs, by new regulations, and by local and global pressure. The National Solid Waste Management Association estimates that recycling alone will account for around 26 percent of solid waste disposal by 2000 (from current levels of around 14 percent), thus forcing activity in related fields such as the processing of recyclable material, the development of products from organic wastes, and the separating of waste.

The waste-to-energy (WTE) and resource recovery market is estimated at around \$17 billion annually, with rapid growth (15 percent). There are some 130 WTE facilities in operation which handle around 16 percent of municipal waste. As waste disposal costs increase, WTE facilities will become more economic - it is estimated that \$20 billion will be spent on WTE plants between 1991 and 2000 and that WTE will handle 28 percent of municipal solid waste by the year 2000.

Medical waste is another rapidly growing aspect of the market, expected to grow from a \$1 billion market in 1990 to \$5 billion in 1994. Waste handling, tracking, packaging and disposal are valued areas of expertise in this regard.

3.4 Hazardous Waste Management

The current number of hazardous waste sites is substantial and growing. There are 1240 Superfund sites, 30 thousand sites in CERCLA's information system inventory, and over 130 thousand industrial sites facing hazardous waste challenges. There are some 20 thousand municipal and utility facilities which each generate more than 55 gallons of hazardous waste monthly.

The \$23 billion market addresses such problems as site assessment, remediation and detection, and waste treatment through recycling, detoxification and stabilization. Chemical companies, primary and fabricated metal companies, paper manufacturers, electrical equipment manufacturers, and transportation companies will be increasingly pressured in hazardous waste management areas.

The following table (Table 5) and paragraphs summarize various components of the hazardous waste market in 1991. For reasons of overlap (and comparing on occasion 1990 and 1991 data), the statistics do not always exactly correspond. They should be interpreted as best estimates aimed at providing an idea of the magnitude of the various areas and the various rates of growth.

Table 5: Hazardous Waste Market Size and Growth

| <i>Hazardous Waste Activity</i> | <i>Market (\$ billion)</i> | <i>Annual Growth (%)</i> |
|---------------------------------|----------------------------|--------------------------|
| Environmental Engineering | \$12 | 16 |
| Hazardous Waste Management | \$13 | 14 |
| Asbestos Abatement | \$4 | 4 |
| Underground Storage Tanks | \$1 | 30 |
| Remediation | \$3 | 15 |
| Nuclear Waste Management | \$1 | na |
| Analytical Services | \$2 | 14 |

These activities flow from the following needs:

- The hazardous waste management field stems from the 500 hazardous wastes that are regulated in the United States. There is a trend in this segment toward on-site treatment, thus generating activity in monitoring systems, bioremediation and stabilization technology.
- The asbestos abatement market is largely related to EPA requirements that asbestos be removed from a building prior to demolition. This may eventually affect some 700 thousand buildings.
- The Underground Storage Tank market is expanding rapidly due to recent EPA regulations. The Agency estimates that \$70 billion will be spent (new tanks, removals and closures, testing, cathodic protection, overfill protection, etc) over the next 30 years to comply with the regulations.
- The site remediation market includes providing on-site remediation services (thermal, biological, vacuum extraction, stabilization, solvent extraction, in-situ vitrification, soil washing) to the public and private sectors. The need to cleanup on-site will also provide an impetus for incineration technologies. The cleanup bill for Superfund, DOD and DOE sites exceeds \$300 billion, while private sector site cleanup costs exceed \$100 billion.
- The nuclear waste management market encompasses handling, transportation, containers, and disposal. Growth is expected in robotics, nuclear bioremediation, and materials for solidification, among other areas.
- The market for analysis of soil, water, air and other samples is driven by virtually all environmental legislation. The water and wastewater testing side of the market, accounting for about one-half, is felt to have matured. Growth will come mostly in hazardous waste analysis, solid waste testing, testing and monitoring related to the Clean Air Act, and other fields.

Approximately 5000 environmental engineering firms are active in the hazardous waste field in the United States. It is expected that 20-30 of these firms will become large, full-service operations while the remainder will operate in niche areas.

**Table 6: Manufacturers' Pollution Abatement Capital Expenditures - by Industry and Selected States
(\$US million in 1990)**

| | Food | W&F | P&P | Chem | Oil,Coal | Metals | E&E | Textile | Trans. Eq. | Printing | Mach | R&P | S&G | Other | Total |
|----------------------|------|-----|------|------|----------|--------|-----|---------|------------|----------|------|-----|-----|-------|-------|
| <i>United States</i> | 249 | 129 | 1075 | 1852 | 917 | 499 | 178 | 46 | 395 | 68 | 108 | 94 | 128 | 156 | 6031 |
| Arizona | - | - | D | D | - | D | 5 | - | 3 | - | * | D | - | - | 18 |
| California | 12 | 7 | 29 | 43 | 277 | 32 | 14 | - | 42 | 17 | 13 | 4 | 7 | 5 | 503 |
| Colorado | 1 | 2 | - | D | D | 11 | 4 | - | - | - | 3 | - | - | 4 | 26 |
| Oregon | 7 | 9 | 21 | 2 | - | 4 | 2 | - | - | 1 | 3 | - | - | - | 52 |
| Texas | 8 | 6 | 79 | 493 | 239 | 24 | 12 | - | D | 3 | 2 | 6 | 3 | - | 895 |
| Utah | 2 | - | - | - | 9 | 1 | - | - | 19 | - | - | - | - | - | 32 |
| Washington | 13 | 2 | 32 | - | 34 | 16 | - | 3 | D | - | 3 | - | - | D | 127 |
| New York | 6 | 17 | 43 | 33 | 1 | 40 | 30 | - | D | - | 13 | 5 | 6 | 2 | 249 |
| Missouri | 18 | - | 17 | - | 4 | 3 | - | D | - | - | D | D | - | - | 72 |

**Table 7: Manufacturers' Pollution Abatement Operating Expenditures - by Industry and selected States
(\$US million in 1990)**

| | Food | W&F | P&P | Chem | Oil,Coal | Metals | E&E | Textile | Trans. Eq. | Printing | Mach | R&P | S&G | Other | Total |
|----------------------|------|-----|------|------|----------|--------|-----|---------|------------|----------|------|-----|-----|-------|-------|
| <i>United States</i> | 1109 | 400 | 1607 | 3943 | 2709 | 2839 | 788 | 198 | 1232 | 241 | 558 | 428 | 497 | 923 | 17071 |
| Arizona | D | - | 7 | 3 | 1 | 4 | 17 | 1 | 8 | 1 | 8 | - | 10 | 2 | 116 |
| California | 124 | 35 | 73 | 135 | 762 | 153 | 110 | - | 196 | 42 | 45 | 27 | 77 | 34 | 1819 |
| Colorado | 16 | 2 | 3 | D | D | 22 | 72 | - | D | - | 3 | 1 | D | 121 | 267 |
| Oregon | 18 | 34 | 61 | 6 | 2 | 17 | 7 | - | 7 | - | 2 | D | 2 | D | 159 |
| Texas | 71 | 20 | 51 | 720 | 766 | 107 | 38 | 1 | 28 | 7 | 19 | 19 | 18 | 17 | 1888 |
| Utah | 1 | 1 | - | - | - | 57 | - | - | 17 | - | 3 | - | 2 | 4 | 95 |
| Washington | 31 | 12 | 109 | 16 | 42 | 80 | 5 | - | D | 3 | 8 | 4 | 4 | D | 374 |
| New York | 60 | 10 | 62 | 108 | 5 | 93 | 56 | 3 | 33 | 12 | 61 | 13 | 35 | - | 620 |
| Missouri | 54 | 14 | 10 | 70 | - | 111 | 14 | - | 33 | 5 | 5 | 11 | 15 | - | 344 |

Source: U.S. Department of Commerce, Bureau of the Census

P&P denotes pulp and paper; E&E electronic and electrical; W&F wood and furniture; R&P rubber and plastic; S&G stone and glass.

"D" denotes that the figure was withheld to avoid disclosing individual company information.

Section Four: The Private Sector Market

Of the total environmental spending by U.S. industry, *Pollution Engineering Magazine* lists the following industries as the most important spenders:

- Chemical Industry - 22 percent of the total;
- Transportation Industry - 20 percent;
- Petroleum and Coal - 15 percent;
- Metals - 13 percent;
- Paper - 10 percent;
- Food - 7 percent;
- Others - 13 percent.

As discussed in Section Thirteen, we believe that key criteria for successfully penetrating the American market is to understand one's strengths and resources and to conduct homework in the U.S. market based on these strengths. In this sense, all U.S. environmental engineering areas offer potential for Canadian firms.

Tables 6 through 12 are compiled from information contained in the 1990 U.S. Department of Commerce report *Pollution Abatement Costs and Expenditures*, which recently became available.¹ Canadian firms may wish to obtain this document as it contains details on "which manufacturing industries are abating what types of emissions in which states".

Tables 6 and 7 present, respectively, the capital and operating expenditures by U.S. manufacturing firms (of greater than 20 employees) in various sectors and in selected states.

As indicated in Tables 8 and 9, American manufacturing firms invested roughly \$US 6.0 billion nationwide in pollution abatement capital expenditures (PACE) in 1990 and a further \$US 17.1 billion in pollution abatement operating expenditures (PAOE). The bulk of these expenditures address air and water pollution areas.

¹ US Department of Commerce, Census Bureau, Current Industrial Reports, *Manufacturers Pollution Abatement Capital Expenditures and Operating Costs, 1990*. Contact Patricia Garner or Pamela Harvey at (301) 763-1755 to obtain a free copy of this useful document.

Table 8: Capital Expenditures in 1990, by Pollution Sector

| <i>Pollution Sector</i> | <i>Amount (\$US mil)</i> | <i>Share (%)</i> |
|-----------------------------|--------------------------|------------------|
| <u>Capital Expenditures</u> | | |
| Air | 2562 | 42 |
| Water | 2651 | 44 |
| Solid - Hazardous | 327 | 6 |
| Solid - Non-Hazardous | 491 | 8 |
| Total PACE | 6031 | 100 |

Table 9: Operating Expenditures in 1990, by Pollution Sector

| <i>Pollution Sector</i> | <i>Amount (\$US mil)</i> | <i>Share (%)</i> |
|--|--------------------------|------------------|
| <u>Operating Expenditures</u> | | |
| Air | 5011 | 29 |
| Water | 6416 | 38 |
| Solid - Hazardous | 2285 | 13 |
| Solid - Non-Hazardous | 2986 | 17 |
| Solid - Public Collection and Disposal | 373 | 3 |
| Total PAOE | 17071 | 100 |

Tables 10 and 11 present, respectively, the capital and operating expenditures by U.S. manufacturing firms (of greater than 20 employees) in selected Western states, allocated by pollution sector. As indicated, manufacturers in Texas spend around \$1 billion annually on capital and operations aimed at addressing air pollution problems, a further \$1 billion addressing water pollution problems, and \$300 million on hazardous waste problems.

As detailed in Table 12, a substantial majority of pollution abatement capital spending by U.S. industry is directed toward end-of-line (EOL) techniques such as scrubbers, clarifiers and other equipment. Specifically, in 1990, about 71 percent of manufacturers' air pollution control capital expenditures are EOL and 78 percent of water pollution control expenditures are EOL. This compares to the respective 1988 figures of 73 percent (air) and 83 percent (water).

The machinery, paper, petroleum and coal, and electrical equipment manufacturing industries appear to be most advanced in terms of addressing air and water pollution problems through process improvements. It is felt that all sectors will place a greater future emphasis upon solving

Table 10: Manufacturers' Pollution Abatement Capital Expenditures in Selected States - by Sector (\$US million in 1990)

| | <i>Air</i> | <i>Water</i> | <i>Hazardous</i> | <i>Non-Hazardous</i> | <i>Total</i> |
|---------------|------------|--------------|------------------|----------------------|--------------|
| United States | 2562 | 2651 | 327 | 491 | 6031 |
| Arizona | 10 | 6 | 3 | 0 | 18 |
| California | 287 | 176 | 24 | 16 | 503 |
| Colorado | 9 | 13 | 3 | 1 | 26 |
| Oregon | 23 | 22 | 4 | 2 | 52 |
| Texas | 329 | 418 | 90 | 59 | 895 |
| Utah | 6 | 22 | 3 | 2 | 32 |
| Washington | 31 | 61 | 5 | 31 | 127 |

Table 11: Manufacturers' Pollution Abatement Operating Expenditures in Selected States - by Sector (\$US million in 1990)

| | <i>Air</i> | <i>Water</i> | <i>Hazardous</i> | <i>Non-Hazardous</i> | <i>Total</i> |
|---------------|------------|--------------|------------------|----------------------|--------------|
| United States | 5011 | 5130 | 2285 | 2986 | 15411 |
| Arizona | 68 | 19 | 12 | 9 | 108 |
| California | 674 | 450 | 335 | 192 | 1651 |
| Colorado | 22 | 109 | 27 | 26 | 184 |
| Oregon | 48 | 42 | 10 | 38 | 138 |
| Texas | 710 | 545 | 238 | 314 | 1806 |
| Utah | 29 | 17 | 11 | 37 | 93 |
| Washington | 103 | 119 | 57 | 52 | 330 |

Source: U.S. Department of Commerce, Bureau of the Census

Table 12: Manufacturers' Capital Spending by Abatement Technique, United States (\$ million in 1990)

| Industry and Market Component | EOL (\$ mil) | Process (\$ mil) | Total (\$ mil) | P/T (%) |
|---------------------------------|--------------|------------------|----------------|---------|
| <u>All Industries</u> | | | | |
| Air | 1111 | 413 | 1524 | 27 |
| Water | 1074 | 216 | 1290 | 17 |
| <u>Food Industry</u> | | | | |
| Air | 83 | 17 | 100 | 17 |
| Water | 80 | 11 | 91 | 12 |
| <u>Wood Industry</u> | | | | |
| Air | 28 | 3 | 31 | 10 |
| Water | 7 | 1 | 8 | 10 |
| <u>Paper Industry</u> | | | | |
| Air | 147 | 86 | 233 | 36 |
| Water | 71 | 26 | 97 | 27 |
| <u>Chemicals</u> | | | | |
| Air | 318 | 53 | 371 | 14 |
| Water | 412 | 76 | 488 | 16 |
| <u>Petroleum and Coal</u> | | | | |
| Air | 95 | 113 | 208 | 54 |
| Water | 164 | 40 | 204 | 20 |
| <u>Primary Metals</u> | | | | |
| Air | 101 | 67 | 168 | 40 |
| Water | 89 | 12 | 101 | 12 |
| <u>Fabricated Metals</u> | | | | |
| Air | 35 | 10 | 45 | 22 |
| Water | 61 | 14 | 75 | 19 |
| <u>Machinery</u> | | | | |
| Air | 14 | 7 | 21 | 33 |
| Water | 25 | 8 | 33 | 24 |
| <u>E&E Equipment</u> | | | | |
| Air | 74 | 7 | 81 | 9 |
| Water | 44 | 10 | 54 | 19 |
| <u>Transportation Equipment</u> | | | | |
| Air | 67 | 21 | 88 | 24 |
| Water | 73 | 8 | 81 | 10 |

Source: U.S. Department of Commerce, Bureau of the Census, 1988 data

¹ EOL denotes end of line techniques; P/T denotes the share of the total pollution abatement capital spending which is accounted for through process improvements. Thus, in the U.S. food processing sector, about 17 percent of the air pollution abatement capital spending is directed at process improvements.

emission problems through process improvements rather than through adding equipment onto the end of an unchanged process.

Listed below are the six top-ranking U.S. industry sectors in terms of capital spending (\$ million) by manufacturers on pollution abatement. Also presented are the operating spending figures of these industries.

Table 13: Pollution Abatement Spending, by Leading Manufacturing Sector

| <i>Sector</i> | <i>PACE</i> | <i>PAOE</i> |
|--------------------------|-------------|-------------|
| Chemicals | 1852 | 3943 |
| Paper | 1075 | 1607 |
| Petroleum/Coal | 917 | 2705 |
| Primary Metals | 499 | 2026 |
| Transportation Equipment | 395 | 1232 |
| Food | 249 | 1109 |

The DOC document also presents the cross-tabulations of the above data. As such, firms could then examine the data to reveal that:

- the Oregon paper industry spent \$US 21 million in environmental capital expenditures and around \$US 61 million in environmental operating expenditures in 1990.
- California manufacturers of petroleum and coal products spent \$US 277 million in environmental capital expenditures and \$US 762 million in environmental operating expenditures in 1990.
- the U.S. producers of asphalt paving and roofing materials spent \$US 82 million in operating costs in 1990, of which \$US 61 million was on air pollution abatement and \$US 11 million on solid waste handling.
- examples in other states and industry sectors.

Table 14: Top Service Contractors to the Environmental Protection Agency

| Company | <i>Contract Amount (\$000) By Fiscal Year</i> | | | | |
|-------------------------------|---|---------------|---------------|---------------|--------------|
| | 86 | 87 | 88 | Total | % |
| Camp Dresser & McKee | 18235 | 49006 | 18924 | 86165 | 15.0 |
| Computer Sciences Corp. | 10669 | 15512 | 19584 | 45765 | 8.0 |
| Viar & Company Inc. | 13813 | 11718 | 17434 | 42965 | 7.5 |
| Lockheed Aircraft Corp. | 13806 | 14052 | 7769 | 35627 | 6.2 |
| Weston Roy F. & Harr JV | 13138 | 12026 | 10365 | 35529 | 6.2 |
| Ecology & Environment Inc. | 0 | 10800 | 14650 | 25450 | 4.4 |
| Nus Corp. | 695 | 13500 | 11227 | 25422 | 4.4 |
| System Development Corp. | 10161 | 11529 | 1364 | 23054 | 4.0 |
| Planning Research Corp. | 2537 | 15206 | 1597 | 19340 | 3.4 |
| Unisys Corp. | 0 | 0 | 18161 | 18161 | 3.2 |
| Shunks Exxon Service Inc. | 14531 | 3000 | 0 | 17531 | 3.1 |
| Rockwell International | 3795 | 4339 | 3104 | 11238 | 2.0 |
| CH2M Hill | 0 | 0 | 8119 | 8119 | 1.4 |
| TRC Company Metatrace Inc. | 0 | 7800 | 0 | 7800 | 1.4 |
| ICF Inc. | 1502 | 2535 | 2562 | 6599 | 1.2 |
| Battelle Memorial Institute | 4695 | 965 | 874 | 6534 | 1.1 |
| Automated Sciences Group Inc. | 3221 | 1752 | 1450 | 6423 | 1.1 |
| Ebasco Services Incorporated | 0 | 0 | 5911 | 5911 | 1.0 |
| Tech Law Inc. | 0 | 3361 | 2295 | 5656 | 1.0 |
| Geo/Resource Consultants Inc. | 1107 | 2572 | 1674 | 5353 | 0.9 |
| NSI/Northrop Group | 1910 | 1348 | 1997 | 5255 | 0.9 |
| American Management Systems I | 1505 | 712 | 2692 | 4909 | 0.9 |
| Versar Inc. | 1623 | 2366 | 566 | 4555 | 0.8 |
| Tetra-Tech Inc. | 1676 | 1888 | 700 | 4264 | 0.7 |
| Science Applications Inc. | 293 | 1279 | 2575 | 4147 | 0.7 |
| Labat-Anderson Inc. | 0 | 1424 | 2516 | 3940 | 0.7 |
| Colejon Mechanical Corp. | 508 | 1854 | 1516 | 3878 | 0.7 |
| PRC Environmental Management | 0 | 0 | 3764 | 3764 | 0.7 |
| PEI Associates Inc. | 200 | 2242 | 1154 | 3596 | 0.6 |
| Acurex Corp. | 822 | 1214 | 1517 | 3553 | 0.6 |
| Peer Consultants Inc. | 0 | 1000 | 2185 | 3185 | 0.6 |
| CRC Systems Inc. | 1075 | 795 | 1310 | 3180 | 0.6 |
| Tymet Inc. | 231 | 1336 | 1612 | 3179 | 0.6 |
| De Bra Fred B Co. The | 1459 | 1518 | 0 | 2977 | 0.5 |
| Transcontinental Enterprises | 500 | 1425 | 1039 | 2964 | 0.5 |
| Midwest Research Institute | 0 | 2239 | 485 | 2724 | 0.5 |
| Research Triangle Institute | 877 | 499 | 1217 | 2593 | 0.5 |
| Program Resources Inc. | 862 | 1234 | 461 | 2557 | 0.4 |
| Litton Industries Inc. | 0 | 465 | 1660 | 2125 | 0.4 |
| Mar Inc. | 555 | 615 | 848 | 2018 | 0.4 |
| All Others | 25189 | 18321 | 22246 | 65756 | 11.5 |
| TOTALS | 151190 | 223447 | 199124 | 573761 | 100.0 |

Section Five: The Public Sector Market

The public sector represents an attractive opportunity for Canadian environmental firms. The U.S. government alone, for example, spends an estimated \$US 19 billion annually in the environmental area. There is a substantial need in the U.S. public sector for technologies and expertise to clean up contaminated groundwater and soils, retrieve and process waste, and minimize or avoid waste.

5.1 Federal Environmental Protection Agency

The EPA consists of approximately 17 thousand employees with a 1993 budget of \$7 billion. Further information on the EPA is presented earlier in Section Two, discussing *legislation* and in Section Nine, describing *how to identify public-sector opportunities*.

Almost two-thirds of its annual budget is directed to cover two areas - construction grants (largely sewage treatment) amount to \$2.5 billion, and the Superfund hazardous waste cleanups amount to \$1.75 billion. Superfund, through its Superfund Innovative Technology Evaluation Program (SITE), also provides an opportunity for technology developers to field test and demonstrate their technologies without requiring extensive permits.

As indicated in Table 14, the EPA spends several hundred million dollars annually on outside service contracts. These funds allow the agency to increase its knowledge base and implement new legislation while allowing companies to prove their technology to the Agency. Major recipients of this spending include Camp Dresser & McKee, with almost \$US 90 million in such contracts during the three years profiled, and Computer Sciences Corp with \$US 46 million in contracts. The emergence of large defence contracts such as Lockheed, Rockwell, and Litton in this area should also be noted. As well, certain research institutes rank among the top 40 contractors. The top 40 contractors account for 90 percent of all EPA service contracts.

The EPA's research activities are handled through 12 environmental laboratories across the country, employing 1900 people with an annual budget in 1993 of around \$US 525 million. Some 65 percent (\$340 million) of this 1993 figure is directed to outside R&D, 22 percent to internal salaries and expenses, and 13 percent to the Superfund Trust Fund. Allocated by sector, the EPA's research budget is as indicated in Table 15.

Table 15: EPA's Research Spending, by Sector

| Sector | \$ mil |
|------------------|---------------|
| Air | 129 |
| Radiation | 5 |
| Water Quality | 33 |
| Drinking Water | 22 |
| Pesticides | 16 |
| Toxic Substances | 27 |
| Hazardous Waste | 43 |
| Multimedia | 177 |
| Superfund | 70 |
| Management | 5 |
| Total | 525 |

With regard to Superfund, there are currently some 1240 sites listed on the EPA's national priorities¹ list. The states with the most Superfund priority cleanup sites include, in descending order, New Jersey, Pennsylvania, California, New York, Michigan, Florida, Washington, Minnesota, Wisconsin, and Illinois. These ten states account for 56 percent of all priority sites.

To date, only 65 Superfund sites have been cleaned up, at an average cost of \$25 million each. In practice, the Superfund has been counterproductive to cleaning sites, as litigation and delays regarding who pays for cleanups have paralyzed the process. And, as stated in an 1992 House Committee report, "available treatment technologies are often expensive, ineffective and unacceptable to the public. These technologies are still unable to clean up many kinds of sites reliably and cost effectively. More times will be needed to allow cleanup technology to catch up with Superfund program expectations".

The EPA also chairs a committee, called the *Federal Remediation Technologies Roundtable*, which was established in 1990 to build a more collaborative atmosphere among federal agencies in the areas of environmental technology development and technology information exchange. The EPA, DOE, numerous departments and organizations of DOD, the department of the Interior, contractor organizations, and others are represented on the Committee.

¹ This list, organized by State, is easily obtained from the EPA, as discussed in Section Five.

5.2 Federal Department of Defense

The DOD has a 1993 budget of \$270 billion, of which \$3.7 billion is for environmental activities. Two-thirds of this figure is directed to helping DOD comply with environmental laws. The remaining one-third will be used to clean up pollution (ie. remove radioactive residue from weapons sites) at 500 American military bases being closed around the world. One facetious analysis suggests that there are two growth areas within DOD - closing bases and cleaning bases. Within DOD, the Army is felt to face the greatest environmental problems followed by the Air Force then Navy. The Installation Restoration Program (examination and cleanups) and the Other Hazardous Waste Operations (research and demonstrations) are the two major environmental programs of DOD.

In examining its installations, the DOD follows four stages of progressive intervention. These are preliminary assessment (PA), site inspection (SI), remedial investigation/feasibility study (RI/FS), and remedial design/remedial action (RD/RA). In total, there are 17,500 sites at some 1900 DOD installations that are following this process, as indicated in Table 16.

Table 16: Defence Sites Under Installation Restoration Program

| | Installations | Sites | Breakdown (%) |
|-------------------|---------------|-------|---------------|
| Army | 1266 | 10459 | 60 |
| Navy | 242 | 2253 | 13 |
| Air Force | 315 | 4513 | 26 |
| Defence Logistics | 32 | 257 | 1 |
| Total | 1855 | 17482 | 100 |

Virtually all of the sites have undergone PAs, one-half have progressed to SIs, one-third to the RI/FS stage, and 8 percent have entered or completed the RA stage. About one-third of the DOD sites require no further action. DOD estimates that it will cost \$US 25 billion to clean up its 11 thousand sites under the Installation Restoration Program over the next 20 years. It is also suggested that this figure will unquestionably increase as "we start digging" and problems are discovered.

The leading states in terms of military personnel are as follows: California, Texas, Virginia, North Carolina, Florida, Georgia, Hawaii, South Carolina, Washington and Colorado. These ten states account for 62 percent of all military personnel in the United States.

The percentage breakdown by state of the 17,500 DOD sites being investigated is as follows: California 12 percent; Texas and Virginia 8 percent each; Pennsylvania and New York 4 percent each; and Alaska, Alabama, Illinois, Maryland and Florida 3 percent each.

Canadian firms attempting to obtain work within the DOD are likely to meet the most success through approaching contractors and through forming alliances. It is not unusual for major DOD contractors, such as Lockheed and Rockwell, to spend 70 percent of a contract value on sub-contracted technology/expertise.

Canadian firms with expertise in explosives and ordinance disposal, and remediation of petroleum spill problems and contaminated sediment may find opportunities within the DOD.

5.3 Federal Department of Energy

The DOE has a 1993 budget of \$20 billion, of which \$5.3 billion is directed toward environmental restoration and waste management programs. Sixty percent of this figure is for waste management with the remainder for site restoration. The DOE faces substantial cleanup challenges:

- There are 3700 contaminated hazardous waste sites within the DOE complex;
- The department is also responsible for 500 surplus nuclear weapons facilities awaiting decontamination and 5000 peripheral properties affected by these pollutants;
- As well, DOE manages 5200 uranium tailings sites associated with the Uranium Mill Tailings Remedial Action Program and the Formerly Utilized Sites Remedial Action Program.

Estimated cleanup costs for the nuclear weapons facilities problem sites are \$200 billion, although this figure will likely be quickly dated given that DOE's previous cleanup cost estimates have already increased by \$60 billion over the last four years.

The Department of Energy has a stated goal of achieving full compliances with all applicable federal, state and local regulations affecting health, safety and the environment for both current operations and previous facilities and sites. The department's Office of Environmental Restoration and Waste Management (EM) was established to meet this goal. In 1990 and 1991, EM completed 57 assessments, 33 cleanups, and 30 interim remedial actions. At a similar pace, it is evident that it will take many decades to remediate all site within the complex.

5.4 Other Federal Departments

Budget requests from other federal agencies such as Agriculture, Commerce, Interior, Justice, Transportation and NASA indicate that hundreds of sites await environmental evaluation and/or cleanup. Given the experience with DOE and DOD, it is conceivable that these departments may incur significant costs well into the future.

5.5 State Governments

According to the Council of State Governments, the state governments spend approximately \$US 7.3 billion annually on the environment, or an average of around \$150 million per state. (These figures include natural resource spending, and thus may be on the high end of the actual "pollution abatement" figure).

The leading spending categories are 22 percent on water quality related matters; 17 percent on water resources; 17 percent on fish and wildlife; 13 percent on forestry; 5 percent on hazardous waste matters and 5 percent on solid waste related matters.

California, New Jersey, Florida, Illinois and Pennsylvania are the five leading states ranked by environmental spending, accounting for 43 percent of total spending by the fifty states. California alone accounts for 20 percent of all state spending and spends three-times the amount of second ranked state of New Jersey.

The next five states - Washington, Massachusetts, New York, Michigan and Louisiana - account for a further 16 percent of all state spending.

In addition to spending substantial sums on environmental goods and services, the state governments are perhaps one of the best sources of information on the industry, including information such as industrial permits and compliance orders (which could lead to identifying laggard companies).

5.6 Municipal Governments

American municipalities spend an estimated \$US 29 billion annually on the environment. While this is a substantial sum and may be appealing to Canadian industry, our view is that the municipal segment may prove difficult to penetrate on a profitable basis.

Table 17: Selected State Statistics - Population, Growth, Manufacturing Orientation, and Abatement Expenditures

| | Population in Millions | | | Growth in Pop (%) | | PCI | M/G | PACE | PAOC |
|---------------|------------------------|------|------|-------------------|--------|-------|-----|------|-------|
| | 1991 | 1980 | 1970 | '80-91 | '70-91 | | | | |
| United States | 252 | 227 | 203 | 11% | 24% | 16318 | 19% | 6031 | 17071 |
| Washington | 5 | 4.1 | 3.4 | 22% | 47% | 16967 | 17% | 127 | 374 |
| Oregon | 2.9 | 2.6 | 2.1 | 12% | 38% | 14997 | 19% | 52 | 159 |
| California | 30.4 | 23.7 | 20 | 28% | 52% | 17705 | 17% | 503 | 1819 |
| Arizona | 3.8 | 2.7 | 1.8 | 41% | 111% | 14232 | 12% | 18 | 116 |
| Colorado | 3.4 | 2.9 | 2.2 | 17% | 55% | 16640 | 14% | 26 | 267 |
| Texas | 17.3 | 14.2 | 11.2 | 22% | 54% | 15187 | 17% | 895 | 1888 |
| Utah | 1.8 | 1.5 | 1.1 | 20% | 64% | 12492 | 18% | 32 | 95 |

- Source: U.S. Department of Commerce, Bureau of the Census for population data. Current Industrial Reports for abatement spending data.
- The "PCI" column denotes the per-capita income of the state.
- The "M/G" column denotes the manufacturing orientation of the state - its portrays manufacturing's share of the Gross State Product
- The "PACE" column (\$US million) refers to total pollution abatement capital expenditures by manufacturing establishments of > 20 employees.
- The "PAOC" column (\$US million) refers to total pollution abatement operating costs by manufacturing establishments of > 20 employees.

Section Six: The Western U.S. Market

The western U.S. market¹ offers substantial potential to Canadian engineering firms. The annual California market alone (30 million people) is likely in the \$US 15-20 billion range. The California cities of Los Angeles, San Diego, Bakersfield, Fresno, and Sacramento consistently rank at the top of lists of U.S. cities that are failing to meet national ambient air quality standards for carbon monoxide and ozone.

The 50 states differ widely in size, industrial orientation, wealth and environmental spending. Data for certain western states is presented in Table 17. As indicated, most of the western states have grown in population at a substantially greater rate than the U.S. as a whole, both during the past decade and during the decade of the 1970s.

In terms of per-capita income of the states listed, California, Washington and Colorado exceed the U.S. average while Oregon, Utah and Texas are considerably below the national average. Generally, the states of the northern and eastern U.S. have the highest per-capita income levels.

As indicated, the western states tend to be less industrialized than the national average. For instance, only 12 percent of the gross state product of Arizona and 17 percent of California's is accounted for by manufacturing, versus a national average of 19 percent.

California is among the leading U.S. states in terms of environmental problems. The state ranks among the top three in terms of number of manufacturing facilities, number of Superfund priority sites, and number of Defense cleanup priority sites. The state's stringent regulatory climate and large associated bureaucracy, as well as some municipalities, are described by some as "anti-business". Berkeley, for instance, is a nuclear-free zone - a reality which causes problems in the area of waste transportation.

With regard to Superfund, some 56 percent of the 1240 sites listed on the EPA's national priorities list are situated (in descending order) in New Jersey, Pennsylvania, California, New York, Michigan, Florida, Washington, Minnesota, Wisconsin, and Illinois. Of possible interest to

¹ The Eastern Seaboard Market, totalling an estimated \$40 billion annually, was discussed in an earlier version of this study, published in February of 1992. It is available though calling Doreen Conrad at External Affairs and International Trade Canada at (613) 944-9440 in Ottawa.

western firms is the fact that fully 12 percent of the 17,500 environmental problem sites being investigated by the Department of Defense are situated in California and 8 percent in Texas.

In response, California is arguably also the leading U.S. state in terms of environmental progress and the state's environmental legislation often pioneers for subsequent federal legislation. Table 18 presents the fourteen top-ranked states in terms of pollution abatement capital expenditures (PACE) and operating expenditures (PAOE) by manufacturers.²

As indicated, Texas and California lead all other states by a significant margin in manufacturers' pollution abatement spending. The states listed are not particularly surprising given the distribution of manufacturers in the United States. For example, according to the U.S. Bureau of the Census, the following states have the most manufacturing establishments: California, New York, Texas, Illinois, Pennsylvania, Ohio, Michigan, Florida, New Jersey, and Massachusetts. These ten states account for 57 percent of all 360 thousand U.S. manufacturing establishments. All, save Florida, appear on the list.

Table 18: Pollution Abatement Expenditures in 1990, by State

| <i>State</i> | <i>PACE</i> | <i>PAOE</i> |
|----------------|-------------|-------------|
| Texas | 895 | 1888 |
| California | 503 | 1819 |
| Louisiana | 302 | 827 |
| Ohio | 299 | 1115 |
| Illinois | 273 | 842 |
| New York | 249 | 620 |
| Indiana | 247 | 629 |
| Georgia | 238 | 408 |
| North Carolina | 212 | 431 |
| Pennsylvania | 206 | 880 |
| Alabama | 196 | 339 |
| Michigan | 179 | 740 |
| Wisconsin | 164 | 348 |
| New Jersey | 152 | 669 |

Canadian firms can obtain further state-specific information from any U.S. almanac or by contacting the individual state governments. Section Nine lists contacts within each state government. This may be of some value to Canadian firms. For instance, the state industry department officials can provide information on local companies, associations, and other contacts,

²Appendix E provides the environmental spending figures of all 50 state governments. The California state government spends almost three-times as much as the second ranked state on environmental matters.

while the state environment department officials can provide insight and contacts pertaining to legislation, liability, licensing, trends and other subjects. In our experience, we have found these individuals to be helpful and cooperative.

The information in Section Eight will also be of interest to Canadian firms attempting to identify private-sector opportunities in the western states. To illustrate one example, a British Columbia engineering firm (with expertise in environmental solutions for lumber mills and most interested in, say, the Washington and Oregon markets) could use a Directory presented in Section Eight to discover that 86 softwood veneer and plywood establishments exist in Oregon and 27 in Washington. Immediate contacts in the region could then be identified from among the firms listed in Section 8.1.

Through these fairly simple steps, then, the engineering consultant has identified 35 companies in the region of interest. Most importantly, these firms are in the same industry sector as those already assisted in Canada. Through a similar exercise, an Alberta engineering firm with environmental expertise in the "lubricating oils and greases" sector, for instance, could identify contacts at 9 potential customers in Texas, 10 firms in California, and so on.

Table 19: Areas of Particular Canadian Environmental Expertise

Hazardous Waste

- Hazardous waste management strategies, including technologies addressing the remediation of leaky underground storage tanks, the destruction of PCBs, and the handling of low level radioactive waste.
- Mine tailing rehabilitation and the rehabilitation of coal mining sites.
- Medical waste management services.
- Innovative approaches to site remediation.
- Destruction of high strength, complex bioresistant chemical wastes.

Solid Waste

- Sludge management, including energy recovery from high-strength organic waste and oil production from sludge.
- The management of landfill sites (leachate management), including the control and management of migrating and emitted gases.

Water and Wastewater

- Aquifer remediation technologies.
- Photo-oxidation of complex compounds in contaminated aquifers.
- Sewers and sewage-related expertise, including the removal of biological and chemical nutrients from wastewater, the dynamic modelling of wastewater treatment plants and controlling of sewage flows and combined sewer overflows, and the application of expert systems to trouble-shoot at wastewater facilities.
- Water and wastewater disinfection technology using UV.

Air Pollution

- Air pollution monitoring devices and services, including acid rain and sulphuric emission management and the analysis and improvement of "sick buildings".

Recovery and Recycling

- Services oriented toward the recovery, recycling, and re-use of various products (solvents, oils, metals, etc) and recovery and recycling technologies involving membrane systems.
- The approval process in all environmental areas, including impact assessment and risk assessment.

Section Seven: Are You Prepared to Enter the Market?

Previous sections have described the substantial size and growth characteristics of the U.S. environmental market. While attractive, this potential is in itself insufficient to merit a market penetration effort by Canadian firms. What is also required is a base of domestic expertise that can identify and sell into niche markets. Individual Canadian firms must have the expertise and experience to "close" on opportunities that may be uncovered.

In general, Canada's infrastructure-related development, resource base, and geographic diversity has required the nation to build a wealth of expertise in various engineering areas. For example, according to Statistics Canada (1989), there are over 5600 consulting engineering firms in Canada, with revenues exceeding \$5.2 billion and exports of almost \$0.5 billion. Canada has expertise to offer the U.S. market in a number of environmental engineering areas. Some of the most noteworthy of these strengths are illustrated in Table 19.

Our discussions with U.S. manufacturers indicate that they have relatively limited knowledge of Canadian environmental or engineering capabilities, although they do hold an overall perception of Canada as a clean, advanced, friendly and progressive country. Such a positive impression is one that Canadian firms can build upon in further exploring U.S. opportunities.

7.1 Are You Prepared?

Before entering the U.S. market, it is necessary that Canadian firms understand the extent to which they are prepared for, and committed to, the marketing effort. Our discussions during the study have suggested that it may take two years or more for Canadian firms to see their U.S. efforts begin to pay off. While smart management can control costs during this period, it is nonetheless possible that the effort may cost small and medium sized firms hundreds of thousands of dollars. For these reasons, it is important that companies be comfortable with their rationale for market entry, with their relative expertise in the marketplace, and with the level of financial, technical and managerial resources available to support the effort.

7.1.1 Why Make the Effort?

Canadian firms may be in a situation where they are fully satisfied with their current position and not particularly enthusiastic toward risking a penetration of the U.S. market. This may be a proper response, provided the firm is confident of its ability to withstand the future competition in Canada that may come from foreign and domestic firms. It is conceivable that, by standing still in the domestic market, such firms risk falling behind their competitors.

Benefits of Exports

While penetrating a new service market such as the United States may not bring economies of scale in a traditional manufacturing sense, market expansion does bring geographic diversification and a resulting decrease in the fluctuation of business levels. Diversified markets also provide a service firm with exposure to new technologies, new financing concepts, and evolving trends. In the case of the American market, for instance, trends and technologies often precede those in Canada. The legislation and trends prevalent in California, New Jersey and other states, and in the Environmental Protection Agency are often a precursor of future Canadian directions. Thus having a presence in the U.S. market may also provide a competitive advantage for Canadian firms in the domestic market. These and other benefits are presented in the following list:

- a market diversification which reduces dependence on a single marketplace;
- an exposure to new technologies, new financing concepts and evolving trends;
- a first-hand knowledge of the strategies of potential future competition;
- an enhanced access to more ideas and broader skills;
- an increased level of revenues and profit;
- an extended life for the firm's service concepts;
- a better utilization of company personnel, facilities and overheads.

Each of the above benefits serves to enhance the overall competitiveness of the Canadian firm and to help it prepare for the increased competition coming to the Canadian market.

Free Trade Agreements

In former years, Canadian professional service firms have often experienced considerable border delays in entering the United States. Even activities such as carrying engineering drawings across the border posed difficulty. Among other service industry benefits, the 1989 Canada-U.S. Free Trade Agreement is designed to reduce border annoyances and delays for professionals entering the United States for business purposes.

In addition to reduced border delays, the FTA stipulates that Canadian firms will be treated in the same way as American suppliers in the U.S. with regard to all future laws. Tariffs on engineering

drawings have been removed by the United States. Future negotiations in the government procurement area may also lead to a reduction of government's ability to discriminate based on nationality.¹

The recently-negotiated North American Free Trade Agreement (NAFTA) encompasses further advances for Canadian engineering firms. First, a rapidly-growing market of 90 million people is opened to Canadian firms. Second, Mexico requires substantial help in infrastructure and environmental fields - both of relevance to Canadian engineers. Third, the NAFTA endeavors "to address" the issue of licensing and registration of engineers. Given the many jurisdictions governing the profession in Canada, the U.S. and Mexico, it is likely that this will take many years. Fourth, the NAFTA opens access to \$70 billion worth of government procurement (goods, services and construction) in the United States and Mexico.

Canadian firms do not appear to have investigated U.S. market opportunities with any broad sense of urgency. The resource, power, and infrastructure-related expertise which Canada has developed over time has helped the engineering consulting industry to become one of the country's most internationally competitive industries. However, to date, Canadian activities in the U.S. market have been fairly limited, with developing-world markets and projects financed by the Canadian International Development Agency often being the preferred route. According to a publication of the Canadian embassy in Washington, Canadian environmental firms sell approximately \$300 million in goods and services to the U.S. market annually. This represents only one-fifth of one percent of the total U.S. market and appears to indicate that substantial untapped potential exists for Canadian firms. The desire to increase the level of these sales, particular in light of the FTA, is an important reason motivating this study.

7.1.2 The Risks and How to Minimize Them

Such payoffs, however, are not attained without making an investment of time and money and without incurring some immediate risks. The following possibilities, for instance, may occur:

- the already established competitors in the U.S. market are stronger than the potential entrant;
- the Canadian firm has insufficient managerial, marketing and financial resources to support its effort;
- the Canadian firm has insufficient focus on its niche areas of expertise;
- the Canadian company has insufficient confidence or commitment to persevere through difficult periods;
- the Canadian firm has an insufficient presence, reputation and contact base in the local market and/or runs into direct barriers for these reasons;

¹ External Affairs and International Trade Canada has information which describes the relevant provisions of the FTA in further detail.

-
- the Canadian firm finds that distances and communication costs inhibit personal client contact and impede the obtaining of U.S. market information.

In these instances, it is necessary to control expenditures while either re-focussing the export strategy or delaying its implementation until a later date.

To minimize the impact of the above possibilities, it is important that the U.S. effort mesh smoothly with the Canadian firm's current organization, expertise, market commitments, and resources. This entails having an understanding of two areas - the Canadian firm's own capabilities and the requirements of the U.S. market.

The list below provides firms with a brief, general set of criteria that should be satisfied prior to investing resources in the United States.

- *Know Your Competitive Niche.*
What service are you providing? What makes it unique? Why should it attract U.S. customers? How do customers select your service? Will it be similar in the U.S.? What competition will you face in the U.S.?
- *Know Your Marketing Plans.*
Why are you selecting this region? How long until you expect profitability? What resources will you dedicate to market development? How will you provide a local image/presence? How will you modify your usual market development strategy? Why? What existing customers can provide you with U.S. leads?
- *Know What to Expect.*
Who have you talked with about doing business in the region? What do you expect to happen? Why? What strategic alliances could you expect to develop? How? What legal/regulatory restrictions will affect your business? How do you expect to get paid? How will you deal with "Buy America" policies and feelings? What political trends might affect your business?
- *Know How to Follow-up.*
If you visit potential clients, what plans do you have for follow-up? How will you judge if you have been successful? If you are successful, what next?
- *Know Your Sales Pitch for this Market.*
How would you describe your service (in ten seconds? in five minutes?) What key words should trigger awareness of your firm?
- *Know How to Ensure Success.*
What experience have you had with strategic partners? What demonstrates the quality of your service? What kinds of trial runs or guarantees do you provide? What would prevent customers from buying your service?

Table 20: What Should be in a Market Plan?

The plan should articulate the objectives, strategies, financial resources, and managerial and technical complement that you will direct toward the U.S. effort. Specifically:

Your Firm

- Who are you? (employment, sales, growth, ownership, legal structure)
- What are you selling?
- What marketplace needs are you satisfying?
- What distinctive competences will allow you to succeed?
- What ongoing/future investments or service concepts might enhance your competences?
- What changes are required to allow your internal operations to accommodate more business?
- What "fall-back" positions do you have in place to accommodate unforeseen circumstances?

The Market

- What characteristics distinguish your target market?
- What trends are affecting the future development of your target market?
- What is the size of your target market? (number of customers, dollar value, growth)
- How price competitive is your service?
- What secondary target markets should you stay abreast of?
- What potential customers have you actually contacted? What was their reaction?
- Who are your main competitors in the target market? What are their strengths and weaknesses?
- How long will you have before your initial success breeds new competition?
- What barriers are there to your entry of the target market? (cost, time, technology, inertia)
- What regulatory requirements are there? Will they change?
- How will these regulatory requirements affect your timing, costing, entry strategies?
- What liability considerations may be associated with the market?
- Do you have adequate insurance?

Entry Strategy

- What is your penetration strategy? (open office, 1-800, joint venture, equity, buy people, etc)
- What methods will you use to identify opportunities in your target market?
- How will you communicate your message to the target market?
- Who will identify, scope out and close your sales opportunities? Who will manage the effort?
- Does the current management team have the required skills, experience, and time availability?
- How will you identify and hire your sales force?
- Through what targets and timetables will you measure their/your performance?

Financial

- What immediate funding requirements are associated with your penetration effort?
- What longer-term funding requirements are associated with your penetration effort?
- Can your cash flow, working capital and debt position support the penetration effort?

Appendices

- Resumés of Key Managers
- Professional References

7.1.3 Formulating a Plan

It is important that Canadian firms establish a market plan prior to investing resources in their U.S. marketing effort. The plan should articulate the objectives, strategies, financial resources, and managerial and technical complement that will be directed toward the U.S. effort. Formulating a plan also stimulates internal feedback and discussion, assists in obtaining outside funding, and helps identify missing information.

The importance of this formal requirement should not be minimized by Canadian engineering firms. For instance, studies conducted by the Canadian Exporters' Association have indicated that firms with previously defined market plans enjoy greater long-term success in their export marketing efforts. Firms without such plans tend to discontinue their efforts.

Questions that should be addressed in a market plan include those presented in Table 20. Some of the questions are clearly more important than others and in greater need of a detailed and immediate response.

7.1.4 Why Partner?

Canadian engineers may enjoy some success in conducting U.S. environmental assignments from their Canadian offices. Our discussions suggest, however, that any such success is likely to be short-lived. Quite simply, American companies that are purchasing outside environmental engineering services must be satisfied regarding a number of local concerns. It is unlikely that Canadian firms will satisfy these insurance, licensing, regulatory knowledge and other concerns through simply supplying a service from Canada. To some degree, such concerns may also remain if Canadian firms choose to open a new office in the United States without hiring knowledgeable local representatives.

In our view, Canadian firms will enjoy the highest likelihood of success through either

- aligning with a local partner; or
- staffing a new office with personnel enticed from firms who already have a local presence.

The former strategy may be the preferred route for a number of reasons, including:

- it provides quick access to new geographical or niche markets;
- it increases knowledge about the supply and demand side of a new market;
- it provides a marketing advantage over competitors;
- it allows idea-trading and strengthens management skills in Canada and the United States;
- it allows firms to pool resources and thus spread risks and costs;
- it assists in raising capital; and
- it is often less expensive than "starting from scratch".

Table 21: Selected Criteria for Rating Potential Partners

| <p><i>How important are the following areas to your success?</i></p> <p><i>How does your potential partner rate in these areas?</i></p> | <p>Rating (1-10)</p> | <p>Weight (1-100)</p> | <p>Weighted Rating</p> |
|---|---------------------------------|----------------------------------|-----------------------------------|
| <p>Synergy with Your Areas of Expertise</p> <p>Service Niche</p> <p>Technical Capability</p> <p>New Ideas or Concepts</p> <p>Success in Previous Joint Ventures</p> <p>Research and Development Capabilities</p> <p>Contacts in Manufacturing</p> <p>Contacts in Government</p> <p>Other Local Contacts</p> <p>Management Philosophy</p> <p>Management Credentials and Reputation</p> <p>Marketing Capabilities</p> <p>Financial Strengths</p> <p>Existing Client Base</p> <p>Short-Term and Long-Term Goals</p> <p>Liability and Insurance Concerns</p> <p>Overall Business Reputation</p> | | | |

7.1.5 Selecting a Partner

Successful joint ventures are generally those that meet a number of criteria, including the following:

- they are well defined from an operational point of view;
- they have clear and common strategic goals;
- the results and possible improvements are regularly evaluated;
- the alliance's future is based upon performance;
- they involve a smooth meshing of the strengths of each partner;
- they have an agreed upon procedure for termination.

Table 21 provides an indication of the types of characteristics that Canadian firms should seek in examining a potential U.S. partner. Among other areas, matters of image, culture, attitude, and technology should be assessed. In examining such areas, Canadian firms may wish to contact prior clients of the prospective partner and to review Dun & Bradstreet and other reports on the company.

Essentially, the table requires that Canadian engineers tabulate the relative importance of various criteria and the relative ranking of the prospective partners in the areas. Obviously firms seeking partners for "local contact" reasons, will attribute more importance to the *contacts* and *local reputation* criteria. While the table may appear overly formal, firms should keep in mind that a comparison of, say, ten or more prospective partners could become confusing and that it will have to be drawn in some objective manner. A listing such as this table may assist in the process.

Our discussions with Canadian engineers already in the U.S. market suggest that a given alliance may not be a permanent institution. With the passing of time, for example, it may become apparent that the partnership is not the ideal combination and the two parties may drift apart. Or, it may become evident that the synergies are not as strong as they were when the alliance was first formed. In these instances, the parties may choose to open their own offices and/or pursue other alliances.

Having satisfied themselves regarding internal readiness for exporting to the U.S., Canadian firms can then begin the process of identifying market opportunities. The following pages are aimed at assisting Canadian engineering firms in identifying actual leads, contacts, and opportunities in the United States environmental market. It is targeted toward those firms that have already assessed, and are confident of, their own ability to enter the market.

Table 22: Tips for Successful Interviews

It is important that firms maximize the benefit derived from each interview, not only because interviews require time and dollars but also because people are often difficult to reach. As well, U.S. customers and suppliers often conduct business and/or provide information by telephone and fax, rather than in person. This sheet presents certain tips on how to maximize the benefit of an interview.

- 1. Set objectives.**
Before starting, ask yourself "what kind of information would help reduce the risk of entering a new market?" What is the respondent likely to know about your potential market? Choose some "must have" questions to ask, in case you cannot get a long interview.
- 2. Revise objectives.**
If you wish to focus on a particular subject, ask the same questions to all interviewees such that you can explore inconsistencies. If you wish to cover a range of subjects, analyze the responses and revise the questions as you move forward. Go for greater depth.
- 3. Ask simple open-ended questions and probe the responses.**
To ask "what makes a supplier good?" will be more useful than going down a whole list of possible items. Similarly, "yes/no" answers in interviews are not very useful - avoid questions that lend themselves to such answers. Also, ask the respondent "if you were in my position, who would you go and see?", "which companies?", "what job function?", "who by name?". Finally, ask if you can call back in the event that you missed something.
- 4. Help the respondent be specific.**
If someone answers "big" or "large" - this does not mean anything. Ask if it means 1,000 or 10,000 or 2 percent or 50 percent. If they respond with "we often use this service", enquire as to how often and in what ways?
- 5. Make it interesting.**
Most people like to talk about their business. Let them talk, while keeping them to the point. Offer some of your experiences, in Canada or in previous interviews, to make them feel they are also benefitting.
- 6. Keep it short and simple.**
Do not take more of the respondent's time than you need. Cover the key points - the fewer, the better - and then see if the respondent wants to continue talking.
- 7. Start with the least important interviews.**
Leave the key interviews to the last when you have polished your approach and have a sense of where gaps may exist.
- 8. Keep track.**
Take good notes. Fill out and expand these notes immediately after the interview so the maximum information is recorded. Studies in the U.S. have shown that one-half the value of an interview is lost if it is not written up within one week.

7.1.6 Conducting Good Interviews

We do not believe that firms need conduct or commission an extensive U.S. market analysis, unless they are intending to make substantial up-front investments in the market. Generally, market analyses are based on assumptions, predictions and opinions that may not be valid a year or two down the road. Such studies can also cost a substantial amount of money - money that could perhaps be best directed toward making contacts, attending shows and opening doors. Our overall view is that the U.S. environmental engineering market is growing at 10-20 percent annually and that Canadian engineering firms with marketable techniques and experience will be able to identify growing niche opportunities within the American market regardless of what a particular market study may project.

In reading through the remainder of this chapter, it is evident that Canadian firms can conduct a significant amount of research on their own. There are a number of insightful information sources and market research steps that can be followed to identify contacts and opportunities - the following pages review some of these steps, techniques and sources.

As is the case in most service industries, it is necessary for Canadian engineers to pursue as many relevant leads and information sources as possible - to in essence have as many "irons in the fire" as can be managed at any one time. These leads should then be prioritized and pursued in the appropriate sequence. Firms that find themselves waiting anxiously for the response of one particular opportunity or partner may not be adequately controlling their own destiny. The opening of 20 or 30 particular leads may be a more fruitful strategy.

As described in some detail in the report, it is important that Canadian firms draw upon their contact base, communicate freely and often with potential clients, and investigate the synergies offered by potential alliance partners. In pursuing each of these angles, Canadian companies must conduct well-planned, sequential and insightful interviews, both on the telephone and in-person. The comments presented in Table 22 should assist Canadian engineers in this interviewing process.

Section Eight: Identifying Private Sector Opportunities

There are a number of techniques that can be followed by Canadian engineering firms to identify potential environmental opportunities in the American private sector.¹ Private sector environmental opportunities for Canadian engineers can be grouped into five categories:

- the manufacturing sector;
- the high technology and research sector (including environmental firms and universities);
- the service industry sector;
- resource companies; and
- other engineering consulting firms.

This section discusses these categories in the above sequence.

8.1 Manufacturing Clients and Contacts

The Ward's Business Directory entitled *Manufacturing USA* provides a comprehensive collection of industry analyses, statistics and companies. It encompasses some 460 manufacturing industries (SIC Codes) and within these sectors provides information on 26 thousand companies.

The directory is an invaluable source of information for Canadian engineering firms who are interested in selling their solutions to American manufacturers. It is available from Gale Research at (313) 961-2242 at a cost of \$US 169 and would be of value to firms who are seriously interested in identifying potential U.S. contacts and clients.

The value of this directory is illustrated by the example of a hypothetical Canadian engineering consulting firm who may have experience assisting manufacturers of softwood veneer in addressing certain environmental problems. The problems may relate to any environmental area, whether solid waste disposal, wastewater treatment, air emissions or other areas.

Such a firm might then examine *SIC Code 2436 - Softwood Veneer and Plywood* of the Directory. This section would provide fairly detailed information on the industry size, structure, recent performance and trends, as well as a comprehensive listing of main companies, contacts, size, and

¹ In identifying these steps, we have attempted to include up-to-date telephone numbers. Canadian firms should note that any long-distance number in Canada and the United States can be obtained from operator information by dialing the area code in question, followed by 555-1212.

location. For a British Columbia engineering firm most interested in, say, the Washington and Oregon markets, the document would indicate that some 86 softwood veneer and plywood establishments exist in Oregon and 27 in Washington. Immediate contacts in the region could then be identified from the following listed firms:

| | |
|---|--|
| Bald Knob Land & Timber Co., Portland, OR | Rosboro Lumber Co., Springfield, OR |
| Boise Cascade Corp., Elgin, OR | Roseburg Forest Products Co., Roseburg, OR |
| Cuddeback Lumber Co. Inc., Eugene, OR | Roseburg Forest Products, Roseburg, OR |
| Davidson Ind. Inc., Mapleton, OR | Stone Container, Medford, OR |
| Freres Lumber Co., Lyons, OR | Sun Studs Inc., Roseburg, OR |
| Goodrich Forest Products, Sherwood, OR | Timber Products Co., Grants Pass, OR |
| Green Veneer Inc., Mill City, OR | Timber Products Co., Springfield, OR |
| Lane Plywood Inc., Eugene, OR | Triangle Veneer Inc., Eugene, OR |
| Leading Plywood Corp., Corvallis, OR | Westbrook Wood Prod. Inc., Coquille, OR |
| Linnton Plywood Association, Portland, OR | |
| Lumber Co. Inc., Eugene, OR | Custom Panels Inc., Tacoma, WA |
| Medford Corp., Medford, OR | Fort Vancouver Plywood Co., Vancouver, WA |
| Medford Corp., Rogue River, OR | Hardel Mutual Plywood Corp., Olympia, WA |
| Medply, White City, OR | Hoquiam Plywood Co. Inc., Hoquiam, WA |
| Multnomah Plywood Corp., St. Helens, OR | K-Ply Inc., Port Angeles, WA |
| Murphy Co., Eugene, OR | Puget Sound Plywood Inc., Tacoma, WA |
| Murphy Co. Florence Div., Florence, OR | Stevenson Co-Ply Inc., Stevenson, WA |
| North Santiam Plywood, Mill City, OR | Textured Forest Products, Washougal, WA |

Through these fairly simple steps, then, the engineering consultant has identified 37 companies in the region of interest. Most importantly, these firms are in the same industry sector as those already assisted in Canada. Through a similar exercise, an Alberta engineering firm with environmental expertise in the "lubricating oils and greases" sector, for instance, could identify contacts at 9 potential customers in Texas, 10 firms in California, and so on.

The subjects reviewed in telephone discussions with the "environmental officer" of such firms might then include:

- current environmental problems facing the softwood veneer and plywood firm;
- immediacy of these problems and source of the pressures²;
- the firm's receptiveness to out-of-state suppliers;
- the firm's purchase criteria when selecting outside engineering/environmental assistance;
- the firm's satisfaction with current suppliers;
- the firm's interest in receiving your company's brochure (include in a followup letter);
- your previous experience in solving softwood veneer and plywood industry problems in Canada; and
- referrals to other companies who might also be interested in your services.

² If the pressures are coming from particular lobby groups or from particular legislators these would then be the logical next interviews for Canadian engineering firms to conduct. Queried would be "what firms are you pressuring", "what environmental improvements are you seeking", etc. These officials would also be interested in having the Canadian engineer describe the improvements brought to their Canadian clients.

Where possible, Canadian firms should develop a relationship with the environmental officers of the firms, rather than simply with the procurement officers (who often already have their list of vendors).

8.2 High Technology and Research Clients

High Tech Firms

The high technology and research category has some overlap with the other categories presented here. Nonetheless, because it represents a substantial share of the future growth opportunities, we have listed it as a separate source of contacts for Canadian firms. It may also be the best method of market entry for Canadian firms with a strong technological/scientific niche.

The *Corporate Technology Directory* is an excellent source of information for Canadian firms in this regard. It is available from Corporate Technology Information Services Inc in Woburn, Massachusetts at (617) 932-3939. The cost for the four volume set is \$US 545. The Directory lists around 35 thousand U.S. firms that develop/manufacture high technology products/services in the following fields: advanced materials; factory automation; biotech; chemicals; computer hardware; defense; energy; environmental; equipment manufacturing; medical; pharmaceuticals; photonics; computer software; subassemblies and components; telecommunications; test and measurement; and transportation.

Canadian firms can approach this directory in one of two ways:

- If firms have identified a U.S. region of interest and their expertise is relevant to a range of technology firms or sectors in that region, they can refer to the geographic index where listings are provided for each city in the region;
- If they have a specialized sectoral niche and their expertise is relevant to firms in that niche in all regions, Canadian firms can refer to the technology index. As it is very detailed, this index should list the niche technology/product area of interest to any Canadian firm. For instance, there are 49 technology/product areas presented under the heading of "environmental".

Each of these two approaches leads to the same place - namely, the identification of relevant U.S. companies. In these corporate profiles, information is presented pertaining to the sales, employment, address, executives, and specializations of each company.

Universities

Universities play a fairly active role supporting environmental research, industrial interaction, and government policy making, among other areas. Multi-million dollar EPA and DOD contracts, for example, are frequently channelled through universities.

The document *Peterson's Guide to Graduate Programs in Engineering and Applied Sciences* is an excellent source of information on the main environmental institutions. It is available from Peterson's Guides in Princeton, New Jersey at (609) 243-9111 for \$US 33. In total, the document presents information on approximately 100 universities (including a few Canadian universities). This document should be obtained by those Canadian firms that intend to enter the U.S. market through research, scientific or other interaction with an American environmental university.

The following represent a brief sampling of western U.S. universities that have environmental engineering faculties and that may be of interest to Canadian engineering firms:

- Montana State University;
- North Dakota State University;
- Oregon Graduate Institute of Science and Technology;
- Oregon State University;
- Rice University in Texas;
- Texas A&M University;
- University of Alaska, Anchorage and Fairbanks;
- University of California at Berkeley

The contacts at these and other relevant schools are listed in the fore-mentioned directory.

Research Centers

The document *Research Centers Directory* provides information on approximately 13 thousand research centers in the United States and Canada. These include laboratories, institutes, incubators, technology transfer centers, and similar organizations. Section 2 of this Directory, entitled Biological and Environmental Sciences, would be the section of most relevance to Canadian consulting engineers interested in the U.S. environmental market. Canadian firms can obtain this document from Gale Research in Detroit at (313) 961-2242.

8.3 Service Industry Clients and Contacts

Canadian engineers who have assisted service companies with certain tasks can also identify a number of potential clients in similar U.S. industries. Like the manufacturing document, the

Ward's Business Directory entitled *Service Industries USA* provides a comprehensive collection of industry analyses, statistics and companies covering 150 service industries and providing information on 4000 companies. It is available from Gale Research at (313) 961-2242 at a cost of \$US 169.

To take one particular example from this document, a Canadian environmental consulting firm may have developed a particular unique niche assisting photofinishing laboratories with their chemical processes and disposal. Such a firm could then refer to *SIC code 7384 - Photofinishing Laboratories* in order to gather information on the U.S. industry size and structure, as well as a comprehensive listing of main institutions, contacts, size, and location. If Illinois, for example, is the state of most interest to a Manitoba environmental firm, this information would reveal that there are 242 photofinishing laboratory establishments in the state. Contacts and telephone numbers at the following Chicago firms would also be provided:

- Weiman Company;
- Helix Ltd;
- Techtron Graphic Arts;
- Pallas Photo;
- Qualex Inc; and
- Astro Photo.

As mentioned, this procedure could be repeated in 150 different service sectors, depending on the particular niche expertise of the engineering firm.

8.4 Resource Clients and Contacts

A similar process can be followed to derive a list of potential clients and contacts in the U.S. resource industries. This segment, however, is not covered in one comprehensive sourcebook. Generally the various resource sectors each have their own reference document(s). Firms should refer to the appropriate industry association, government contact, or industry contact to obtain the relevant sourcebook.

Selecting two areas of Canadian strength (pulp and paper and forestry) illustrates how pertinent information may be obtained on the U.S. market. The document *Pulp and Paper North American Factbook* is available from Millar Freeman Publications in San Francisco at (415) 905-2200 for \$US 285, and should be obtained by firms and governments that are seriously interested in examining the U.S. market potential in this sector. The document has a five-page chapter which discusses environmental spending and regulations and also provides a schematic documenting the

Table 23: Engineering Service Firms, United States

| State | Establishments | | Employment | | Payroll | | Revenues (\$ million) | |
|----------------|----------------|-----------|------------|-----------|-----------------|-----------|-----------------------|------------|
| | Total | % of U.S. | Total | % of U.S. | Total (\$ mil.) | Per Empl. | Total | Per Estab. |
| California | 5,920 | 16.4 | 80,762 | 14.5 | 2,925.8 | 36,227 | 7,164.4 | 1.2 |
| Texas | 2,800 | 7.8 | 40,622 | 7.3 | 1,286.5 | 31,671 | 3,433.8 | 1.2 |
| Pennsylvania | 1,516 | 4.2 | 36,870 | 6.6 | 1,238.7 | 33,596 | 3,421.5 | 2.3 |
| Massachusetts | 1,189 | 3.3 | 32,659 | 5.8 | 1,195.9 | 36,617 | 2,914.1 | 2.5 |
| New York | 1,877 | 5.2 | 34,261 | 6.1 | 1,262.4 | 36,847 | 2,817.5 | 1.5 |
| Virginia | 1,144 | 3.2 | 34,067 | 6.1 | 1,052.3 | 30,888 | 2,114.1 | 1.8 |
| Maryland | 865 | 2.4 | 30,391 | 5.4 | 1,014.9 | 33,394 | 1,959.1 | 2.3 |
| New Jersey | 1,399 | 3.9 | 22,280 | 4.0 | 785.9 | 35,275 | 1,764.5 | 1.3 |
| Florida | 2,092 | 5.8 | 25,752 | 4.6 | 718.6 | 27,906 | 1,577.7 | 0.8 |
| Michigan | 1,402 | 3.9 | 22,764 | 4.1 | 731.8 | 32,149 | 1,407.7 | 1.0 |
| Illinois | 1,359 | 3.8 | 17,677 | 3.2 | 609.0 | 34,452 | 1,249.7 | 0.9 |
| Ohio | 1,222 | 3.4 | 16,689 | 3.0 | 503.0 | 30,141 | 980.4 | 0.8 |
| Alabama | 450 | 1.2 | 7,972 | 1.4 | 259.3 | 32,525 | 864.3 | 1.9 |
| Colorado | 939 | 2.6 | 10,317 | 1.8 | 338.5 | 32,809 | 755.7 | 0.8 |
| Georgia | 774 | 2.1 | 11,923 | 2.1 | 365.8 | 30,677 | 746.1 | 1.0 |
| Washington | 805 | 2.2 | 9,733 | 1.7 | 320.5 | 32,928 | 714.7 | 0.9 |
| Connecticut | 660 | 1.8 | 8,644 | 1.5 | 300.8 | 34,801 | 706.8 | 1.1 |
| Missouri | 564 | 1.6 | 9,961 | 1.8 | 306.1 | 30,726 | 631.7 | 1.1 |
| Tennessee | 503 | 1.4 | 8,499 | 1.5 | 269.0 | 31,646 | 502.9 | 1.0 |
| Arizona | 678 | 1.9 | 8,095 | 1.4 | 237.5 | 29,336 | 478.1 | 0.7 |
| North Carolina | 623 | 1.7 | 7,983 | 1.4 | 215.8 | 27,028 | 476.0 | 0.8 |
| Louisiana | 642 | 1.8 | 6,831 | 1.2 | 212.1 | 31,054 | 448.2 | 0.7 |
| South Carolina | 375 | 1.0 | 5,927 | 1.1 | 166.0 | 28,015 | 386.3 | 1.0 |
| Minnesota | 509 | 1.4 | 6,625 | 1.2 | 186.3 | 28,126 | 382.5 | 0.8 |
| Wisconsin | 486 | 1.3 | 5,656 | 1.0 | 162.2 | 28,670 | 374.7 | 0.8 |
| New Mexico | 251 | 0.7 | 4,591 | 0.8 | 135.7 | 29,549 | 306.8 | 1.2 |
| Indiana | 531 | 1.5 | 5,364 | 1.0 | 149.0 | 27,771 | 305.8 | 0.6 |
| Oklahoma | 425 | 1.2 | 3,790 | 0.7 | 113.0 | 29,819 | 258.7 | 0.6 |
| Oregon | 382 | 1.1 | 3,268 | 0.6 | 104.8 | 32,062 | 221.5 | 0.6 |
| Kentucky | 354 | 1.0 | 3,903 | 0.7 | 95.3 | 24,415 | 195.3 | 0.6 |
| Nevada | 177 | 0.5 | 2,696 | 0.5 | 83.4 | 30,928 | 185.5 | 1.0 |
| Hawaii | 217 | 0.6 | 2,552 | 0.5 | 76.1 | 29,814 | 175.6 | 0.8 |
| Kansas | 251 | 0.7 | 2,732 | 0.5 | 80.5 | 29,476 | 161.7 | 0.6 |
| Utah | 243 | 0.7 | 2,295 | 0.4 | 59.3 | 25,860 | 157.9 | 0.6 |
| D.C. | 134 | 0.4 | 2,220 | 0.4 | 74.1 | 33,376 | 153.7 | 1.1 |
| New Hampshire | 250 | 0.7 | 2,681 | 0.5 | 72.9 | 27,205 | 139.3 | 0.6 |
| Iowa | 196 | 0.5 | 2,557 | 0.5 | 59.6 | 23,292 | 119.8 | 0.6 |
| Rhode Island | 167 | 0.5 | 2,052 | 0.4 | 57.5 | 28,028 | 118.7 | 0.7 |
| Idaho | 137 | 0.4 | 1,492 | 0.3 | 44.9 | 30,127 | 117.2 | 0.9 |
| Nebraska | 158 | 0.4 | 1,714 | 0.3 | 46.6 | 27,194 | 98.8 | 0.6 |
| Maine | 175 | 0.5 | 1,574 | 0.3 | 44.5 | 28,283 | 93.1 | 0.5 |
| Alaska | 149 | 0.4 | 1,112 | 0.2 | 37.8 | 33,970 | 88.4 | 0.6 |
| Mississippi | 227 | 0.6 | 1,809 | 0.3 | 39.2 | 21,647 | 86.6 | 0.4 |
| West Virginia | 146 | 0.4 | 1,596 | 0.3 | 42.1 | 26,355 | 82.8 | 0.6 |
| Arkansas | 171 | 0.5 | 1,421 | 0.3 | 34.2 | 24,034 | 71.0 | 0.4 |
| Montana | 117 | 0.3 | 843 | 0.2 | 20.2 | 23,924 | 43.4 | 0.4 |
| Delaware | 110 | 0.3 | 874 | 0.2 | 22.1 | 25,245 | 39.6 | 0.4 |
| Wyoming | 109 | 0.3 | 682 | 0.1 | 16.6 | 24,282 | 39.0 | 0.4 |
| Vermont | 104 | 0.3 | 788 | 0.1 | 19.5 | 24,793 | 38.6 | 0.4 |
| North Dakota | 58 | 0.2 | 447 | 0.1 | 13.7 | 30,624 | 25.5 | 0.4 |
| South Dakota | 54 | 0.1 | 371 | 0.1 | 8.7 | 23,321 | 17.7 | 0.3 |

Source: Service Industries USA, Gale Research

location of paper and pulp mills by state. Sources such as the American Paper Institute or the individual state governments could then be accessed to obtain more detailed information on names, locations, sizes, etc. The directory also provides information on foreign investment and indicates, for instance, that 30 Canadian pulp and paper companies are under some degree of U.S. ownership. Western engineering firms conducting Canadian environmental work for Celgar Pulp, Northwood Pulp and Timber, Weyerhaeuser and others could then enquire about U.S. opportunities through the parent firm.

The *Forest Industries North American Factbook*, available at the above telephone number, provides a range of relevant information including a listing of the size and location of the prominent lumber mills in North America. From this document, for example, a firm could identify the fact that Weyerhaeuser, Noranda, and others have various mills in Canada and the United States. The operative question would then be whether engineering firms who have assisted these companies with their Canadian environmental concerns have also inquired regarding the feasibility of being involved with the affiliates' U.S. environmental expenditures and solutions.

Generally, all resource industries, ranging from petroleum to metals mining to power generation, would have corresponding associations, reference documents, and other information sources. Canada is an international force in many resource areas. Canadian engineers with expertise in these areas may wish to broaden their horizons, canvas the appropriate sources, and promote their expertise into the U.S. market.

8.5 American Engineering Firms

It is evident that, in many instances, Canadian firms should choose to align themselves with American engineering firms in a given region. While perhaps not a client in the traditional sense, U.S. engineering/environmental firms do represent a route to a potential client base for Canadian firms. There is certainly a wide selection of U.S. firms with which to partner. As indicated in Table 23 (describing the number, employment, payroll, and revenues of engineering firms by state), there are some 6000 engineering firms in California alone and several other states have over 1000 firms.

The alliance may involve acting as a subcontractor on a given project or it may involve working together in pursuing certain opportunities. The form of the alignment may range from joint venture to merger to office sharing, among others.

Our discussions with Canadian engineering firms already present in the United States indicate that they have generally followed a strategy of forming some form of local alliance. Similarly, our discussions with U.S. engineering firms suggest that these firms are open to being approached by Canadian firms with the appropriate expertise, and that alliances and joint bids are very common within the U.S. engineering community. Finally, our discussions with over 100 American "buyers" of environmental services suggest that they place a premium upon local knowledge, local credibility, and satisfaction of local insurance concerns. This suggests that some form of local presence will be required if Canadian environmental engineers are to penetrate the market. The following pages discuss how individual Canadian firms can begin the task of researching the engineering community and finding appropriate partners.

American Consulting Engineers Council

The American Consulting Engineers Council (ACEC) is the largest national organization of consulting engineers, with some 5000 member companies employing 160 thousand engineers. The Council's annual directory is available from Washington, D.C. at (202) 347-7474 for a non-member price of \$US 140.³ The Directory is a useful source of information on individual firms and indicates that U.S. engineering firms range in size from one employee up to large firms of several thousand employees.

There are some 39 committees and 50 member organizations comprising the ACEC. Of the committees, the following six may be of particular interest to Canadian firms:

- Business Insurance Advisory Committee, James Pierce, Staff;
- Education and Registration Committee, Sally Keene, Staff;
- International Engineering Committee, Angelo Iasiello, Staff;
- Hazardous Waste Action Coalition, Terre Belt, Staff;
- Small Firm Coalition, James Pierce, Staff;
- Environmental Committee, Lee Garrigan, Staff.

The staff members are permanent employees of the ACEC and can be contacted at the above number. With the proviso that these members work first and foremost for the U.S. community, they would nonetheless be a useful source of information for Canadian firms. The approach taken with them by Canadian firms should be to indicate an interest in the U.S. market, an interest in possibly aligning with local partners, an interest in teaming together for third-country markets, etc.

In general, the ACEC in the U.S. will refer Canadian firms to the Consulting Engineers Council in the appropriate State. The ACEC does provide a computerized search listing through which firms

³ Foreign firms cannot be direct members of this organization.

in given states and given disciplines can be identified, printed and mailed out. For instance, all environmental firms in Oregon could be identified in this manner. The cost of such a computerized list would range from \$US 50-150, according to the ACEC.

Detailed Industry Surveys

Detailed information describing the human resource practices, the average fees, and the typical financial statistics of U.S. engineering firms is available from three separate survey studies, each costing \$US 195.

The *1991 Fee Survey* details a range of billing and professional fee areas based on an extensive survey of the U.S. engineering community. These areas include: Billing Rates and Markup; Contract Forms and Terms; Government Pricing Data; Bidding/Price Competition; Computer Pricing; Marketing Department Structure; Project Type Fee Data; and Regional Analysis. The *1991 Financial Statistics Survey* details a range of financial areas based on an extensive survey of the U.S. engineering community. These areas include: Key Survey Results; The Income Statement; The Balance Sheet; Marketing Costs; Cash Basis Results; Staff Ratios; Multi-Discipline/Branch Office Impact; Automation Analysis; Non Financial Managers Data; Historical Trends and Patterns; and Regional Analysis.

These studies are conducted by the Professional Services Management Journal of Newton, Massachusetts, and can be obtained by calling (617) 965-0055. Firms interested in obtaining quite detailed information on, for example, professional fees charged certain client types by American engineering firms might wish to obtain the appropriate study.

The Environmental Engineering Community

There is a well organized formal environmental engineering community in the United States. The document *Environmental Engineering Selection Guide* is published by the American Academy of Environmental Engineers and provides a description of the capabilities, location, number of employees, and key personnel of each member firm of the Academy (see Appendix D). The Guide can be obtained free of charge from Annapolis, Maryland at (301) 266-3311. It also discusses the Academy's objectives, certification requirements, by-laws and other matters.

The Academy also publishes an annual document *Who's Who in Environmental Engineering* which identifies specialists in all facets of environmental engineering. It is available at the above number for \$US 60.

Section Nine: Identifying Public Sector Opportunities

In addition to private sector opportunities discussed in the previous section, the public sector also represents an area of potential interest and business for Canadian firms. For example, the U.S. government alone represents around \$US 19 billion in annual environmental spending (approximately double the total Canadian private and public market). Sources that we have interviewed suggest that the EPA, DOD and DOE are becoming increasingly receptive to unique, cost effective cleanup technologies and to being approached by firms with innovative technologies, ideas or solutions.

Canadian engineering firms should note that purchases by state and local governments are not covered by the Free Trade Agreement's chapter on government procurement. Some 32 states and many local governments routinely include domestic preference clauses in their contracts. Some of these clauses are intended to favour local suppliers, while others favour American products in general. The extent to which such clauses exist in purchases of engineering services is obviously a subject that Canadian firms should investigate before attempting to sell directly to this market. (Canadian firms should also note that future NAFTA negotiations will likely cover state and provincial procurement policies.)

In our view, Canadian firms with strong research/technical capabilities are most likely to profitably penetrate the public sector market through alliances with a U.S. partner. The partner might be a university, an engineering firm, an environmental lobby group, a defence contractor, or some of the other channels discussed in this report. Partnering may mean an ongoing alliance or it may mean selling one-time service to a contractor. For instance, as stated by an environmental executive of Lockheed, large firms such as Lockheed¹ and Rockwell typically spend 70 percent of contract value on subcontracts.

The General Services Administration (GSA) is the central purchasing organization for the U.S. federal government, similar to Canada's Department of Supply and Services. The GSA, at (202) 708-5804, also produces a range of inexpensive or free documents such as *Doing Business with the Federal Government*, the *Federal Buying Directory*, *Contracting Opportunities with GSA*, and *Listing of Commodities and Services*.

¹ To put things in perspective regarding the challenge Canadian firms face in penetrating the U.S. market, Lockheed has a current database of 450 qualified contractors in the various environmental technologies.

The U.S. federal government market is notorious for its bureaucratic layers - small Canadian firms attempting to penetrate it without a partner may find that they devote substantial resources without a corresponding payback. Buy American requirements² can also appear often without much warning and often in rather unpredictable ways. Similarly, projects which are publicized in the *Commerce Business Daily*, a daily publication which describes federal projects being tendered, are often felt to be "wired", with the winning firms having laid the necessary groundwork several months previous.³ As well, some federal projects entail "small business set-asides" wherein entire contracts or portions thereof may be reserved for small businesses or may offer a 12 percent price advantage to small firms. Canadian Trade Commissioners in the appropriate region should be referred to for additional information in this regard.

It has also been suggested that Canadian firms should extend their marketing effort beyond the central "procurement" people at federal agencies to encompass officials in other managerial, engineering, regional, and/or industry sector areas. The small business liaison offices and the "advocacy officers" of government departments may represent a channel worth pursuing as well. Regarding DOD's remediation efforts, some suggest that the regional offices and the hands-on contracting officials are the sources that should be contacted.

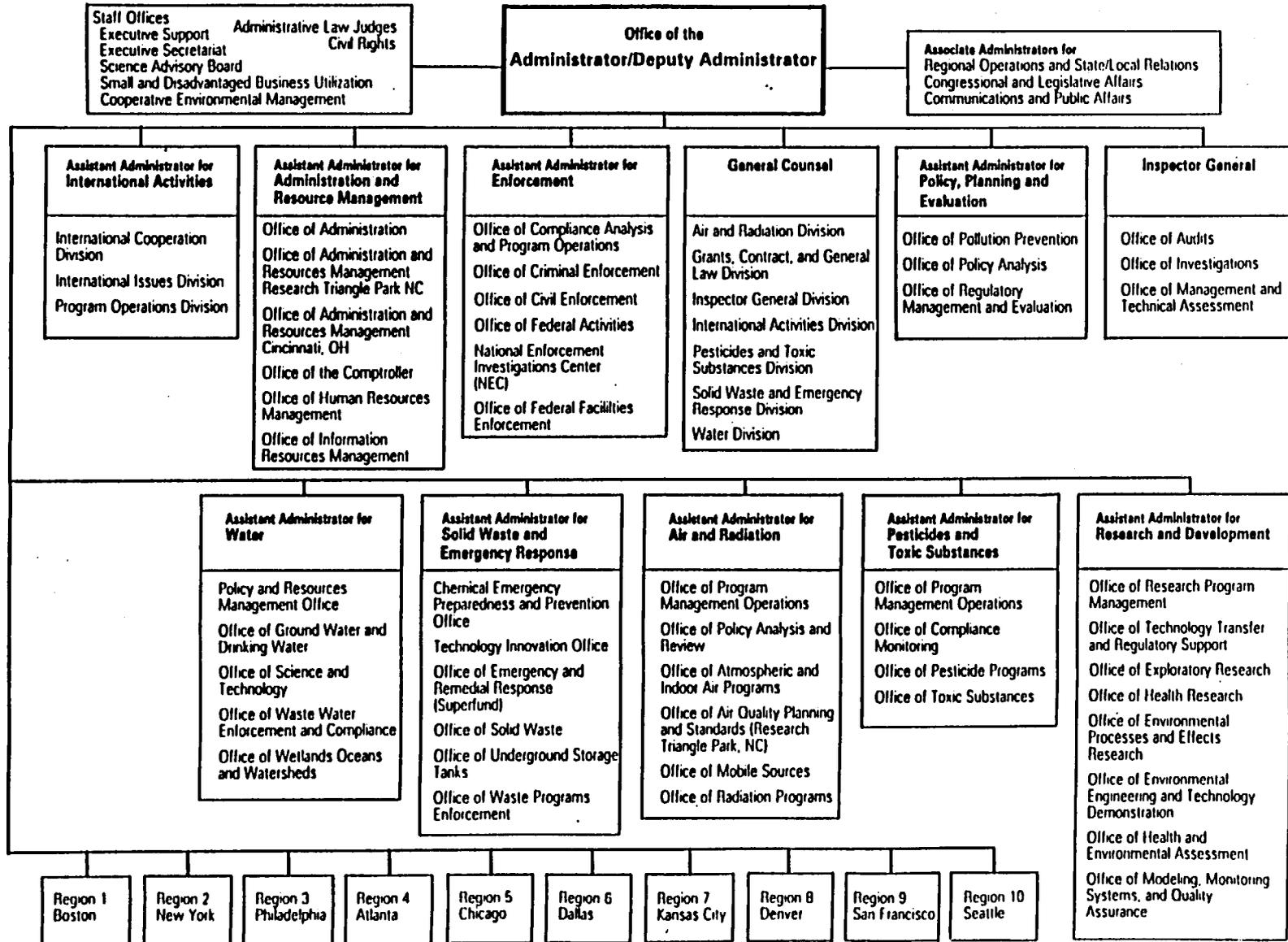
This section illustrates certain steps that can be followed, and sources that can be consulted, by Canadian engineering firms to identify potential environmental opportunities in the American public sector. Public sector opportunities can be found principally within the EPA, the Department of Defense, the Department of Energy, the State Governments, and Municipal Governments. Economic development agencies and downtown core development agencies also play a relatively active role in the United States and may represent a useful source of information and/or contracts.

The *Environmental Contract Opportunity Report*, a report available from the United Communications Group at (301) 816-8950 for \$274 annually, is a weekly publication which details the federal, state and local environmental procurement opportunities of potential interest to industry. Generally, opportunities are classified into the following categories: asbestos, energy conservation, environmental engineering, environmental equipment, environmental research, hazardous/solid waste, recycling, health and training, storage tanks, water, soil and air.

² The Buy American Act of 1933 represents a potentially significant U.S. federal legislation limiting the use of Canadian materials and services in U.S. public sector contracts. This Act generally requires price preferences (six percent on most contracts; twelve percent on those contracts partially set aside for U.S. small business or labour surplus areas) to be applied in favour of domestic suppliers. Services are not covered by the FTA chapter on government procurement. The Buy America Act therefore applies to services tendered by the U.S. Federal Government.

³ Nonetheless, the CBD is a valuable source of daily information. It is available from the Government Printing Office at (202) 783-3238 for \$US261 per year.

Table 24: EPA Organization Chart



The *Government Agencies Directory*, published by the Air and Waste Management Association in Pittsburgh, can be obtained from the association at (412) 232-3444 for \$US 8. The directory provides an overview of the federal, state, and local agencies involved in environmental matters.

9.1 Federal Government - The EPA

The Environmental Protection Agency, the general telephone number for which is (202) 382-2090, is the largest federal player in the environmental area, with an annual budget of approximately \$US 7 billion. The Agency was formed in 1970 to consolidate 15 components from five government departments into one independent agency. Currently, the EPA consists of 17 thousand employees and implements programs to cover fourteen major laws passed by Congress. Its organization chart is presented on the attached schematic. The EPA can be a complex organization to navigate (see Table 24) - the following contacts should provide Canadian firms with some assistance in reaching the appropriate officials.

- Deborah Janes is a public affairs specialist at the EPA who has extensive knowledge of the organization and key players within the Agency. She has expressed a willingness to assist Canadian firms in "finding their way around the EPA". She can be contacted at (919) 541-4577 in North Carolina.
- David Berg, the Director of Technology Innovation, at (202) 260-9153 is a good contact for Canadian firms interested in applying for a Research Development and Demonstration permit to demonstrate a technology at a U.S. site.
- INFOTERRA is part of a UN network of 138 countries that registers environmental experts for some 1000 environmental topics. The U.S. focal point can search several hundred databases and also lists about 600 experts who have agreed to respond to inquiries concerning their particular areas of environmental expertise. INFOTERRA is located at the EPA Headquarters Library in Washington, D.C. at (202) 260-5917.
- Information on the agency's technical and research-oriented aspects can be obtained from the EPA's Center for Environmental Research Information in Cincinnati at (513) 569-7562. For instance, project summaries for some 1100 research projects (covering the 11/91 to 03/92 period) can be obtained from this source. These projects are technical in nature, organized by type of media, and easily obtainable.

-
- The annual document *EPA Research Program Guide* is also available from this number. This is an excellent source of information documenting all research activities in the air, drinking water, water quality, hazardous waste, toxic substances, pesticides, radiation, multimedia and Superfund areas. It provides details regarding the project, the contact and laboratory name and telephone number, the dollar value of the project, and the percent being conducted in-house. Given that over 60 percent of the EPA's research budget is spent through extramural contracts, grants and cooperative agreements with organizations outside of the EPA's labs, it is evident that Canadian firms interested in conducting research for the EPA should obtain this document.
 - The *EPA Journal*, produced monthly by the Office of Communications and Public Affairs in Washington, D.C. at (202) 382-4454, might also be a useful source of information for Canadian firms. The issue of January 1991, for instance, is entirely devoted to a discussion of the Clean Air Act amendments and implications.
 - The document *Environmental Investments: The Cost of a Clean Environment* is a comprehensive compilation of information that might also prove useful to Canadian firms. It is a report by the EPA to Congress. It is available from the National Technical Information Service of the federal Department of Commerce in Springfield, Virginia at (703) 487-4650 for approximately \$US 50.
 - The EPA has four Centres of Excellence typically mandated to examine, develop and advance the technological status of their respective fields, as follows:
 - Center on Airborne Organics, (617) 253-4566
 - Multiscale Experimental Ecosystem Research Center, (410) 228-8200
 - Center for Clean Industrial and Treatment Technologies, (906) 487-2798
 - Center for Ecological Health Research, (916) 752-2113

Further information on the relevant centres can be obtained by Canadian firms through contacting Karen Morehouse, EPA Director of Centers, at (202) 260-5750.

The EPA is a large organization with vast knowledge and information on the U.S. environmental scene. Canadian firms should be able to obtain helpful insights from the agency.

9.2 Federal Government - The Department of Defense

Each year, Congress produces a document listing all DOD sites and the environmental status of each. This document, *The Defence Environmental Restoration Program Annual Report*, is available from the National Technical Information Service at (703) 487-4650.

One can obtain fairly detailed information from DOD and DOE describing plans and expenditures for individual military and energy installations, and the contractors engaged by these various facilities. One example that we obtained described the division of the \$818 million projected to be spent at the Oak Ridge National Laboratory Site during 1993-1997. The breakdown covers the defence and nondefence aspects and the assessment, cleanup, waste management, and corrective activities spending.

As well, the DOD's annual report lists all installations, by state, and the progress that has been attained at each.

David Olson of DOD's Installation Restoration Branch, (703) 602-2571, is a good contact for firms interested in DOD work. Other possible contacts include the following:

| <i>Contact</i> | <i>Group</i> | <i>Telephone</i> |
|-------------------|--------------------------------------|------------------|
| Carl Nealing | Air Force Environmental Office | (202) 697-9267 |
| Paul Yaroschak | Navy Environmental Office | (202) 692-7110 |
| Larry Barb | Army Environmental Office | (202) 695-7824 |
| Guy Everhart | Defense Environmental Support Office | (703) 325-2215 |
| Michael Carricato | Office of Environmental Restoration | (202) 695-7820 |
| William Parker | Office of the Environment | (202) 695-7820 |

If the contact is no longer in the position, Canadian firms should ask for the Environmental Restoration Division.

9.3 Federal Government - The Department of Energy

The department's five-year plan describes in detail the priorities and activities of the department. It can be obtained from (301) 903-3555 and represents a base from which sites can be identified and contacted. It organizes the department's thirty year cleanup mission into more manageable increments.

Table 25: State Government Contacts in Economic Development Departments

| | | | | | | | |
|--|--|---|---|--|---|--|---|
| <p>ALABAMA David P. Rumberger Director Dept. of Economic & Community Affairs 3465 Norman Bridge Rd. Montgomery, AL 36103 (205) 242-8672</p> | <p>DELAWARE John J. Casey Jr. Director Development Off. 99 Kings Hwy. Dover, DE 19901 (302) 739-4271</p> | <p>IOWA Allan T. Thoms Director Dept. of Economic Development 200 E. Grand Des Moines, IA 50309 (515) 281-4817</p> | <p>MARYLAND James W. Peiffer Director Off. of Business & Development 217 E. Redwood St. Baltimore, MD 21202 (301) 333-2100</p> | <p>NEBRASKA Steve Buttress Director Dept. of Economic Development 301 Centennial Mall S. P.O. Box 94666 Lincoln, NE 68509 (402) 471-3111</p> | <p>NORTH DAKOTA (Vacancy) Director Economic Development & Finance State Capitol Grounds 604 E. Blvd. Bismarck, ND 58505 (701) 224-2810</p> | <p>TENNESSEE Carl Johnson Commissioner Dept. of Economic & Community Development 120 Sixth Ave., N Nashville, TN 37243 (615) 741-1888</p> | <p>WISCONSIN Irlt Albert Director Bur. of Business & Recruitment Dept. of Development P.O. Box 7970 Madison, WI 53707 (608) 266-1018</p> |
| <p>ALASKA Paul Fuhs Director Economic Development Dept. of Commerce & Economic Development P.O. Box D Juneau, AK 99811 (907) 463-2017</p> | <p>FLORIDA Steve Mayberry Director Div. of Economic Development Dept. of Commerce 301-B Collins Bldg. Tallahassee, FL 32399 (904) 488-4300</p> | <p>KANSAS Tom Fitzgerald Director Div. of Existing Industry Dept. of Commerce 400 SW Eighth, 5th Fl. Topeka, KS 66663 (913) 296-5298</p> | <p>MASSACHUSETTS Daniel Gregory Secretary Executive Off. of Economic Affairs 1 Ashburton Pl., Rm. 2101 Boston, MA 02108 (617) 727-8380</p> | <p>NEVADA Jim Spoo Executive Director Comm. on Economic Development 3131 S. Carson St. Carson City, NV 89710 (702) 687-4323</p> | <p>OHIO Donald Jalkway Director Dept. of Development 77 S. High St., 29th Fl. Columbus, OH 43266 (614) 466-3379</p> | <p>TEXAS (Vacancy) Director Economic Development Div. Off. of the Governor P.O. Box 12428 Austin, TX 78711 (512) 463-2000</p> | <p>WYOMING Steve Schmitz Executive Director Div. of Economic & Community Development Dept. of Commerce 122 W. 25th St., 2 W. Cheyenne, WY 82002 (307) 777-5948</p> |
| <p>ARIZONA James E. Marsh Director Dept. of Commerce 1800 N. Central Ave. Phoenix, AZ 85012 (602) 280-1306</p> | <p>GEORGIA Randolph B. Cardoza Commissioner Dept. of Industry, Trade & Tourism 283 Peachtree Ctr. Ave., NE, Ste. 1000 Atlanta, GA 30303 (404) 634-3373</p> | <p>KANSAS Laura Nichol Secretary Dept. of Commerce 400 SW Eighth, 5th Fl. Topeka, KS 66612 (913) 296-3480</p> | <p>MICHIGAN Bill Lantz Director Manufacturing Development Dept. of Commerce P.O. Box 30223 Lansing, MI 48909 (313) 373-0601</p> | <p>NEW HAMPSHIRE William Pillsbury Director Dept. of Resources & Economic Development P.O. Box 836 Concord, NH 03301 (603) 271-2341</p> | <p>OKLAHOMA D. Gregory Mala Executive Director Dept. of Commerce 6401 Broadway Est. Oklahoma City, OK 73116 (405) 843-9770</p> | <p>UTAH Lynn Blake Director Div. of Business & Economic Development Community & Economic Development Dept. 324 S. State St., Ste. 200 Salt Lake City, UT 84111 (801) 538-8810</p> | <p>DISTRICT OF COLUMBIA Austin E. Penny Jr. Deputy Mayor Economic Development 1330 Pennsylvania, NW Washington, DC 20004 (202) 727-6600</p> |
| <p>ARKANSAS Dave Harrington Director Industrial Development Com. 1 Capitol Mall, Rm. 4C-300 Little Rock, AR 72201 (501) 682-1121</p> | <p>HAWAII Murray E. Towill Director Dept. of Business, Economic Development & Tourism 220 S. King St., # 1000 Honolulu, HI 96813 (808) 548-6914</p> | <p>KANSAS Bill Thompson Director Div. of Industrial Development Dept. of Commerce 400 SW Eighth, 5th Fl. Topeka, KS 66603 (913) 296-2652</p> | <p>MINNESOTA Dave Jennings Director Economic Development Div. Dept. of Energy & Economic Development 150 E. Kellogg Blvd., Rm. 980 St. Paul, MN 55101 (612) 296-3976</p> | <p>NEW JERSEY Rocco Guerrieri Director Div. of Economic Development Dept. of Banking 20 W. State St., CN 823 Trenton, NJ 08623 (609) 292-7757</p> | <p>OREGON Greg Baker Manager Business Development Dept. of Economic Development 393 Cottage St., NE Salem, OR 97310 (503) 373-1223</p> | <p>VERMONT William Kenerson Commissioner Dept. of Economic Development 109 State St. Montpelier, VT 05602 (802) 828-3221</p> | <p>AMERICAN SAMOA Lydia Galefine Director Off. of Economic Development Planning American Samoa Government Pago Pago, AS 96799 (684) 613-3155</p> |
| <p>CALIFORNIA Julie Wright Director Dept. of Commerce 801 K St., Ste. 1700 Sacramento, CA 95814 (916) 322-3962</p> | <p>IDAHO Jay E. Engstrom Administrator Dept. of Commerce 700 W. State St. Boise, ID 83720 (208) 334-2478</p> | <p>KENTUCKY Gene C. Roysky Secretary Commerce Cabinet Capital Plaza Tower Frankfort, KY 40601 (502) 584-7678</p> | <p>MISSISSIPPI J. Mac Holladay Executive Director Dept. of Economic & Community Development P.O. Box 649 Jackson, MS 39205 (601) 339-3449</p> | <p>NEW MEXICO William E. Garcia Secretary Dept. of Economic Development 1100 St. Francis Dr. Santa Fe, NM 87503 (505) 827-0180</p> | <p>PENNSYLVANIA Andrew T. Greenberg Acting Secretary of Commerce Dept. of Commerce 433 Forum Bldg. Harrisburg, PA 17120 (717) 783-3340</p> | <p>VIRGINIA Hugh D. Keogh Director Dept. of Economic Development 1021 E. Cary St. Richmond, VA 23219 (804) 371-6100</p> | <p>GUAM Charles Citoivomso Administrator Guam Economic Development Authority 590 S. Marine Dr. Tamuning, GU 96911 (671) 646-4141</p> |
| <p>COLORADO Fred Niehaus Special Assistant to the Governor (N) of Business Development Governor's Off. 1625 Broadway, Ste. 1710 Denver, CO 80202 (303) 892-3848</p> | <p>ILLINOIS Jan Grayson Director Dept. of Commerce & Community Affairs 620 E. Adams St., 3rd Fl. Springfield, IL 62701 (217) 783-1032</p> | <p>LOUISIANA Kirstin A. Nyrop Secretary Dept. of Economic Development P.O. Box 94185 Baton Rouge, LA 70804 (504) 342-3339</p> | <p>MISSOURI Carl Koupal Director Dept. of Economic Development P.O. Box 1117 Jefferson City, MO 65102 (314) 731-4962</p> | <p>NEW YORK Vincent Tese Commissioner Dept. of Commerce 1 Commerce Plz. Albany, NY 12243 (518) 474-6100</p> | <p>RHODE ISLAND Joseph Paulino Jr. Director Dept. of Economic Development 7 Jackson Walkway Providence, RI 02903 (401) 277-2601</p> | <p>WASHINGTON Paul Isaki Director Dept. of Trade & Economic Development 101 General Administration Bldg. M/S: AX 13 Olympia, WA 98504 (206) 753-7426</p> | <p>NORTHERN MARIANA ISLANDS Lydia M. Sablan Acting Executive Director Community Development Authority P.O. Box 2149 Saipan, MP 96950 (670) 214-7145</p> |
| <p>CONNECTICUT Joseph McGee Commissioner Dept. of Economic Development 845 Brook St. Ritchy Hill, CT 06067 (203) 258-4201</p> | <p>INDIANA Pat Vercauteren Director Business Development & Marketing Group Dept. of Commerce 1 N. Capitol, Ste. 700 Indianapolis, IN 46204 (317) 232-8888</p> | <p>MAINE Lynn Wachtel Commissioner Dept. of Economic & Community Development State House Station # 39 Augusta, ME 04333 (207) 289-2634</p> | <p>MONTANA Robert Jeffer Administrator Business Development Div. Dept. of Commerce 1424 Ninth Ave. Helena, MT 59620 (406) 444-3923</p> | <p>NORTH CAROLINA Aiah H. Ward Jr. Director Business & Industry Development Dept. of Economic & Community Development 401 N. Salisbury St. Raleigh, NC 27603 (919) 733-4111</p> | <p>SOUTH CAROLINA Wayne L. Serthing Director State Development Board P.O. Box 927 Columbia, SC 29202 (803) 734-1400</p> | <p>WEST VIRGINIA Ann Johnson Director Governor's Off. of Community & Industrial Development State Capitol, Rm. 146 Charleston, WV 25303 (304) 348-0400</p> | <p>SOUTH DAKOTA Darrell Butterwick Commissioner Governor's Off. of Economic Development Capitol Lake Plz Pierre, SD 57501 (605) 773-3032</p> |

The document entitled *Doing Business with the Department of Energy* is a useful source for Canadian firms and is available free from (202) 254-5583.

Paul Grimm of DOE's Environmental Restoration and Waste Management section would be a useful source for Canadian firms interested in potential DOE work. He can be contacted at (202) 586-7709. Other possible contacts include the following:

| <i>Contact</i> | <i>Group</i> | <i>Telephone</i> |
|----------------|---|------------------|
| Henry Garson | Office of the Environment | (202) 586-7413 |
| Diane Morales | Office of the Environment, Safety and Health | (202) 586-6151 |
| Kathleen Taimi | Office of Environmental Compliance | (202) 586-5518 |
| John Tseng | Office of Environmental Guidance and Compliance | (202) 586-5680 |
| Leo Duffy | Environmental Restoration and Waste Management | (202) 586-7710 |
| Robert Barber | Office of Risk Analysis and Technology | (301) 353-3477 |

If the contact is no longer in the position, Canadian firms should ask for the Environmental Restoration Division.

9.4 State Governments

In addition to spending large amounts on environmental goods and services, the state governments are perhaps one of the best sources of information on the industry, including information such as industrial permits and compliance orders (which could lead to identifying laggard companies).

The Council of State Governments is an excellent source of information for Canadian engineering firms looking to penetrate markets in particular states. The Council produces a document entitled *Resource Guide to State Environmental Management* which encompasses a broad range of information such as:

- Organization Charts of State Environment Departments;
- State expenditures by 15 environmental categories;
- State environmental orientation (per-capita spending and percent of total budget);
- Number of manufacturers by State;
- Names, positions, and telephone numbers for the 80 most important State government environmental officials in each State. These contacts cover all facets of state environmental management.

To obtain this \$US 40 document, contact the Council in Lexington, Kentucky at (606) 231-1866. It should be purchased by all Canadian firms who are seriously interested in entering regional markets in the United States. Technical information on the document can be obtained from Steven Brown at the above number.

Table 26: State Government Contacts in Environmental Protection Departments

ALABAMA

Lugh Pegues
Director
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A similar document, entitled *State Administrative Officials*, is available from the Council's order department at (606) 231-1850, for \$US 30. This document lists senior officials in various state departments, including the Commerce and Economic Development departments. Table 25 presents a listing of the "economic development contacts" at each of the 50 state governments while Table 26 presents a similar listing of "environmental protection contacts".

- The State government environmental contacts are able to provide Canadian firms with insights regarding the environmental challenges, problem areas, programs, capabilities, legislation and priorities of the state.
- The State "economic development contacts" are a valuable potential source of information regarding industrial capabilities, alliance partners, manufacturing firms under pressure, and other industry-related subjects.

The documents *Government Finances* and *State Government Finances* provide comprehensive information on sewerage, highway, and education capital outlays by state governments and local governments. The latter are divided into county, municipal, township, school district, and special district governments. This information is available from the Governments Division of the Census Bureau at (301) 763-7664.

The National Association of State Purchasing Officials (NASPO) is located in Lexington, Kentucky at (606) 231-1906. The NASPO is staffed by the Council of State Governments. It represents 110 members, namely the purchasing officials of all states. The NASPO has an annual conference, and offers a course to companies on selling services to market to state governments. The NASPO produces a quarterly publication as well as the guide *How to do Business with the States: A Guide for Vendors*. Canadian firms interested in selling to state governments should contact the NASPO officials listed in Table 27.

Through consulting the *State Administrative Officials* document and the NASPO described above, Canadian firms can then contact the appropriate state officials to discuss state plans, needs, and the like. States also produce relevant material, such as the reference "Establishing a Representative Office in California". Available from the state's Department of Commerce in Los Angeles, this document describes how to establish a physical presence in the state.⁴

⁴ The document estimates that a four-employee office in California would cost \$370 thousand to establish and operate for one year. This estimate includes a generous allocation for furniture, computers, and rent (\$4300 per month) and salaries (\$262,000 for four people).

Table 27: Contacts at the National Association of State Purchasing Officials

| | | | |
|----------------------|-----------------------|----------------|----------------|
| Alabama | N. Kent Rose | Montgomery | (205) 242-7250 |
| Alaska | Dugan Petty | Juneau | (907) 465-2250 |
| Arizona | Margaret E. McConnell | Phoenix | (602) 542-5308 |
| Arkansas | Edward J. Erxleben | Little Rock | (501) 324-9312 |
| California | John S. Babich | Sacramento | (916) 445-6942 |
| Colorado | David Leavenworth | Denver | (303) 866-6191 |
| Connecticut | Peter W. Connolly | Middletown | (203) 638-3247 |
| Delaware | Richard Cathcart | Delaware City | (302) 834-4550 |
| District of Columbia | Ric Murphy | Washington | (202) 727-1179 |
| Florida | George C. Banks | Tallahassee | (904) 488-7303 |
| Georgia | Richard J. Weiskittel | Atlanta | (404) 656-3240 |
| Hawaii | Robert J. Govers | Honolulu | (808) 586-0554 |
| Idaho | Gerry L. Silvester | Boise | (208) 327-7465 |
| Illinois | Ted Curtis | Springfield | (217) 785-7282 |
| Indiana | Mable Martin-Scott | Indianapolis | (317) 232-3032 |
| Iowa | Kenneth Paulsen | Des Moines | (515) 281-3089 |
| Kansas | Jack R. Shipman | Topeka | (913) 296-2376 |
| Kentucky | Mike Haydon | Frankfort | (502) 564-4510 |
| Louisiana | Virgle LeBlanc | Baton Rouge | (504) 342-8062 |
| Maine | Richard Thompson | Augusta | (207) 289-3521 |
| Maryland | Paul T. Harris | Baltimore | (301) 225-4620 |
| Massachusetts | Philmore Anderson III | Boston | (617) 727-7500 |
| Michigan | William Warstler | Lansing | (517) 373-0300 |
| Minnesota | John W. Haggerty | St. Paul | (612) 296-1442 |
| Mississippi | Donald G. Buffman | Jackson | (601) 359-3409 |
| Missouri | Joyce Murphy | Jefferson City | (314) 751-3273 |
| Montana | Marvin Eicholtz | Helena | (406) 444-2575 |
| Nebraska | Barbara Lawson | Lincoln | (402) 471-2401 |
| Nevada | Phyllis T. Williams | Carson City | (702) 687-4070 |
| New Hampshire | Wayne Myer | Concord | (603) 271-2700 |
| New Jersey | Giullo Mazzone | Trenton | (609) 292-4751 |
| New Mexico | Gene Baca | Santa Fe | (505) 827-0472 |
| New York | Paula Moskowitz | Albany | (518) 474-6710 |
| North Carolina | William J. Stuckey | Raleigh | (919) 733-3581 |
| North Dakota | Bud Walsh | Bismarck | (701) 224-2683 |
| Ohio | Roger W. Grime | Columbus | (614) 644-8493 |
| Oklahoma | Ross Johnson | Oklahoma | (405) 521-2115 |
| Oregon | Sandra Burt | Salem | (503) 378-4643 |
| Pennsylvania | George C. Fields | Harrisburg | (717) 787-5295 |
| Rhode Island | Peter S. Corr | Providence | (401) 277-2321 |
| South Carolina | James J. Forth Jr. | Columbia | (803) 737-0619 |
| South Dakota | Milton Schwartz | Pierre | (605) 773-3405 |
| Tennessee | Janice L. Harber | Nashville | (615) 741-5970 |
| Texas | John Poulard | Austin | (512) 463-3446 |
| Utah | Douglas G. Richins | Salt Lake City | (801) 538-3026 |
| Vermont | Peter Noyes | Montpelier | (802) 828-2211 |
| Virginia | Donald F. Moore | Richmond | (804) 786-3846 |
| Washington | Michael Levenson | Olympia | (206) 753-6461 |
| West Virginia | Ron Riley | Charleston | (304) 558-2309 |
| Wisconsin | Jan Abrahamson | Madison | (608) 266-0974 |

9.5 Municipal Governments

For Canadian environmental engineers, municipal governments probably represent the least attractive level of opportunity among the three tiers. Generally, municipal work is of a local nature, civil construction, roadwork, sewers, and the like and often involves governments that have long-established relationships with firms in the area.

Canadian firms may have some success in entering the municipal environmental market if they offer highly specialized expertise and align locally. For these firms, we offer the following random insights obtained from representatives of U.S. municipalities.

- Some, though not all, municipalities adhere to the Brooks Act⁵, which generally stipulates that qualifications-based selection be followed and that lowest price bids need not necessarily win the contract.
- Contracting is generally administered by individual municipal departments, such as engineering, water, etc.
- Municipal requirements are usually advertised in the local newspapers, to which firms respond with a Letter of Interest outlining their qualifications to do the work.
- The city then reviews these, shortlists on the basis of firm's experience and qualifications and issues an RFP for two documents - a Technical Proposal and a Price Proposal.
- If not simply awarded to the lowest bid, the municipal government will evaluate the technical proposals first and rank the firms according to a number of selection criteria, before negotiating an acceptable price with the first ranked firm. Some of the selection criteria include; location of firm, participation of minority peoples, etc. In the case profiled, out-of-state and out-of-country firms are awarded equally - each receiving no points for this category (versus 10 points for an in-city firm).
- It is not at all unusual for six or more months to elapse from initial notification to signing of contract. Some municipalities have standing offer agreements, where certain specialized services would be procured directly without a competitive process. For example, one municipality uses a standing offer to procure geo-technical services for eroded slopes which have caused landslides.
- Company expertise is however the most important qualification criteria and if states cannot source the appropriate expertise locally, outside firms would certainly be called upon.

⁵ The Brooks Act generally stipulates that qualifications-based selection be followed, where lowest price bids need not necessarily win the contract. Around 35 states apply Brook's Act requirements to their procurement, while a number of other states that do not have state procurement laws generally adhere to Brooks Act selection procedures. The ACEC in the United States generally has the advancement of qualifications-based selection as a priority activity.

-
- As a result of the insurance crisis of the late-1980s, some municipalities loosened their requirements. Rather than carrying full insurance, firms needed only general liability coverage (and worker's compensation).
 - Many municipalities generate documents describing how to sell to the City government. For example, the Los Angeles government produces "Selling to the City of Los Angeles", available from the City Purchasing Agent at (213) 485-2248, which describes the appropriate contacts for construction work, water and power, airports, community redevelopment, school districts and others.
 - In addition to contacting the City Procurement Offices, companies should speak with the appropriate environmental contact for the particular city. For example, in Los Angeles, David Luther at (213) 237-0462, manages the Environmental Affairs area of the city government.
 - Many municipalities also have departments and/or programs serving small business. For example, the Office of Small and Minority Business in Sacramento, (916) 322-5060, is oriented toward small companies and favours small or minority firms on certain types/aspects of contracts.
 - Potential opportunities within water districts may be worth further investigation by appropriate Canadian firms. For example, the Metropolitan Water District of Southern California will be undertaking an estimated \$6 billion in revamp and expansion of reservoirs and treatment facilities during the next decade. Canadian firms can complete a "qualified vendors list" questionnaire (it is segmented into civil engineering, environmental work, consulting services, and other subjects) through contacting the District in Los Angeles. Similar Districts exist in various U.S. states.

Section Ten: Using Your Existing Contact Base

Canada represents the largest export market for the United States, receiving 22 percent of all U.S. exports. Similarly, the U.S. is Canada's largest export destination, receiving some 72 percent of Canadian goods and services exports. Literally thousands of Canadian companies have some form of daily business interaction with Americans - interaction and contacts which the engineering community could conceivably draw upon in some manner in entering the U.S. market.

Similar patterns are displayed in the direct investment area, where Canada is resident to 18 percent of all U.S. foreign direct investment, and in turn represents the fourth largest foreign investor in the United States after the United Kingdom, Japan, and the Netherlands.

Given this degree of interaction, it would be unusual for a Canadian engineering firm to not have among its existing client base a selection of companies with some form of connection to the United States. In our view, Canadian firms interested in penetrating the U.S. market should be more active in drawing upon these contacts in order to advance their own interests. Such contacts would be most beneficial in those instances where Canadian engineering firms have provided services, where the client is pleased with the services, and where U.S. contacts of the client may be undertaking similar activities and have a need for similar services. This then represents a natural means of opening a door to a potential opportunity.

These and other similar channels are discussed in the following paragraphs.

10.1 Foreign Companies with Canadian Investments

Canada has the heaviest reliance upon foreign investment of any of the world's industrialized nations. This characteristic was established during the 1890-1930 period, when the nation's Industrial Policy caused many foreign companies to establish in Canada to avoid paying high tariffs. The characteristic was reinforced during the period following the Second World War, as Canadian policy-makers emphasized the benefits of foreign investment.

Presently, some 175 of the largest 500 corporations in Canada are foreign-controlled. Of the entire manufacturing industry asset base in Canada, approximately 55 percent is controlled by foreign interests. Within manufacturing, the following industries have substantial levels of U.S. direct

investment: tobacco (99 percent of industry sales are foreign controlled¹); transport equipment (86 percent); rubber products (87 percent); chemicals (76 percent); petroleum (74 percent); electrical products (58 percent); machinery (53 percent); textiles (46 percent); and beverages (38 percent).

The largest foreign-controlled corporations include the following: General Motors of Canada; Ford Motor Company of Canada; Imperial Oil; Chrysler Canada; Canada Safeway; IBM Canada; Amoco Canada; Great Atlantic and Pacific (A&P); FW Woolworth; Dow Chemical; General Electric Canada. A comprehensive list of foreign-owned companies operating in Canada is provided in the annual *Largest Industry* publications of the Financial Post and Canadian Business.

Beyond these, among other sources, a number of regional *Made In* publications are also of value in identifying local companies who may have a substantial contact base in the United States. For example, the publication "1991 Manitoba Trade Directory" provides a comprehensive listing of all firms producing in the province. From this Directory, one could then identify the Campbell Soup Company or Nabisco Brands, for example, as local investors who are also prominent international players in the food processing industry. Similarly, the "Alberta Manufacturers Index" lists those companies active in the local petroleum products area, such as Esso Petroleum Canada and Shell Canada. Engineering firms who might have conducted environmental work for such companies in Canada, assuming a level of client satisfaction with the work, might then "ride" these contacts into the market opportunity of solving similar environmental problems for the affiliate company in the United States.²

Similar documents are available in each Canadian region. Such documents usually cost around \$25-50 and would likely be housed in any sizeable business or government library. The provincial industry departments should be able to provide the document or a number where such documents could be obtained.

10.2 Canadian Companies with American Investments

While not to the same extent as our levels of inward direct investment, Canada also has a substantial degree of capital (and contacts) invested in foreign nations.

¹ Generally, 75-80 percent of the investment is American. The source of the foreign investment levels information is Statistics Canada.

² For example, it was suggested to us that Dow Canada is advanced in its efforts to address environmental problems and that its U.S. parent could arguably benefit from some of the Canadian expertise. Canadian engineers involved with this client might then have an obvious door into the U.S. market.

Table 28: Canadian Companies Present in Western States

The following represent some of the Canadian-owned subsidiaries currently operating in the western states of California, Arizona and Nevada.

- 3-D Systems Inc;
- Alcan;
- Spar Aerospace;
- Bank of Montreal;
- Beak Engineering;
- Bentall Development;
- Bramalea Ltd;
- Canada Wire and Cable;
- Canadian Airlines International;
- Canadian Pacific Hotels;
- Cini Little Associates;
- Confederation Life Insurance Co;
- Seltech Satellite Corp;
- Klohn-Leonoff;
- D.C.S. International Systems;
- DMR & Associates;
- Fast-Trax Sound Corp;
- First City Financial
- Four Seasons Hotel Ltd;
- Gandalf Systems Group;
- Great West Life Assurance;
- Trilon Financial;
- Kilborn Engineering;
- Western Pottery Co;
- Lucas Aerospace;
- Champs Food Systems;
- Newbridge Networks;
- Northern Telecom;
- DW Thomson Consultants;
- Prevost Car Inc;
- Thomson Newspapers
- Skyword Marketing;
- Spicer Corporation;
- Trizec Corp Ltd;
- Hollinger Inc;
- Air Canada;
- Noranda;
- Dyment;
- BCE Development;
- Golder Associates;
- Derlan Industries;
- Canada Life Assurance;
- Canadair;
- Canadian Imperial Bank of Commerce;
- Cineplex Odeon;
- Canadian Force Structures;
- Coscan Development;
- Northern Airborne Tech;
- SNC-Lavalin
- Domtar Inc;
- Electrovert Ltee;
- Financial Collection Agencies Ltd
- Fleet Aerospace;
- NRS/National Real Estate Service;
- Glenayre Electronics;
- Harbour Industries Ltd;
- Homelife Realty Services;
- Laidlaw Transit;
- Litton Systems Canada;
- Manulife Financial;
- National Bank of Canada;
- Noranda Inc;
- PCL Construction;
- Watts, Griffis and McQuat
- Royal Bank;
- Agra Industries;
- Smed Manufacturing Inc;
- Standard Aero Ltd;
- UMA Engineering;
- Suzy Shier Inc.

The list of Canadian companies active as direct investors in the United States is broad and includes a number of resource, service, telecommunications, real estate, food and beverage, and retail companies. Through contacting the appropriate Consulate, firms can obtain an updated listing of Canadian companies with investments in the region of interest. For example, contacting the Consulate in Los Angeles reveals that the Canadian firms listed in Table 28 all have some type of presence in the California, Arizona and Nevada region.

Canadian engineering firms, particularly those with a relationship with these companies, may wish to investigate possible related U.S. market opportunities. Again, such opportunities are enhanced if the engineer has provided innovative solutions and top quality service to the client in previous dealings.

10.3 Other Private Firms

In implementing an environmental project, there are generally as many as eight separate steps that must be covered.

- the situation must be diagnosed, analysed, and a decision made;
- conceptual plans must be devised;
- financing matters must be arranged;
- design and engineering procedures must be conducted;
- procurement must be completed;
- construction and installation must be completed;
- training manuals and courses must be prepared and presented to those affected;
- the implemented project must be operated and maintained.

The above activities are handled by a range of industries, including engineering, real estate, architectural, financial, management, construction, legal, and environmental companies. In a sense, each of these activities provides opportunities for environmental engineering firms and those industries conducting each activity may also represent a source of information and/or partnership for Canadian engineers.

Many individuals and documents have argued that these Canadian communities (particularly engineering, architectural and construction) do not work in a sufficiently coordinated manner and that improvements should be made in this regard. While we have not attempted to address this matter in any detail, we do feel that Canadian engineering firms should be exploring a range of professional contacts, as part of their overall market penetration strategy.

Table 29: U.S. Projects of Canadian Contractors

This table presents a sample of some U.S. activities undertaken by Canadian construction firms in recent years.

| Company | Project |
|---------------------------|---|
| Atlas-Gest | Submerged tunnel in Mobile, Alabama Underground pumping station in Chicago, Illinois |
| Banister Continental | Crude oil line in Louisiana Sewer tunnel in Wisconsin |
| Bechtel Canada | Coal handling facility in the U.S. |
| Black and McDonald | Defence and Aerospace projects in the Florida region |
| Both Belle Robb | Office and hotel complexes throughout the U.S. |
| Canron | Steel Erection for Office building in New York City Bridge in Troy, New York |
| Commonwealth Construction | Gold mine in Butte, Montana |
| Concordia | Stores throughout the U.S. Apartments in Oklahoma City, Oklahoma |
| Ellis Don | Institutional facility, Washington State |
| Fitzpatrick Construction | Subway station in Buffalo, New York Rapid transit extension in New York State |
| Frankel Steel | Steel Supply and Erection for Office Buildings in New York |
| Milne & Nicholls | Various U.S. projects |
| Mollenhauer Construction | Commercial developments in Florida |
| PCL Construction | 18 Special U.S projects underway in 1992, including Denver, Los Angeles, Minneapolis |
| Petrifond Foundation | Office building in Baltimore, Maryland Power dams in Washington and Alabama |
| SCI | Viaduct in Hawaii, transportation project in Seattle |
| W.A. Stephenson | Mass transit projects in Seattle and other areas |
| Schokbeton | Prefab concrete for casino in Atlantic City and hotel in D.C. |
| Taylor Woodrow | Airport in Florida, among other projects |
| Western Caissons | Subway piling in Washington, D.C. |
| George Wimpey Canada | Rapid transit in Miami, Florida Roads and sewers work in Florida |

Source: Canadian Construction Association and other sources.

For example, a number of Canadian construction firms have entered the U.S. market in recent years. Table 29 indicates a selection of these firms, as well as the types of projects that they have undertaken. Given that many real estate development projects in the United States require that some form of environmental assessment be conducted, it may be worthwhile for Canadian engineering firms to contact real estate firms and construction contractors (in Canada and the United States) in order to broaden the current scale of their services to these types of clients.

There are also a handful of Canadian engineering firms that are currently working in the U.S. environmental market. Gore & Storrie, SNC-Lavalin, Conestoga-Rovers, Monenco-Agra, Acres, Golder, Trow, and Simons are among the prominent Canadian firms active in the United States environmental market. Canadian engineering firms in the U.S. are regionally located. For example, the Canadian firms Beak Engineering, Klohn-Leonoff, Golder Associated, SNC-Lavalin, DW Thomson, and Watts, Griffis and McQuat are all located in the Seattle Post territory. While such firms might naturally be somewhat sensitive to divulging information to potential competitors, they nonetheless represent a potential source of information, experiences, advice, and alliance for Canadian engineers.

The sale of pollution abatement equipment and services in foreign countries often requires engineers capable of providing pre-sales and post-sales counselling. The Canadian environmental equipment and service community (4000 companies) has some sectors which are foreign controlled and not particularly active in export markets. Other segments are, however, active in foreign markets and may view some form of engineering alliance as being potentially beneficial to them in their long-term export efforts. Companies such as Laidlaw, Browning Ferris, Waste Management, and Wheelabrator sell goods and services in both Canada and the United States. Canadian engineering firms with previous contacts in the machinery, equipment and service community may wish to investigate this channel in further detail.

Management consulting firms are often a valuable tool to be accessed in entering a particular region or market segment. These firms can conduct market assessments as well as identify and/or screen potential partners for strategic alliances. Prior to engaging a management consulting firm, it is most advantageous for Canadian firms to conduct as much *homework* in-house as possible. Through conveying targeted and specific requests to a consulting firm, Canadian engineering firms will generally obtain higher quality and more useful reports and recommendations. The *Big Five* consulting firms³ have an extensive array of offices throughout the United States and Canada, as well as a strong base of local contacts and sectoral expertise.

³ Ernst & Young, Deloitte Touche, Price Waterhouse, Coopers & Lybrand, and Peat Marwick Thorne.

As discussed below, each of these industries have their own representative association(s). Beyond using existing contacts in individual companies, Canadian firms might wish to also derive information from the appropriate associations.

10.4 U.S. Companies and Canadian Government Offsets

The Canadian government has an "offset" program, wherein it attempts to maximize benefits to Canada resulting from its major capital projects. Typically, as part of the negotiations with a foreign supplier of goods and/or services, the federal government will attempt to commit the company to providing future benefits to Canada. One such benefit might be the company subsequently purchasing a good or service from a Canadian firm. It is important to note that these companies need not themselves purchase the Canadian goods/services to reduce their commitment. They need simply be involved in the process.

One intent of the program is that Canadian exporters to the United States (or the country which owes the offset) might use the leverage of owed offsets to assist in landing an export contract. *The Canadian firm might contract directly with an offset company or it might use the influence of the offset company to secure a contract.*

International companies committed to Canadian offsets include those listed below. The person responsible for offsets is also listed as well as the contact telephone number. If the person is not available or no longer in the position, then firms should speak with the "offsets manager", "industrial benefits manager" or "contracts manager" available.

- Raytheon, Bob Danner, (508) 440-6986, or George Lehner, (508) 490-1473;
- Martin Marietta, Denise Clarke, (613) 783-4718;
- Exide Electronics, John Milloy, (416) 625-9627;
- Hughes Aircraft, DN Turner, (604) 279-5608;
- Canadian Marconi, David Woodhouse, (613) 592-6500;
- General Electric, Kenneth Porter, (416) 858-5472;
- E.H. Industries Canada, Victor Ingram, (613) 563-2180;
- Oerlikon Aerospace, Jean LaPointe, (514) 358-2000;
- Lockheed Aeronautical, Noreen Field, (404) 494-8455;
- McDonnell Douglas, Michael Murphy, (314) 232-6531;
- Litton Systems, Cliff Kinney, (613) 236-2358;
- General Motors Diesel, K. Yamashita, (519) 452-5184.

The federal department of Industry, Science and Technology is the responsible government department. For further information on the program, contact the appropriate Director of Industrial Benefits in the Department.⁴

10.5 Canadian Governments

The federal and provincial governments represent very useful contacts for Canadian firms in a number of ways. These are described in Appendix A.

At the federal level, the industry department (ISTC) and the trade department (EAITC) are the most relevant to Canadian firms interested in the U.S. market. The former provides industry sector information and insight, while the latter provides a range of export programs and services both in Canada and in the United States. For instance, EAITC Trade Commissioners can promote Canadian firms to local customers, recommend appropriate trade fairs and marketing channels, identify information on potential foreign partners, and assist with joint venturing and other strategic arrangements.

In some instances, there may be in existence international agreements between Canadian and American departments. For example, the U.S. DOE and Canada's AECL have a formal agreement in place to conduct joint experimental and analytical development activities to dispose of spent nuclear fuel and high-level waste. Clearly, firms working with Canadian departments in areas where bilateral agreements exist should explore opportunities to gain U.S. business through these agreements.

The following Canadian Consulates all have designated environmental contacts. The telephone numbers are as indicated in Appendix A.

Atlanta - John Alexander
Boston - Martin Robichaud
Chicago - Mathew Share
Cleveland - Joseph Mikula
Dallas (Houston) - Nancy Jo Mayeux
Detroit - Anne Cascadden
Los Angeles - Michael Pascal, Mark Ritchie
Minneapolis - Jim Brompton
New York - Don Russell

⁴ If a Canadian engineering firm is seriously pursuing this angle as a possible route to a contract, it is best that the firm first talk with the appropriate person in the Canadian federal government. Currently, these are Rick Rantz at (613) 954-3425, Rick Thomas at (613) 954-3748, and Mike Taylor at (613) 954-3740.

Seattle - Jane Hardessen Shaw
Washington, D.C. - Connie Connor

Canadian engineering firms should, however, have reasonable expectations of what can and cannot be conducted by government officials abroad. While officers in both departments attempt to assist all Canadian companies, they concentrate their efforts on small and medium size companies that are "export ready". There are obviously many such companies in Canada and officers are consequently faced with a multitude of demands. Further advice regarding how to benefit from Canadian government services is presented in Section Thirteen.

10.6 Industry Associations and Lobby Groups

While the numbers and combinations of firms in these sectors are too numerous to conduct any detailed assessment in this study, we have provided below the location and telephone number for some appropriate industry associations. More detailed information on American "national associations" can be found in the Encyclopedia of Associations, a reference which describes 22 thousand associations⁵ in the United States, providing:

- name, address and telephone numbers;
- Executive Director or other contact;
- number of members;
- focus of organization;
- upcoming shows, meetings, conventions; and
- organization's publications and periodicals.

Information or copies of this reference may be obtained from the Encyclopedia of Associations, Gale Research Company in Detroit at (313) 961-2242. The cost is \$US 305 for the three-volume set. The same firm produces a five-volume document which describes 47 thousand "regional, state and local" associations and which costs \$US 405 for the set or \$US 95 per geographic region (five in total). Local business libraries and government offices might have copies of these documents.

Further information on Canadian associations is available from the Directory of Associations in Canada, produced by Micromedia in Toronto. The document costs \$C 190 and can be obtained by calling (416) 362-5211 or toll-free at (800) 387-2689. This publication describes 20 thousand Canadian organizations (including around 70 environmental groups).

⁵ This comprehensive guide also lists 54 "Elvis" organizations, including the Elvis Presley Fan Club of Luxembourg.

There are actually three types of associations that may provide useful information to Canadian environmental engineering firms. The first group encompasses those organizations which represent and accredit firms and individuals in the service industries. The second group includes associations which represent particular manufacturing sectors, while the third group consists of lobby firms and environmental pressure groups. Note also that there are a number of environmental industry lobby groups pressuring for tougher green legislation on behalf of various environmental industries.

Interested Canadian engineering companies should identify and pursue the appropriate sources, either individually or through their own association. We believe that such organizations might be helpful, both in Canada and the United States.

10.6.1 Service Industry Organizations

The following Canadian organizations would be among those who might be of relevance to the Canadian engineering community. Similar organizations exist in the U.S. and potentially represent another source of information and contacts for interested Canadian firms.

- Association of Consulting Engineers of Canada, Ottawa, (613) 236-0569;
- Royal Architectural Institute of Canada, Ottawa, (613) 232-7165;
- Canadian Environmental Industries Association, Toronto, (416) 777-0015; and
- Canadian Construction Association, Ottawa, (613) 236-9455.

10.6.2 Manufacturing, Resource and Other Organizations

There are a few general organizations that may provide U.S. information and/or contacts to Canadian engineering firms. The Canadian Manufacturers Association in Ottawa at (613) 233-8423 represents the manufacturing community in Canada. The Canadian Exporters Association in Ottawa at (613) 238-8888 assist Canadian exporters. The various Chambers of Commerce might have some useful information at the local community level.

Beyond these organizations, there are hundreds of industry specific organizations that Canadian engineers might wish to identify and contact. For instance, the Machinery and Equipment Manufacturers Association of Canada, the Pharmaceutical Manufacturers Association of Canada, the Canadian Mining Association, and the Canadian Pulp and Paper Association would potentially represent good sources of contacts and information relating to the U.S. market. These are all listed in the Directory of Associations in Canada, described above.

World Trade Centers (WTC) are found in 151 locations internationally, including Canadian centres in Calgary, Edmonton, Montreal, Ottawa, Toronto, Vancouver and Winnipeg. The WTC offers

members the use of office space, information services, trade research services, conference facilities, on-line trade networks, and other services. Further information can be obtained from the WTC Association in New York at (212) 432-2626.

10.6.3 Environmental Groups

The following environmental organizations represent a sampling of those who might be of relevance to the Canadian engineering community.

- Sierra Club, San Francisco, (415) 776-2211;
- Canadian Environmental Industries Association, Toronto, (416) 777-0015;
- Environmental Action Foundation, Washington D.C., (202) 745-4870;
- Canada-United States Environmental Council, Washington D.C., (202) 659-9510;
- National Association of Environmental Professionals, Virginia, (703) 660-2364;
- Greenpeace, Washington D.C., (202) 462-1177;
- Air and Waste Management Association, Pittsburgh, (412) 232-3444;
- Water Pollution Control Federation, Alexandria, Virginia, (703) 684-2400;
- Coastal Conservation Association, Houston, Texas, (713) 626-4222;
- Centre for Sustainable Agriculture, Davis, California, (916) 756-7177;
- National Environmental Training Association, Phoenix, Arizona, (602) 956-6099.

These organizations are generally active in lobbying and pressuring organizations into making environmental commitments. They may represent a good source of information pertaining to industries, policies, and trends. Firms should refer to the Encyclopedia of Associations for a comprehensive listing of relevant associations.

Section Eleven: Benefitting from Experience: Case Studies

Several Canadian engineering firms are currently conducting environmental work in the United States. These firms have generally entered the market for reasons similar to those described in the Executive Summary, namely to diversify market risk, to access greater revenues and profits, and to advance the Canadian and American operations toward the technical and managerial "cutting edge" of the industry.

With a few exceptions, Canadian engineers have entered the U.S. environmental market through a local partner. This approach allows access to local credibility and contacts, while also addressing the *Catch 22* situation where Canadians "require a U.S. track record to obtain business yet need U.S. business to develop a track record".

One Canadian firm suggested that "a well satisfied client will bring in other business", implying that through developing a network, and conducting quality work, Canadian firms will succeed in the United States. Another source presented the view that Canadian firms have to "become American" in order to succeed, suggesting that firms that attempt to control their U.S. operation with excessively tight strings from Canada will not succeed. This source felt that Canadians often attempt to sell *Canadian* services to Americans ("as if the U.S. is some third-world market") when these firms should be selling *American* services to Americans.

One firm expressed the view that its success is based upon technical expertise and high quality, responsive service. A combination of these two elements is required for successful market penetration in the opinion of this company, although the fundamental question that must be asked is "do I have a product and/or service of interest to Americans?" It is also necessary to view the penetration strategy as "going North American" wherein the border essentially disappears.

To provide a further indication of strategies followed by other firms, we have selected six anonymous companies and briefly profiled their path in the following case studies.

Case Study A

This case profiles one British Columbia engineering consulting firm that entered the U.S. market approximately ten years ago. The firm broke into the U.S. market through a joint venture arrangement with a twenty-year old Georgia firm. Over time, the firm has become one of the

largest engineering companies in the United States. The U.S. operation is now a wholly owned subsidiary of the Canadian company.

Through entering into the original joint venture arrangement, the Canadian firm effectively acquired a U.S. experience and client base which had been developed over two decades. The move also facilitated penetration of the lucrative and large American market and allowed the Canadian organization to broaden the spread of its expertise in the pulp and paper industry. Its sphere of activity in the United States has broadened to also include a range of clients in the chemical, food and beverage, and public sector areas. As a result, the subsidiary organization is less oriented to the pulp and paper industry than the Canadian company. The subsidiary company currently has offices in four states and, through the benefit of reciprocal arrangements, many of the firm's engineers are registered in 5-6 states.

The Canadian parent and American subsidiary work very closely on many projects. A number of specialists have been transferred back and forth across the border to accommodate work permit problems, with some specialists having settled in the U.S. and acquired citizenship. The organization used to have some difficulty in having Canadian engineers' credentials accepted and they needed an L1 permit to work on projects in the United States. These matters pose fewer problems today.

Liability is a significant consideration for the U.S. operation because the profit margin on their services contracts is small and the risks are relatively large. The organization has countered this by leaving most of the long-term liability in the hands of their clients. Having a well-established reputation with their client base has allowed the firm to follow this strategy without facing any major restriction in business.

Case Study B

The key success factor for this Western Canada firm is the narrow niche market that it fills and the high expertise that it has developed in this area. Company B's initial contracts in the U.S. engineering market resulted from its reputation in the field and from being approached by certain institutions. With its subsequent success, mainly resulting from word-of-mouth marketing, B decided to open an office in neighbouring Seattle. The office currently employs a number of Americans who assist in the process of licensing and accreditation. Most of the design work continues to be conducted in its Canadian office. The Free Trade Agreement has assisted Company B through reducing border delays formerly associated with transferring design drawings to the United States.

The company suggests that 2-3 years are necessary to "become established" in the U.S. market and that smaller organizations could make a reasonable penetration effort with a well-spent sum of \$100,000.

Case Study C

This small firm has a high level of technical knowledge and respect in certain coastal and marine engineering areas. More specifically, the firm has compiled considerable experience in waterfront, shoreline and breakwater areas.

In entering the U.S. market, Company C appears to have followed a "textbook model" of market penetration. Building upon a previous contact in a bordering state, the firm entered an informal alliance for its first project. The Canadian firm brought technical insight and modelling capabilities which it had developed through its previous Canadian public (NRC) and private projects. The American firm brought a knowledge of the local conditions and players to the partnership.

The Canadian firm has continued to enhance its reputation through such channels as writing articles in the appropriate journals, speaking at seminars, publishing papers, appearing as expert witnesses, and developing and mailing a marketing brochure. The founding partner of the company is also a member of the relevant committee board of the American Society of Civil Engineers.

The original partnership continued to conduct a series of waterfront development projects in the U.S., although after 2-3 years each partner began to acquire expertise in the other partner's traditional areas. Eventually a split made the most sense, at which time the Canadian company opened a U.S. office and hired an engineer away from its original partner to head up the office. The firm has continued to enjoy success in the U.S. market, receiving a Standing Offer arrangement with the Corps of Engineers for coastal engineering work, and expanding its office to four professionals. Maintaining such an office in the northern U.S. costs an estimated total of \$100,000 per person annually.

Case Study D

Company D, a large Canadian engineering firm with service lines in a number of different sectors, has developed a client base in the United States through a combination of gradual, word of mouth publicity and an aggressive acquisition program. The firm has opened a number of branch offices during their 25 years in the U.S. market.

A prime challenge faced by D in penetrating the market has been the building of credibility with U.S. clients. In D's view, such credibility takes 2-3 years to establish and the market should thus be viewed as requiring a long-term commitment.

Regarding the question of liability, the company emphasized that this is relatively more important in the United States, as more claims are made and laws appear to be more punitive. In addressing such obstacles, D simply follows a strategy of insuring themselves to the fullest extent possible.

Although D would provide no specific figures on market penetration costs, they do suggest that their U.S. operations are more profitable than their Canadian operations at this point in time. Substantial U.S. growth is anticipated over the next five years.

Case Study E

This successful entrant has offices in over a dozen U.S. cities. The initial penetration of the market followed two simultaneous paths - namely opening an office in a border state and acquiring an environmental company. The former route did not succeed in the long-term as it "did not become sufficiently American" and the firm subsequently closed the office.

The latter route did succeed and E proceeded to acquire a total of four firms during the early 1980s. These acquisitions generally arose out of previous contacts and/or working relationships. The firm has used the professional associations, contacts and networking route for its advancement, the foundation of which is based upon its technical expertise and its quality, responsive service. In the view of E's management, to succeed in the U.S. market, it is necessary to run the companies autonomously "with U.S. roots". This is particularly true in the southern states where residents are arguably more parochial than in the northern states. Company E's four subsidiaries have grown internally since the acquisitions and indeed have progressed into other states as well.

The Canadian benefit from U.S. market penetration is obtained through collecting management fees, through moving engineers back and forth, and through accessing U.S. ideas and technology. In E's words "we are definitely benefiting in Canada from our American specialists and experiences". The transferring of ideas and the exchange of expertise is fostered through the formation of a joint management committee which encompasses the President of each company and which meets regularly.

Case Study F

This Canadian engineering firm has expanded into the U.S. market through acquiring two U.S. companies. Both acquisitions have taken place during the past five years. In each case, the U.S. offices themselves are now expanding more aggressively into environmental markets. The core business of the two firms was not directly in environmental consulting although there is a sufficient fit with environmental matters to make a gradual expansion feasible. The firm views their U.S. penetration as part of a long-term strategic plan to expand further - probably with an additional 1-2 offices. In this regard, the firm feels that "it's easier to expand in the U.S. than in other Canadian provinces".

In both of its acquisitions, F searched appropriate firms and subsequently engaged an outside firm to evaluate the candidate's qualifications and status, including its stability, size, track record, nature of business, and so on. The "times earnings" approach was the method of evaluation and negotiation followed by F in making the purchases. Typically, the acquisition price was approximately 3-4 times the annual earnings of the firms. In some instances, F is aware of firms in higher growth environmental service areas where the asking price ranges as high as 8-10 times earnings.

In conclusion, F warns firms against expecting quick profitability. "You must put in a couple of years and some good dollars before seeing profits".

Section Twelve: U.S. Viewpoints: Private and Public Sources

12.1 Advice From U.S. Manufacturers

A substantial aspect of this study involved the probing of American manufacturers regarding a number of subjects, including the process they follow in buying engineering services, the qualities they seek in selecting a firm, their preferences regarding local versus foreign (or out-of-state) firms and their environmental spending intentions during the coming years.

In general, there has been a wide variance in responses from the firms in the survey. This leads us to a first and fairly basic (yet nonetheless important) observation that there does not seem to be any distinguishing characteristic of U.S. firms that purchase environmental engineering services.

Earlier in the report, we identified the industrial sectors which are most likely to be buyers of these services. Beyond this, Canadian suppliers will have to thoroughly canvass individual U.S. companies in particular sub-sectors of interest in order to qualify the demand for their services. Obviously, this effort may be lessened in the case where a Canadian firm seeks to create a joint venture with a U.S. partner wherein the marketing activities may be shared.

In our discussions, we have found that many U.S. manufacturing companies are explicitly unenthusiastic regarding the use of Canadian service firms - their concern rests with sourcing from an unknown non-local firm, rather than with any particular aversion to Canada or any other region. These companies typically source their engineering expertise in-house or from small local firms. Thus, in this (roughly) one-half proportion of calls, it is unlikely that Canadian firms will uncover any opportunities without the use of local alliances.

Virtually all interviewed firms placed a selection emphasis upon quality firms, experienced personnel and local knowledge. Thus, even in these specific instances of receptiveness to Canadian suppliers, it may be advisable for Canadian firms to acquire some form of local credibility, whether through acquisition or partnership.

The following paragraphs provide added detail regarding the opinions of American manufacturing firms.

12.1.1 Purchasing Process

Do you acquire environmental engineering services or do you have such capabilities in-house? What process do you follow in acquiring environmental engineering services? How should prospective contractors approach you?

- Those firms with in-house engineers also acquire outside services when the need exists, the workload is too great, the in-house expertise is unavailable and/or when a particular problem needs to be resolved.
- Most large corporations use a competitive process and pre-qualify vendors who then go on a bidders list. The majority of firms are open and willing to add new firms to their list.
- Firms purchasing outside services will use small firms for small contracts and look for large national engineering firms to handle the large contracts where there is more exposure to liability.
- Small manufacturers tend to either stick to a small group of trusted firms or they rely on their insurance company, or raw materials vendors to provide assistance.
- There does not appear to be any one preferred way in which environmental affairs managers of U.S. firms would like to be approached by Canadian environmental engineering consulting firms. Approaches vary from one firm to the next depending on a number of factors, including the type of project work, the purchasing policies of the firm and the personality of the manager hiring the consultants. Many respondents state that they don't have time for telephone calls, but admit that they are often approached in this way. As well, many state that they prefer to be sent promotional literature outlining the firm's capabilities, but only that which is relevant to their particular problems.
- Representatives of a number of larger corporations indicated that they preferred to gather information about potential consultants themselves through the conferences and seminars they attend. They appreciate hearing from consultants who are well recognized in their field.
- A few companies remarked that they look to their head office or parent company for recommendations regarding which environmental engineering consulting firms to hire.
- When questioned regarding the types of services that would be sourced externally, respondents listed (in no particular order): groundwater monitoring; site assessment; oil removal from sludge; soil and groundwater remediation; site contamination assessments; environmental audits; design and modelling of specific equipment, machinery and applications; emission reduction and clean-up processes to adapt to air and water regulations; plant dust reduction; handling of chemical spills; waste management through recycling; employee training; and the preparation of documents for the government.
- When questioned regarding relevant trade shows and information sources, respondents suggested a number of shows and associations. Most of these are of a regional nature, such as state environmental expositions, the American Iron and Steel Engineers Conference, and the Water Environment Federation in Washington. In general, Canadian firms will have to determine the most appropriate regional and sectoral shows through following the steps outlined earlier.

12.1.2 Selection Criteria

What qualities do you look for in a contractor for environmental engineering consulting services? Do you have preferences with regard to origins of the contractor?

- The top selection criteria always revolve around the issue of reliability and competence. Managers comment that there are a lot of new firms in this business and they need to separate the true specialists from those that are only marginally competent.
- Some firms have standard hiring practices which are set by their purchasing department and incorporate a variety of requirements. These may include proof of insurance coverage, financial capacity to complete the project, listing in business directories such as Dun & Bradstreet Directories, etc.
- None of the firms contacted placed competitive *price* before *quality of work* or *company reputation* in their selection criteria. However, competitive costs were usually ranked among the top three criteria.
- Another notable manufacturers' selection criteria that arose in our discussions was the opinion of local, state and federal agencies regarding the consultant's competence. Manufacturers often consult regulatory officials for their opinions. One firm stated that they meet state regulatory officials once per month. While state and federal officials cannot formally recommend one firm over another, they do present their views and knowledge regarding the capabilities of particular firms. "Most regulatory agencies will suggest companies who have done similar work or give a list of firms that do certain types of work, but they tend to shy away from recommending someone".
- Lawyers and insurance firms also play a role in some instances in recommending a particular engineering firm to their client. All interviewed manufacturers have legal counsel to help interpret legislative requirements. (Industry associations were also mentioned in some instances as the relied-upon source to "turn regulations into English"). All interviewed manufacturers have insurance firms to guard against liability concerns.
- Another key selection criteria was *mobilization rate* or response time. Managers who expressed a preference for using local consultants explained that this was because "out of state" firms could not respond as quickly and would have to be a great deal more competitive in order to justify travel expenses. There may also be a concern with after-sale service. In this regard, respondents suggested that Canadian firms might wish to open a local office or buy a small state firm in order to demonstrate the ability to be responsive.

12.1.3 Perceptions of Canadian Capabilities

What are your views regarding Canadian engineering capabilities?

- Very few of the interviewees had any previous experience with Canadian consultants. Those who did commented that their perception of Canadian environmental engineers was that they were as sound and technically competent as their American counterparts but that they lacked a fundamental knowledge of the regulatory environment south of the border (and specifically how it affects the industry they are working in).
- Receptiveness to Canadian firms, as stated earlier, varies from firm to firm. Most expressed the views that "a competent, competitive Canadian firm who has quality work experience is as appealing to us as any American firm".

12.1.4 Spending Trends

How will your operating expenditures for environmental projects change over the next five years?

- The majority of interviewees anticipate an increase in operating expenditures over the next five years in the range of 10-20 percent annually. The majority foresee increased expenditure but relatively few would disclose actual dollar amounts. In some cases, firms appear to include their environmental spending in capital expenditures and they are thus difficult to separate.
- The manufacturers still tend to be reactive with regard to environmental spending, in that they will comply with, but not exceed or anticipate the relevant regulations. Firms, perhaps moreso in the United States, face quarterly pressures and often view environmental spending as a drain upon quarterly earnings. Firms in the consumer products area tend to be more aware of the need for environmental sensitivity and how this can affect sales and earnings.
- Many of the interviewed firms do not have a separate environmental budget. In these instances, it falls under operating expenses, or health and safety issues.

12.2 Other American Sources

In conducting this assignment, we also spoke with a selection of American utilities, engineering consulting firms, universities, and governments regarding their priorities, strategies and activities in the environmental field. Most of these insights are reflected in other parts of this study - this section summarizes some of the more pertinent views.

12.2.1 Engineering Consulting Firms

A number of the firms that we spoke with displayed a willingness to speak with and possibly meet with appropriate Canadian firms. Our experience suggests that American business managers are quite outgoing, enjoy talking, and are quite approachable.

In general, there is a substantial amount of interaction among U.S. engineering firms. Large firms often align with smaller companies to fill certain technical and experience gaps. The geographic location of this expertise is less important than its nature, experience and reputation - as such Canadian firms would not be ruled out. Many of the firms interviewed already have some form of informal Canadian connection, as a result of conducting work in Canada, or having Canadians on staff, etc.

In discussions with U.S. companies, the approach taken by Canadian firms should be along the lines of "we have conducted these types of projects, solved these types of problems, are interested in examining some U.S. opportunities, are interested in working with an appropriate firm to

improve our joint prospects in the U.S. and Canadian markets, believe we could also work together in penetrating the Mexican market, etc". Canadian consulting engineers should be aware that American firms may expect Canadian market assistance as a quid pro quo to any mutual U.S. market success. As well, any expertise held by the Canadian firm in selling to the Canadian government may well be of interest to a prospective U.S. partner. Canadian engineering firms should also be fairly aggressive in their dealings, ensuring that U.S. market benefits are maximized and that they have appropriate portions of the potential benefits without assuming disproportionate shares of the potential liability.

12.2.2 Utilities

Like most of the opportunities and sources identified in this study, the utilities must be approached on a case-by-case basis. Results will vary depending on individual circumstances. One utility that we contacted, for example, is located in the same U.S. building as a Canadian industry department office. This source was coincidentally very familiar with the Canadian government's marketing officer and would be receptive to approaches from Canadian firms. This anecdote indicates that Canadian firms must spread their network broadly and pursue the various people-related opportunities that will inevitably arise.

There are two particularly important characteristics of the U.S. utility community. First, this sector has substantial private ownership and is generally less bound to local pressures and purchasing commitments. Second, this segment is being directly affected by recent amendments to the Clean Air Act. The fossil fuel burning side of this sector must make substantial investments in stack technology and in process efficiency in order to comply with sulphuric emission requirements. Canadian firms with utility experience and with knowledge of local regulations (again probably acquired through a local alliance) might wish to pursue utility-related opportunities further.

12.2.3 Universities

Universities play an active role in the U.S. environmental scene and many institutions interact regularly with industry and government. One interviewee, for instance, relayed the unconfirmed estimate that "one Southern U.S. university receives \$US 90 million annually in Defense dollars for environmental and related work". Research, development and training are obvious prime areas of university expertise. It should be noted as well that universities themselves represent environmental markets. For instance, Duke University is resident to a Superfund-related medical waste site.

In discussions with Canadian industry, some firms have mentioned the fact that the scientific/academic route has played an integral role in helping them penetrate the U.S. environmental market. Firms with a substantial scientific/research element may wish to investigate opportunities with appropriate U.S. academic contacts. Generally, these institutions are open to working together with Canadian or American industries (provided industry money is invested) on environmental matters.

12.2.4 Municipalities

Given the use of local engineering firms for such work, it is unlikely that Canadian firms will find this to be a profitable route, unless they bring unique or innovative approaches.

In discussing optimal entry strategies, one municipal official expressed the view that "large, entrenched companies are very greedy" and that Canadian firms should approach small/medium sized firms to match Canadian strengths with weaknesses of the potential partner.

12.2.5 State Governments

As indicated in other sections of this report, states are an active purchaser of environmental goods and services. While the responsible parties are required to hire the individuals to do the cleanup, the state government in question may hire an "oversight contractor" to follow the progress of the cleanup. States generally will use out-of-state companies but, as expressed by an official in the Utah state government, "they encourage a local presence or sub-contractor".

State governments do not provide formal recommendations to private companies regarding the relative quality of potential environmental service firms. Most states appear to maintain a list of suppliers "that anyone can join and that is of limited usefulness". It should be noted, however, that we also spoke with private sector representatives and manufacturers who suggested that the opinions of state officials regarding possible suppliers are offered, at least indirectly, and that they are quite important. Thus, Canadian firms should bring their capabilities to the attention of the appropriate state officials.

In our discussions with them, state officials also reiterated a point that we have attempted to make throughout this report. "Most firms learn about potential environmental service firms through word-of-mouth and industry associations". This suggests that Canadian firms must do their homework and develop as broad a contact base as possible.

Section Thirteen: Advice from Canadian Sources

13.1 Advice from Trade Commissioners

When Attending a Trade Show

Many firms are taking advantage of trade shows, an activity which ranks among the most important of all marketing vehicles, particularly in the United States. A trade show provides sellers with the opportunity to exhibit products or services, to meet with top buyers in the industry, and to investigate the competition. Trade shows are fast-paced - typically a trade show lasts 2-3 days, during which the sales representative attempts to meet as many buyers as possible, while often in the midst of direct competition.

In interviews regarding trade shows, many of our sources have suggested that firms should:

- 1) return each year to maintain visibility;
- 2) not expect to "make a sale" in the first year;
- 3) remain on their feet and in active conversation throughout the duration of the show;
- 4) observe the practices, exhibits, strategies of competing firms; and
- 5) enhance the aggressiveness and confidence of their approach, in line with general American practices.

Appendix B provides a listing of important trade shows related to the environmental sector. Interested firms may wish to contact appropriate industry associations to find out more topical information on other relevant upcoming trade shows.

Generally, these trade shows are offered on an annual basis, usually during the autumn season. External Affairs and International Trade Canada (contacts are presented in Appendix A) are very active in the trade show area, sponsoring Canadian pavilions at dozens of trade shows each year. Department officials could also be contacted by firms in search of more topical information on upcoming shows.

When Using the Trade Commissioner Service

Canadian engineering firms should have reasonable expectations of what can and cannot be conducted by government officials abroad. While these officials attempt to assist all Canadian companies, they concentrate their efforts on small and medium size companies that are "export ready". There are obviously many such companies in Canada, in numerous industry sectors, and

officers are consequently faced with a multitude of demands. In this regard, EAITC officials that we have spoken with suggest the following techniques as ways of maximizing the benefit of a Trade Commissioner:

- Do as much advance homework as possible such that requests can be precise and detailed.
- Apply a personal touch (rather than mass mailing) to your contact with the Commissioner such that a level of seriousness is indicated.
- Follow an initial faxed contact with a telephone call - again, such that a level of seriousness is indicated.
- In the initial contact letter or fax, provide a succinct description of your company, type of service offered, capabilities and areas of competitive edge, current customers and projects, types of contacts sought, and your specific request. The tone should not be overly technical.
- In the follow-up telephone discussion with the Commissioner, review the nature and background to your request and discuss the timing of a potential visit.
- Provide at least two weeks advance notice for a Commissioner to attempt to arrange the requested meetings and/or open the appropriate doors.
- If attending a trade show, remain on your feet and constantly meet and talk with potential clients. Obtain and review the show's agenda in advance and establish a strategy for the show. American trade shows tend to reward such practices.
- If attending personal meetings, the Commissioner may be free to also attend if you so desire. In any event, follow-up with the Commissioner in the week following the interviews to bring him/her up to date and to indicate your next steps.
- Recognize that some Commissioners are well-established in a region and have extensive contacts, while others may be new to the region and have only a relatively new contact base.

13.2 Advice from Ernst & Young

While there are many such studies which have detailed the size and scope of the U.S. environmental market, we believe that they are of only limited value to Canadian firms for three reasons.

- First, statistics and market projections change almost on a daily basis and become "dated" quite quickly. They are often based on estimates, forecasts and numerous assumptions and may change substantially based on changes to the assumptions.

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- Second, such studies presume that environmental enforcement by state governments will be predictable and comprehensive. This may not be a valid assumption, as enforcement authorities are often over-burdened with responsibilities, yet under-funded and under-staffed. State enforcement is also described as loosening somewhat during periods of economic slowdown. At the federal level of enforcement, some sources have stated that "the EPA has never once conformed to an original target", implying that ambitious targets and target slipping is part and parcel of the U.S. environmental scene.
 - Third, such studies are quite costly and may encompass a number of activities that Canadian firms could best undertake on their own. Conducting these steps themselves will allow Canadian firms to acquire more of an on-the-ground sense of their U.S. market potential.

Thus, rather than becoming overly dependant on existing market statistics, Canadian firms can assume that their niche markets are substantially larger in the United States and will likely be growing for several years to come. A firm's marketing efforts should be directed toward making new contacts, developing existing contacts, conducting on-the-ground research, identifying partners and competitors, meeting potential clients, and honing current expertise.

Recommendations

There is no one market penetration strategy that will suit all firms. The particular strategy that a firm ultimately chooses to follow should be based on a number of factors including the firm's experience and knowledge of the U.S. market, the resources (both financial and personnel) at the firm's disposal for market expansion into the U.S., and the objectives that the firm wishes to achieve in selling its services to the United States market.

In previous chapters of the report, we have suggested a number of documents that could assist Canadian firms in quantifying the market size, identifying specific companies of interest, detailing trends, and researching other matters. Conducting such "homework" will allow Canadian firms to either develop projects themselves or bring added "clout" to any local partnership they may choose to enter.

The following documents might be particularly useful for those firms, governments and associations that are seriously interested in the U.S. environmental engineering market. The names and numbers where such documents can be obtained are presented earlier in the report.

- Manufacturing USA - \$US 169
- ACEC-US Annual Directory - \$US 140
- Environmental Engineer Selection Guide - free

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- The Cost of a Clean Environment - \$US 50
 - Resource Guide to State Environmental Management - \$US 40
 - Encyclopedia of Associations - \$US 305

Once the appropriate market research has been conducted, there are a number of activities that all firms should consider in formulating a strategy for entering the U.S. market. Some of these are practical, common business sense suggestions that we have found are sometimes overlooked when firms approach a foreign market. Other suggestions are related to the particular nature of service industries and specifically the environmental engineering consulting industry.

The following recommendations should, therefore, be considered when Canadian environmental engineering firms are preparing their entry strategies. Most are addressed to Canadian engineering firms, although some recommendations to governments and other organizations are also included.

1) Local contacts, reputation, and knowledge are very important in capturing environmental business in any U.S. region. Teaming with local partners serves a number of purposes, including reducing risk, increasing the chances of winning, lowering marketing and bid costs, and increasing the number of opportunities that can be pursued. In many instances, the "teaming" may be on a project-by-project basis, where the Canadian firm provides some niche expertise.

Buying a company or "buying" some local people may be the preferred and most profitable route to market entry. (Expected acquisition costs would likely be in the range of 3-4 times annual earnings, although higher growth firms may command a premium up to double this amount.)

2) In establishing their local presence, Canadian firms should extend autonomy to the U.S. operation, in effect facilitating the growing of American roots. Our discussions suggest that the Canadian benefit is derived from management fees, profit sharing, employee sharing, and technical advances, rather than through exerting tight managerial control from a Canadian base.

3) Successful penetration of the American market begins at home. Canadian firms should pursue opportunities within their own fields of expertise and not be unwittingly led into unfamiliar areas. In essence, Canadian firms should "ride" their own expertise and contacts into the identified U.S. market niches. Straying outside of core competences may place firms on unfamiliar and risky terrain. In this respect, one source stated that "a confused client doesn't buy", the suggestion being that firms should not confuse their potential clients by venturing into areas with which they are not familiar.

4) It is important that Canadian firms establish a market plan prior to investing resources in their U.S. marketing effort. The plan should articulate the objectives, strategies, financial resources,

scheduling, and managerial and technical complement that will be directed toward the U.S. effort. The importance of this formal requirement should not be minimized by Canadian engineering firms. For instance, studies conducted by the Canadian Exporters' Association have indicated that firms with previously defined market plans enjoy greater long-term success in their export marketing efforts. Firms without such plans tend to discontinue their efforts.

5) Canadian engineers should be aware that U.S. firms will probably expect Canadian market assistance (toward private and/or public markets) as a quid pro quo to any mutual U.S. market success. Canadian engineering firms should also be fairly aggressive in their dealings with U.S. partners, ensuring that U.S. market benefits are maximized and that they have appropriate portions of the potential benefits without assuming disproportionate shares of the potential liability.

6) Canadian firms should maintain close relations with (and follow into the market) those Canadian industries which are increasing their American investments. Through this strategy, Canadian environmental engineering firms may benefit from Canadian direct investment in the United States, just as American engineers and other service firms have so benefitted over the years from the substantial U.S. direct investment in Canada.

7) Firms should visit the region(s) of interest in order to "get a first-hand feel" for the area into which they are considering entry. Visiting local companies, local governments, associations, Canadian consulate officials, and other organizations will provide a wealth of information for potential market entrants.

8) Maintaining tight control on overheads is considered essential in the U.S. service industries. Some sources suggest that competition is tighter in the U.S. market, although potentially higher profits can accrue to qualified firms.

9) A commitment to a region and market niche is required to successfully enter the U.S. environmental market. Some have suggested that "brawn beats brains" in the early stages of market penetration, implying that substantial work is required in identifying and following up on contacts and opportunities. As well, a trend toward increased service/quality emphasis in the U.S. market suggests that "client follow-up" upon completion of a project is important, both to determine levels of client satisfaction and to stay abreast of future work opportunities. Toll-free telephone numbers might also be considered by Canadian firms as another means of providing service and quick access to their client base.

10) Over time, most Canadian engineering firms develop a surprisingly broad range of American contacts. Some of these may be direct contacts, while others may be indirect contacts, through

existing clients and other channels. In our view, each contact represents one step closer to a potential U.S. contract. Governments, associations, municipalities, management consultants, multi-national companies, competitors, construction firms, architects, previous clients, defence contractors, and real estate developers are among those Canadian contacts who may have U.S. contacts or clients who could benefit from Canadian environmental engineering consulting expertise. Each Canadian firm must exploit and expand its own network.

11) There is a growing appreciation in some circles for the linkage that exists between legislative enforcement, environmental investment and increased economic competitiveness. While such a linkage may be true in the long-term, our U.S. industry conversations suggest that environmental dollars are still spent somewhat grudgingly. Short-term earnings and shareholder pressures are widespread in the United States. As such, Canadian engineers should be able to package their approach to U.S. clients in terms of payback period, economic spin-offs, long-term benefits, and other such terms. Canadian engineering firms who can present a strong cost/benefit rationale for their proposal will enjoy long-term success. Sources cited examples such as lowered sewer surcharges, enhanced feedstock recovery, increased process water recycling, reduced heat loss, and so on.

12) Trade missions and shows are an important part of successful export market penetration. In this regard, it is vital that Canadian firms be fully prepared for such activities, with relevant company and product information in hand. One-on-one appointments (at the trade shows) with potential partners are also vital to success, as is constant on-the-feet contact with other interested parties.

13) In this report, we have emphasized the importance of Canadian industry drawing upon its network of contacts and support. We view the Association of Consulting Engineers of Canada, ISTC and EAITC as playing valuable roles in this market penetration effort. Such a role encompasses, among other activities, the promotion and distribution of this report, the acquisition of the key reference documents identified, the organization of and participation in relevant missions and trade shows, and the facilitation of relations with U.S. counterparts. The latter point might include aiding in negotiating mutual accreditation agreements such as that which exists between New Brunswick and Maine.

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Appendix A

Government Assistance

Appendix A: Canadian Government Assistance

External Affairs and International Trade Canada

The federal Department of External Affairs and International Trade Canada has Trade Centres located in every region of Canada, as well as 21 trade offices/consulates in the United States, which offer a comprehensive and integrated program of assistance to Canadian industry.

The consulates in the United States are staffed by Trade Commissioners and Commercial Officers who assist Canadian firms in winning export contracts in their region. These individuals generally have good knowledge of the local environment and are often of valuable assistance in penetrating the market and region in question. They are helpful in a variety of ways, including promoting Canadian companies to local customers, recommending appropriate technical experts to assist in negotiating a deal, selecting appropriate sales agents, assisting in the settlement of payments, and assisting in travel matters. Canadian trade office locations are indicated below. Ask to speak to the Trade Commissioner or Commercial Counsellor.

The Department provides a trade development program which, both, introduces new exporters to the U.S. market, and supports experienced exporters by increasing their exposure to new regional markets using the NEBS and NEXUS programs (described below) as well as trade shows. The program plays a prominent role in the federal Government's strategy of ensuring that the Canadian business community is well positioned and well supported when accessing the U.S. market.

Promotion of trade into the United States is managed by the U.S. Trade, Tourism and Investment Development Bureau. Canadian companies can take advantage of the following trade development initiatives, sponsored by the Bureau. The activities would be of varying degrees of relevance to Canadian engineering firms.

Trade Shows

Trade shows are proven tools for companies to use in the U.S. market to introduce new products, raise awareness of capabilities and services, establish representation, transact business and obtain a very clear, concise picture of the competition.

In 1989, External Affairs and International Trade participated in over 400 major events in some 72 industrial sectors, as well as in smaller, regional trade shows. The Department typically

establishes a Canadian pavilion and shares related expenses with the Canadian companies participating in the pavilion. In cooperation with the local Embassy, receptions are often organized to bring the participants and local buyers together for one-on-one discussions.

Missions

The Department sponsors various missions, such as an Incoming Buyers' Mission, whereby key decision-makers from the U.S. will be brought to a location in Canada to offer presentations and meet with Canadian companies. Similarly, outgoing missions to the U.S. are conducted in which Canadian companies are taken to a geographic location to meet prospective buyers.

Market Studies/Directories/Seminars

External Affairs and International Trade also publishes market studies, such as this one, on a sectoral basis. In addition, the Department sponsors seminars and workshops for industry groups on specific subjects.

New Exporters to Border States (NEBS)

A NEBS mission "walks" a group of approximately 25 small companies through the entire process of exporting. Documentation and customs clearance procedures are explained in Canada and at one of the northern border posts where further information is provided on banking, insurance, agents and distributors, and other aspects of export activity. Studies indicate that fifty percent of NEBS participants eventually make an export sale.

New Exporters to the United States (NEXUS)

NEXUS is a relatively new program for the numerous small to medium sized companies from every region of the country who have traditionally traded just over the Canada/U.S. border, as a logical extension of their operations. Under NEXUS, companies will be encouraged to venture into other U.S. regional markets by participating in outgoing, sectorally-based missions, usually to a post or a selected regional trade fair. In the new markets, participants receive a briefing on local opportunities from post trade officers who will organize an itinerary of meetings with manufacturers' agents, distributors and/or buyers.

Marketing Information and Assistance

The International Trade Development Branch is the Department's focal point for export promotion activities. The branch administers the following programs offered by the Department:

- a) *Program for Export Market Development*: a cost-sharing assistance program that helps Canadian businesses participate in, or undertake various types of export promotion activities. The activities for which PEMD funding is available include: participation in trade fairs; visits outside Canada to identify markets; visits of foreign buyers to Canada; project bidding; and formulating marketing agreements. Further information on this program is available from the International Trade Centre within the local office of Industry, Science and Technology Canada. These numbers are provided below.
- b) *The World Information Network for Exports (WIN Exports)*: a computerized directory of Canadian exporters designed to help trade development offices around the world respond more quickly to opportunities identified in their territory.
- c) *Info Export Toll Free Number*: information and questions relating to any aspect of exporting may be directed to the toll free number (1-800-267-8376) for assistance.

Trade Officers

The Department has a number of sectoral desk officers in Ottawa who are responsible for coordinating international initiatives with the posts abroad. Each officer prepares a calender of events and attaches certain priorities to the international development efforts in his or her area of responsibility. Canadian firms should contact the appropriate officers to find out more regarding the priorities and upcoming activities of relevance.

Canadian Consulates and Trade Offices in the United States

| <i>Location</i> | <i>Telephone</i> | <i>Fax</i> | <i>Territory</i> |
|-----------------|--------------------|--------------------|----------------------------|
| Washington D.C | (202) 682-1740 | (202) 682-7726 | DC, DE, MD, VA, East.PA |
| Atlanta | (404) 577-6810 | (404) 524-5046 | AL, FL, GA, MS, NC, SC, TN |
| Boston | (617) 262-3760 | (617) 262-3415 | ME, MA, NH, RI, VT |
| Buffalo | (716) 852-1247 | (716) 852-4340 | west, central NY |
| Chicago | (312) 616-1860 | (312) 922-0637 | IL, MO, WI, IA |
| Cincinnati | (513) 762-7655 | (513) 762-7802 | satellite office |
| Cleveland | (216) 771-0150 | (216) 771-1688 | KY, OH, WV, west PA |
| Dallas | (214) 922-9806 | (214) 922-9815 | TX, AR, KS, LA, NM, OK |
| Dayton | (513) 255-4382 | (513) 255-1821 | satellite office |
| Detroit | (313) 567-2340 | (313) 567-2164 | Toledo, MI, IN |
| Los Angeles | (213) 687-7432 | (213) 620-8827 | AZ, south CA, NV |
| Miami | (305) 372-2352 | (305) 374-6774 | satellite office |
| Minneapolis | (612) 333-4641 | (612) 332-4061 | IA, NE, MN, MT, ND, SD |
| New York | (212) 768-2400 | (212) 768-2440 | CT, NJ, south NY, Bermuda |
| Philadelphia | (215) 697-1264 | (215) 697-5299 | satellite office |
| Pittsburgh | (412) 392-2308 | (412) 392-2317 | satellite office |
| Princeton | (609) 452-9027 | (609) 452-8464 | satellite office |
| San Diego | (619) 546-4467 | (619) 457-2844 | satellite office |
| San José | (408) 289-1157 | (408) 289-1168 | satellite office |
| San Juan | 8-1-(809) 758-3500 | 8-1-(809) 250-0369 | satellite office |
| Seattle | (206) 443-1777 | (206) 443-1782 | AK, ID, OR, WA |

Note: Canadian firms should ask for the Trade Commissioner or Commercial Officer in the appropriate office.

Addresses of Canadian Consulates in the United States

Canadian Embassy, 501 Pennsylvania Avenue, Washington, D.C., 20001, U.S.A.

Canadian Consulate General, Atlanta, One CNN Center, South Tower, Suite 400,
Atlanta, Georgia, 30303-2705, U.S.A.

Canadian Consulate General, Boston, Three Copley Place, Suite 400
Boston, Massachusetts, 02116, U.S.A.

Canadian Consulate General, Buffalo, One Marine Midland Center, Suite 3150
Buffalo, New York, 14203-2884, U.S.A.

Canadian Consulate General, Chicago, 310 South Michigan Avenue, 12th Floor
Chicago, Illinois, 60604-4295, U.S.A.

Canadian Consulate General, Cleveland, Illuminating Building, 55 Public Square, Suite 1008
Cleveland, Ohio, 44113-1983, U.S.A.

Canadian Consulate General, Dallas, St. Paul Place, 750 N. St. Paul Street, Suite 1700
Dallas, Texas, 75201-3281, U.S.A.

Canadian Consulate General, Detroit, 600 Renaissance Center, Suite 1100
Detroit, Michigan, 48243-1704, U.S.A.

Canadian Consulate General, Los Angeles, California Plaza, 300 South Grand Avenue, 10th Floor
Los Angeles, California, 90071, U.S.A.

Canadian Consulate General, Minneapolis, 701 Fourth Avenue South, Suite 900
Minneapolis, Minnesota, 55415-1899, U.S.A.

Canadian Consulate General, New York, 1251 Avenue of the Americas
New York City, New York, 10020-1175, U.S.A.

Canadian Consulate General, Seattle, 412 Plaza 600, Sixth and Stewart Streets
Seattle, Washington, 98101-1286, U.S.A.

Industry, Science and Technology Canada

The federal department of Industry, Science and Technology Canada has regional offices in all Canadian provinces. These offices house EAITC's International Trade Centres, as indicated below. The appropriate Trade Commissioner in these Centres may be able to assist Canadian engineering firms with their export-related questions.

| <i>Location</i> | <i>Telephone</i> | <i>Fax</i> |
|-----------------------|------------------|----------------|
| St. John's, Nfld. | (709) 772-5511 | (709) 772-2373 |
| Charlottetown, P.E.I. | (902) 566-7400 | (902) 566-7450 |
| Halifax, N.S. | (902) 426-7540 | (902) 426-2624 |
| Moncton, N.B. | (506) 857-6452 | (506) 857-6429 |
| Montreal, Que. | (514) 283-8185 | (514) 283-3302 |
| Toronto, Ont. | (416) 973-5053 | (416) 973-8161 |
| Winnipeg, Man. | (204) 983-8036 | (204) 983-2187 |
| Saskatoon, Sask. | (306) 975-5925 | (306) 975-5334 |
| Calgary, Alta | (403) 292-6600 | (403) 292-4578 |
| Edmonton, Alta. | (403) 495-2944 | (403) 495-4507 |
| Vancouver, B.C. | (604) 666-1444 | (604) 666-8330 |

As well, the Department has sector officers responsible for developing and maintaining a knowledge base regarding Canada's various manufacturing and service sectors. General information in this regard can be obtained from (613) 995-5771.

Provincial Industry Departments

Provincial industry departments also offer expertise and programs to assist companies in penetrating export markets. Firms may wish to contact the Industry Department offices listed below in order to obtain further information in this regard.

| <i>Location</i> | <i>Telephone</i> | <i>Fax</i> |
|-----------------------|------------------|----------------|
| St. John's, Nfld. | (709) 576-2781 | (709) 576-3627 |
| Charlottetown, P.E.I. | (902) 566-4222 | (902) 566-4030 |
| Halifax, N.S. | (902) 424-4242 | (902) 424-5739 |
| Moncton, N.B. | (506) 453-2875 | (506) 454-8410 |
| Montreal, Que. | (514) 873-5575 | (514) 873-4230 |
| Toronto, Ont. | (416) 963-2501 | (416) 963-1526 |
| Winnipeg, Man. | (204) 945-3172 | (204) 945-2775 |
| Regina, Sask. | (306) 787-2222 | (306) 787-2198 |
| Edmonton, Alta. | (413) 427-4809 | (403) 427-0610 |
| Vancouver, B.C. | (604) 660-3935 | (604) 660-2457 |
| Whitehorse, Yukon | (403) 667-5466 | (403) 667-3518 |
| Yellowknife, N.W.T. | (403) 873-7381 | (403) 873-0101 |

Appendix B

**Canadian Governments U.S.
Environmental Priority
Activities for 1993/94**

Appendix B: Canadian Government's U.S. Environmental Activities for 1993/94

The federal Department of External Affairs and International Trade Canada participates and establishes "Canadian stands" at a number of trade shows each year. In addition, the department supports a range of missions, seminars, workshops and investment initiatives relating to the U.S. environmental market. The priority activities are presented below.

| | | |
|---|----------|---------------------------------------|
| Environment technology; national stand: New England Environmental Expo | Apr 1993 | Boston |
| Restoration opportunities; mission to | May 1993 | Idaho Falls |
| Analytical laboratory certification; workshop | May 1993 | Washington (D.C.) |
| Environmental technology; investment forum | May 1993 | Atlanta |
| Municipal water management and handling products; national stand: American Water Works Association | Jun 1993 | San Antonio |
| Equipment for handling, treatment, storage and transportation of hazardous material; national stand: HazMat International | Jun 1993 | Atlantic City |
| Air and waste management; national stand: Air and Waste Management Association | Jun 1993 | Denver |
| Waste management and treatment; national stand: Waste Expo '93 | Jun 1993 | Chicago |
| Partnering; seminar: North Coast Growth Capital Conference | Jun 1993 | Cleveland Pittsburgh Cincinnati |
| Solid waste management and treatment; national stand: Solid Waste Association of North America | Aug 1993 | San Jose |
| Canada-United States environmental; forum | Aug 1993 | Raleigh |
| Biomass industry; national stand: First Biomass Energy Conference of the Americas | Aug 1993 | Burlington |

| | | | |
|---|-----|------|-------------------------------------|
| Wastewater management and treatment; national stand: International Public Works Congress and Exposition | Sep | 1993 | Phoenix |
| Environment Instrumentation; national stand: North American Instrumentation Society Exposition | Sep | 1993 | Chicago |
| Water and wastewater equipment and services; mission to | Sep | 1993 | Houston |
| Environmental partnering; workshop | Sep | 1993 | Seattle |
| Incoming Buyers Mission from United States to | Sep | 1993 | Toronto |
| Wastewater treatment; national stand: Water Environment Federation | Oct | 1993 | Anaheim |
| Equipment for handling, treatment, storage and transportation of hazardous material; national stand: Great Lakes North-Am HazMat Show | Oct | 1993 | Detroit |
| Environment; investment mission to | Oct | 1993 | Washington (D.C.) |
| Oil spill recovery and prevention products and services; national stand: Oil Spill Recovery and Prevention Exposition | Nov | 1993 | San Francisco |
| Environmental strategic alliance; workshop | Nov | 1993 | Boston |
| Environment; information booth: Great Lakes Trade Show | Nov | 1993 | Buffalo |
| Hazardous waste; roundtable | Nov | 1993 | Chicago, St. Louis, Milwaukee |
| Equipment for handling, treatment, storage and transportation of hazardous material; national stand and conference: Superfund '93 | Dec | 1993 | Washington (D.C.) |
| Hazardous waste; workshop | Jan | 1994 | Pittsburgh or Cincinnati |

| | | | |
|--|-----|------|---------------|
| Industrial wastewater management (solid and waste); roundtable | Jan | 1994 | New York City |
| Environmental partnering; workshop | Feb | 1994 | Seattle |
| Environmental technology; forum | Feb | 1994 | Atlanta |
| Hanford tour and partnering opportunities; workshop | Mar | 1994 | Seattle |
| Air quality; seminar | Mar | 1994 | New Jersey |

Source: External Affairs and International Trade Canada

Appendix C

Useful Documents

Appendix C: Useful Documents

There are literally hundreds of journals, references, studies and other types of documents which provide useful information relating to the U.S. environmental engineering market. For particular regions and narrow sector niches, firms will best locate the most appropriate journals through speaking with the state governments, industry associations, academics, and other channels mentioned throughout the main text of this study.

In the text of the report, we have suggested a number of documents that could assist Canadian firms. The following documents might be particularly useful for those firms (and governments and associations) that are seriously interested in the U.S. market. Through selecting the appropriate documents, an expenditure of around \$US 4-500 might then provide these organizations with substantial savings during the selling process.

- Manufacturing USA - \$US 169
- Service Industries USA - \$US 169 (less relevant)
- Pulp and Paper Factbook - \$US 275 (or other similar resource factbooks)
- American Consulting Engineers Council, Annual Directory - \$US 140
- Environmental Engineer Selection Guide - free
- The Cost of a Clean Environment - \$US 50
- Resource Guide to State Environmental Management - \$US 40
- Encyclopedia of Associations - \$US 305

Beyond these documents, many associations produce their own monthly or periodical publication. For example, the Water Pollution Control Federation produces the monthly *Water, Environment and Technology*, while the National Association of Environmental Professionals produces the monthly document *Environmental Professional*. Canadian firms should gather this documentation through the appropriate organizations.

Various regions also produce documents of potential interest to Canadian engineering firms. For instance, *Waste Business West* is a bi-monthly journal aimed at providing waste generating companies with information on new technologies and regulations in the Western United States. Most such documents will be identified by Canadian firms through their discussions with state governments, local associations and the like.

This appendix lists a sampling of other documents which can be collected and reviewed by interested Canadian firms.

American Consulting Engineer

This document is published quarterly by the American Consulting Engineers Council (ACEC) and is available by calling Washington, D.C. at (202) 347-7474. Annual cost for non-members of the association (Canadian firms cannot be members of the ACEC) are \$US 40. This journal is the best available publication for discussing the issues, players, and strategies that are at the forefront of the U.S. engineering community.

ENR Magazine

Formerly known as Engineering News Record, ENR is a weekly publication of McGraw-Hill. It reviews activities, trends, forecasts, companies, and issues which are topical in the U.S. construction and engineering industries. Each weekly issue contains information on specific projects by state and specific proposals by city. ENR is described by some industry contacts as the best source of construction information in the country. Further information and subscriptions may be obtained from ENR at (609) 426-5129. Subscriptions cost around \$US 60 annually.

United States Industrial Outlook

The Outlook is produced annually by the International Trade Administration of the U.S. Department of Commerce. The telephone number for the industry publications staff is (202) 377-4356, and the document costs around \$US 30. It is a large book which provides a general perspective on the recent status, long-term outlook, trends, and characteristics for some seventy industries. Particularly useful are the names and numbers of the appropriate federal government contact for each of these 70-odd industry sectors.

Trade Show and Convention Guide

This annual publication, available in June of each year, lists and provides information on U.S., Canadian and international trade shows by industry. The guide is available for approximately \$US 85 from Billboard Publications in Nashville at (615) 321-4250.

Other Environmental Engineering Periodicals

The following documents deal with a range of environmental subjects of both a technical and general nature. The periodicals are available from Executive Enterprises in New York City at (212) 645-7880. Their contents and annual costs are described below.

Environmental Claims Journal - a quarterly journal which provides information on legal, technical and insurance issues surrounding environmental claims (\$US 152).

Environmental Finance: The Journal of Environmental Financing, Accounting, Taxation & Reporting - a quarterly journal that assists finance and accounting professionals and environmental engineers in planning for the impact of environmental laws and regulations on the corporation's bottom line (\$US 195).

Environmental Manager - a monthly issue which tracks environmental regulations and the techniques being used to comply with them (US 132).

Federal Facilities Environmental Journal - a quarterly journal which assists firms in answering their detailed compliance questions (\$US 144).

Journal of Environmental Permitting - a quarterly journal which assists environmental engineers and managers in developing a method of obtaining and maintaining the necessary air, water and RCRA permits (\$US 168).

Journal of Environmental Regulation - a quarterly publication which provides a detailed overview of all major existing and potential environmental legislation (\$US 168).

Municipal Environmental Journal - a quarterly journal which addresses the environmental problems facing local political areas and the strategies being adopted (\$US 168).

Pollution Prevention Review - a quarterly journal which discusses source reduction and waste minimization, focussing on solving problems before they begin (\$US 132).

Remediation: The Journal of Environmental Cleanup Costs, Technologies & Techniques - a quarterly journal which focusses on remediation techniques and technologies including the economic aspects (\$US 168).

Supervisor's Environmental Alert - a monthly newsletter that offers advice to managers and supervisors regarding the handling of daily environmental problems (\$US 132).

Total Quality Environmental Management - a quarterly journal that discusses the application of TQM to environmental issues and which addresses industry attitudes and perceptions regarding environmental regulation (\$US 168).

Environmental Engineering Books

The following books deal with a range of environmental subjects of both a technical and general nature. Like the above periodicals, they are available from Executive Enterprises in New York City at (212) 645-7880. Their contents and costs are described below.

Chemical Hazard Communication Guidebook - OSHA, EPA, and DOT Regulation - this guide concentrates on chemical hazards, including proper communication, transportation, labeling, and other matters (\$US 75).

The Environmental Audit Handbook Series - this five-volume set examines each component of environmental auditing in detail, including the reporting, recordkeeping, management, staffing, government inspection, and other areas (\$US 175).

The Environmental Compliance Handbook Series - this six-volume set details the issues and actions surrounding the major environmental regulations and examines how to comply with the legislation governing water, air, solid, toxic and other pollution (\$US 195).

The Environmental Dictionary - this 500 page guide defines around 5000 terms used by the EPA and cross-references these to specific regulations (\$US 70).

The Environmental Litigation Deskbook - this book details each step of litigation, covering discovery, expert witnesses, causes of action, exposures, statutes and other related matters (\$US 60).

Insurance Claims for Environmental Damages - this book examines the legal aspects of insurance claims, what is necessary to manage claims, and technical and engineering strategies (\$US 75).

PCB Management Handbook - this guide updates regulations and practices regarding PCBs and their effects (\$US 50).

The Pesticide Regulation Handbook - this guide discusses the registration and regulation of pesticides and analyses the complex web of federal and state procedures governing production, distribution and use of pesticides (\$US 75).

Protecting Trade Secrets Under SARA Title III - this 300 page book examines how confidentiality and trade secrets can be protected while complying with government regulations on right-to-know matters (\$US 60).

Real Estate Transactions and Environmental Risks - this reference explores how different parties to real estate transactions can be affected by environmental complications and outlines steps that can be followed to minimize liability (\$US 80).

SARA Title III - Community Right-to-Know - this handbook examines the requirements for reporting, data gathering and information sharing stemming from the SARA requirements for community right-to-know (\$US 60).

The Superfund Claims and Litigation Manual - this guide provides insights, lessons and strategies absorbed from firms involved in Superfund projects (\$US 50).

Understanding Ground-Water Contamination: An Orientation Manual - this guidebook examines ground-water contamination questions such as cleanup requirements, potential sources, cost estimates, liability costs, and others (\$US 60).

Waste Reduction: Policy and Practice - this book explains means of waste reduction such as recycling and source reduction, and also examines other related areas such as government requirements (\$US 40).

Appendix D

Leading Engineering and Environmental Firms in the United States

Leading Engineering Firms in the United States

| Company Name | Address | CEO Name | Phone | Co. Type | Sales (\$ mil) | Empl. (000) |
|--------------------------------|---------------------|------------------------|--------------|----------|----------------|-------------|
| Fluor Corp. | 3333 Michelson Dr. | Irvine CA 92730 | 714-975-2000 | P | 6,278 | 20.1 |
| Fluor Daniel Inc. | 3333 Michelson Dr. | Irvine CA 92715 | 714-975-2000 | S | 6,000 | 15.3 |
| Bechtel Group Inc. | P.O. Box 3965 | San Francisco CA 94119 | 415-768-1234 | R | 5,100 | 27.8 |
| Halliburton Co. | 3600 Lincoln Plz. | Dallas TX 75201 | 214-978-2600 | P | 4,263 | 65.5 |
| Brown & Root Inc. | P.O. Box 3 | Houston TX 77001 | 713-676-3011 | S | 2,100 | 36.0 |
| Wheelabrator Technologies | Liberty Ln. | Hampton NH 03842 | 603-648-9496 | P | 1,493 | 7.0 |
| BE & K Inc. | 2000 International | Birmingham AL 35243 | 205-969-3600 | R | 1,400* | 2.8 |
| Austin Co. | 3650 Mayfield Rd. | Cleveland OH 44121 | 216-382-6600 | S | 1,319 | 2.0 |
| Foster Wheeler Corp. | Perryville | Clinton NJ 08809 | 201-730-4000 | S | 1,243 | 8.0 |
| Ebasco Services Inc. | 2 World Trade | New York NY 10048 | 212-839-1000 | P | 1,000 | 5.4 |
| CDI Corp. | 10 Penn Center Plz. | Philadelphia PA 19103 | 215-569-2200 | S | 887 | 15.0 |
| Bechtel Power Corp. | 15740 Shady Grove | Gaithersburg MD 20877 | 301-258-3000 | S | 870* | 7.6 |
| Parsons Corp. | 100 W. Walnut St. | Pasadena CA 91103 | 818-440-2000 | R | 820 | 80.0 |
| Rust International Corp. | P.O. Box 101 | Birmingham AL 35201 | 205-995-7000 | S | 800 | 35 |
| Jacobs Engineering Group Inc. | 251 S. Lake Ave. | Pasadena CA 91101 | 818-449-2171 | P | 794 | 36 |
| Tracor Holdings Inc. | 6500 Tracor Ln. | Austin TX 78725 | 512-926-2800 | S | 740* | 75 |
| Westmark Systems Inc. | 6500 Tracor Ln. | Austin TX 78725 | 512-322-0222 | S | 740* | 75 |
| AECOM Technology Corp. | 3250 Wilshire Blvd. | Los Angeles CA 90010 | 213-381-3612 | S | 710* | 7.0 |
| Tracor Inc. | 6500 Tracor Ln. | Austin TX 78725 | 512-926-2800 | S | 660* | 75 |
| Bechtel Civil Co. | 50 Beale St. | San Francisco CA 94105 | 415-768-1234 | S | 620* | 3.1 |
| CRS Sirmine Inc. | 1177 W. Loop S. | Houston TX 77027 | 713-552-2000 | P | 617 | 27 |
| Air & Water Technologies | P.O. Box 1500 | Somerville NJ 08876 | 201-685-4600 | P | 606 | 3.0 |
| Lummus Crest Inc. | 1515 Broad St. | Bloomfield NJ 07003 | 201-893-1515 | S | 600 | 35 |
| Fru-Con Construction Corp. | P.O. Box 100 | Ballwin MO 63022 | 314-391-6700 | S | 595 | 4.7 |
| Foster Wheeler Intl. Corp. | 666 5th Ave. | New York NY 10009 | 212-581-7770 | S | 570* | 3.7 |
| Stone & Webster Inc. | 250 W. 34th St. | New York NY 10119 | 212-290-7500 | P | 566 | <0.1 |
| MK-Ferguson Co. | 1500 W. 3rd St. | Cleveland OH 44113 | 216-523-5600 | S | 520 | 26 |
| Day & Zimmermann Inc. | 1818 Market St. | Philadelphia PA 19103 | 215-299-8000 | R | 500 | 14.0 |
| Foster Wheeler USA Corp. | Perryville | Clinton NJ 08809 | 201-730-4000 | S | 500 | 0.8 |
| Sverdrup Corp. | 13723 Riverport | Maryland MO 63043 | 314-436-7600 | R | 487 | 5.1 |
| Fluor Daniel Inc. Houston Div. | P.O. Box 5014 | Sugar Land TX 77478 | 713-263-1000 | D | 480 | 2.0 |
| United Engineers/Constructors | P.O. Box 8223 | Philadelphia PA 19101 | 215-422-3000 | S | 480 | 5.0 |
| Badger Engineers Inc. | 1 Broadway | Cambridge MA 02142 | 617-494-7000 | S | 460* | 2.3 |
| Bendix Field Engineering | 1 Bendix Rd. | Columbia MD 21045 | 301-964-7000 | S | 450 | 7.0 |
| Brown & Root Intl. Inc. | P.O. Box 3 | Houston TX 77001 | 713-676-3011 | S | 450 | 1.0 |
| Planning Research Corp. | 1500 Planning | Mc Lean VA 22102 | 703-556-1000 | S | 438 | 6.0 |
| Wyle Laboratories | 128 Maryland St. | El Segundo CA 90245 | 213-322-1763 | P | 416 | 2.0 |
| CH2M Hill Inc. | P.O. Box 428 | Corvallis OR 97339 | 503-752-4271 | R | 400 | 4.1 |
| TAD Technical Services Corp. | 639 Massachusetts | Cambridge MA 02139 | 617-868-1650 | R | 375* | 0.8 |
| Reynolds Electrical & Eng. | P.O. Box 98521 | Las Vegas NV 89193 | 702-295-1000 | S | 360 | 5.0 |
| Fluor Daniel Inc. | 10 Twin Dolphin | Redwood City CA 94065 | 415-595-6000 | D | 350 | 0.6 |
| Henkels & McCoy Inc. | 985 Jolly Rd. | Blue Bell PA 19422 | 215-283-7600 | R | 350 | 1.3 |
| Sargent & Lundy | 55 E. Monroe St. | Chicago IL 60603 | 312-269-2000 | R | 350* | 1.0 |
| CF Braun Inc. | 1000 S. Fremont | Alhambra CA 91802 | 818-300-1000 | R | 330 | 1.6 |
| Dames & Moore | 911 Wilshire Blvd. | Los Angeles CA 90017 | 213-683-1560 | S | 330* | 1.3 |
| BDM International Inc. | 7915 Jones Branch | Mc Lean VA 22102 | 703-848-5000 | S | 314 | 1.1 |
| M.W. Kellogg Co. | 3 Greenway Plz. | Houston TX 77046 | 713-960-2000 | S | 308* | 2.4 |
| H-R International Inc. | 2045 Lincoln Hwy. | Edison NJ 08817 | 201-287-2111 | S | 300 | 0.4 |
| Yeargin Inc. | P.O. Box 6508 | Greenville SC 29606 | 803-242-6960 | S | 300 | 6.0 |
| ICF Kaiser Engineers Inc. | 1800 Harrison St. | Oakland CA 94612 | 415-268-6000 | S | 298 | 1.6 |

Source: *Ward's Business Directory of U.S. Private and Public Companies*, Volumes 1 and 2, 1991. The company type code used is as follows: P - Public, R - Private, S - Subsidiary, D - Division, J - Joint Venture, A - Affiliate, G - Group. Sales are in millions of dollars, employees are in thousands. An asterisk (*) indicates an estimated sales volume. The symbol < stands for 'less than'. Total company sales are shown. These values may include activities in other SIC categories as well as activities in this industry.

Source: Service Industries USA, Gale Research

Environmental Engineering Firms in the United States

AIR POLLUTION CONTROL

BCM Engineers, Inc.
Curt B. Beck, Consulting Engineers
Camp Dresser & McKee Inc.
Crosa/Tesitore & Associates, P.A.
PA Engineering, Science, and Technology, Inc.

The ERM Group
Engineering Science, Inc.
Hemson Associates, Inc.
Mark N. Herman, P.E., DFE
Herrick Engineering, Inc.

IT Corp.
Kennedy/Jenks Consultants
Maguire Group, Inc.
METCO Environmental
Peake Engineering, Inc.

Planet Pacific Inc.
Shapiro Engineering, P.C.
TRI Environmental Consultants, Inc.
Roy F. Weston, Inc.
Vates & Auberle, Ltd.

GENERAL ENVIRONMENTAL ENGINEERING

BCM Engineers, Inc.
Blaisland, Bouck & Lee
Burns & McDonnell
Camp Dresser & McKee Inc.
Cochrane Associates, Inc.

EA Engineering, Science, and Technology, Inc.
EMA, Inc.
The ERM Group
Engineering Science, Inc.
Environmental Laboratories, Inc.

First Environment
G & E Engineering, Inc.
Gannett Fleming, Inc.
Grealey and Hansen
Hazen and Sawyer Environmental Engineers and Scientists

Kennedy/Jenks Consultants
Knepf & Lange, Inc.
Charles Licht Engineering Associates, Inc.
Malcolm Pirnie, Inc.
Planet Pacific Inc.

Radian Corporation
D.W. Ryckman & Associates, Inc.
Resource Applications, Inc.
Resource Engineering
Fernando L. Rodriguez, P.E. & Associates

Sports, Stevens and McCoy, Inc.
Strom & Associates, Inc.
Strom & Webster Environmental Services
Roy F. Weston, Inc.
The Whitman Companies, Inc.

HAZARDOUS WASTE MANAGEMENT

BCM Engineers, Inc.
Camp Dresser & McKee Inc.
EMCON Associates
Engineering Science, Inc.
Environmental Engineering Consultants, Inc.

C.C. Johnson & Malhotra, P.C.
NTH Consultants, Ltd.
Noble & Associates, Inc.
Malcolm Pirnie, Inc.
Remtech, Inc.

Sports, Stevens and McCoy, Inc.
Roy F. Weston, Inc.

INDUSTRIAL HYGIENE

First Environment
Shapiro Engineering, P.C.

SANITARY ENGINEERING

Allen & Hoshall, Inc.
Alliance Technologies Corporation
Alvord, Burdick & Howson
BCM Engineers, Inc.
Baker Environmental, Inc.

Bankson Engineers Inc.
Baxter & Woodman, Inc., Environmental Engineers
Black & Veatch
Blaisland, Bouck & Lee
Clinton Rogers Associates

Boyle Engineering Corporation
Brown and Caldwell
Camp Dresser & McKee Inc.
John Carollo Engineers
Chester Environmental Group, Inc.

Conner, Townsend & Associates
Davy Engineering Company, Inc.
Domique, Szabo & Associates, Inc.
Ebasco Services Incorporated
The ERM Group

Enclbra S.A.
Engineering Science, Inc.
Environmental Consultants, Inc.
Esvek Environmental Engineering
Gannett Fleming, Inc.

Guy & Davis, Consulting Engineers
H2M Group/Holzmaier, McLendon & Murrell, P.C., H2M Labs, Inc.
HDR Engineering, Inc.
Hansen Engineering
Harza Environmental Services, Inc.

Havens and Emerson, Inc.
Hazen and Sawyer Environmental Engineers and Scientists

David R. Hornsfield, Consulting Engineer
Howard Needles-Tammien & Bergendoff
Hubbell, Roth & Clark, Inc.

HydroQual, Inc.
ICF Kaiser Engineers, Inc.
C.C. Johnson & Malhotra, P.C.
Y. Katsura Consulting Civil & Sanitary Engineers
Kelley, Gidley, Blair & Wolfe, Inc.

Kennedy/Jenks Consultants
Kupper Associates
Joseph F. Lagnese, Jr., Consulting Engineer
Lawrence, Fink & McFarland, Inc.
Letter and Associates, Inc.

T.Y. Lin International
Metcalf & Eddy, Inc.
James M. Montgomery, Consulting Engineers, Inc.
Owen Engineering & Management Consultants, Inc.
Malcolm Pirnie, Inc.

Resource Consultants, Inc.
Reak, Henry, Metzenheimer and Gende, Inc.
Rummel, Klepper & Kahl
SEATEC International Co., Ltd.
The Splink Corporation

Stearns & Wheeler Environmental Engineers and Scientists
Sverdrup Corporation
Tryck Nyman Hayes, Inc.
Roy F. Weston, Inc.
Whitman, Requardt and Associates

Wiley & Wilson
CS Young Engineers, Inc.

SOLID WASTE MANAGEMENT

Black & Veatch
Boyle Engineering Corporation
Brown and Caldwell
Burns & McDonnell
Camp Dresser & McKee Inc.

Cashin Associates, P.C.
Cook Environmental Engineering
Donohue & Associates, Inc.
EMCON Associates
EEC Environmental, Inc.

The ERM Group
HDR Engineering, Inc.
Lewis & Zimmerman Associates, Inc.
Maguire Group, Inc.
Metcalf & Eddy, Inc.

NTH Consultants, Ltd.
Noble & Associates, Inc.
Pedersen & Pedersen, Inc.
Malcolm Pirnie, Inc.

Charles R. Vetry Associates, Inc.

Roy F. Weston, Inc.
Wiley & Wilson

WATER SUPPLY AND WASTEWATER

Advanced Engineering, P.C.
Richard A. Alamo Associates
Alvord, Burdick & Howson
Aquatic, Inc.
BCM Engineers, Inc.

Baker Environmental, Inc.
Bankson Engineers Inc.
Baxter & Woodman, Inc., Environmental Engineers
Black & Veatch
Blaisland, Bouck & Lee

Clinton Rogers Associates
Boyle Engineering Corporation
Brown and Caldwell
Burns & McDonnell
CFS Associates

CMA Architects & Engineers
Camp Dresser & McKee Inc.
John Carollo Engineers

Chandler, Armentrout & Norbeck, P.C.
Chester Environmental Group, Inc.
Commonwealth Engineers, Inc.
Commonwealth Technology, Inc.
Consoer, Townsend & Associates
Dames & Moore

Davy Engineering Company, Inc.
DeB Engineering, Inc.
Donohue & Associates, Inc.
Dufrene Henry, Inc.
Dvirka & Barilucci, Consulting Engineers
Ebasco Services Incorporated

Eckenfelder Inc.
The ERM Group
Economic & Engineering Services, Inc. (EES)
EMCON Associates
Engineering Science, Inc.

Environmental Science & Engineering, Inc.
Esvek Environmental Engineering
Fishbeck, Thompson, Carr & Huber
Freese and Nichols, Inc.
Gannett Fleming, Inc.

Grealey and Hansen
Guy & Davis, Consulting Engineers
H2M Group/Holzmaier, McLendon & Murrell, P.C., H2M Labs, Inc.
HDR Engineering, Inc.
Hammontree & Associates, Limited

Harza Environmental Services Inc.
Havens and Emerson, Inc.

Hazen and Sawyer-Environmental Engineers and Scientists
Howard Needles-Tammien & Bergendoff
Huey, Gay, Bell & DeYoung, Inc. of Carolina

HydroQual, Inc.
ICF Kaiser Engineers, Inc.
JACA Corporation
C.C. Johnson & Malhotra, P.C.
Jordan, Jones & Goulding, Inc.

William G. Karam Associates, Inc.
Kasper Group
Kelley, Gidley, Blair & Wolfe, Inc.
Kennedy/Jenks/Consultants
Kilian Associates, Consulting Engineers

L. Robert Kimball & Associates
Lewis & Zimmerman Associates, Inc.
Ray E. Lewis Consulting Engineers, Inc.
Mabbett, Capaccio & Associates, Inc. — Consultants and Engineers
Maguire Associates Inc.

Maguire Group, Inc.
Eduardo N. Martinez Associates
McClure Engineering Company
McNamee, Porter & Seelye, Inc.
Metcalf & Eddy, Inc.

James M. Montgomery, Consulting Engineers, Inc.
NDA Consulting Engineers, Inc.
NTH Consultants, Ltd.
Pickard & Anderson Companies
Malcolm Pirnie, Inc.

Planet Pacific Inc.
Professional Engineering Consultants, Inc.
Quourc Engineering, Inc.
RJN Environmental Associates, Inc.
Remtech, Inc.

Dolph Rotfeld Engineering, P.C.
Rummel, Klepper & Kahl
Russell Environmental Engineering & Development Corp. (REED)
S & S Engineers, Inc.
R.E. Serrano Associates

SEA Consultants Inc.
SEATEC International Co., Ltd.
Shaw, Weiss & De Naples, Professional Corporation
Shive-Hartney Engineers and Architects, Inc.
Sports, Stevens and McCoy, Inc.

Stearns & Wheeler, Environmental Engineers and Scientists
Strom & Associates, Inc.
John R. Stratford Consulting Engineer
Sverdrup Corporation
Tight & Bond Consulting Engineers

Tribble & Richardson, Inc.
Vaughn Consultants, Inc.
Water Resource Associates
Roy F. Weston, Inc.
Wiley & Wilson

Wills Engineers, Inc.
CS Young Engineers, Inc.

Source: American Academy of Environmental Engineers

Appendix E

State Government Environmental Expenditures

**State Government Environmental
Expenditures**

(\$ Million)

| | | |
|-----|---------------------|---------|
| 1. | California..... | \$1,486 |
| 2. | New Jersey..... | 524 |
| 3. | Florida..... | 466 |
| 4. | Illinois..... | 393 |
| 5. | Pennsylvania..... | 289 |
| 6. | Washington..... | 247 |
| 7. | Massachusetts..... | 238 |
| 8. | New York..... | 236 |
| 9. | Michigan..... | 221 |
| 10. | Louisiana..... | 194 |
| 11. | Oregon..... | 186 |
| 12. | Wisconsin..... | 168 |
| 13. | Virginia..... | 152 |
| 14. | Maryland..... | 150 |
| 15. | Alaska..... | 132 |
| 16. | Wyoming..... | 128 |
| 17. | Minnesota..... | 126 |
| 18. | Ohio..... | 126 |
| 19. | Kentucky..... | 120 |
| 20. | Texas..... | 114 |
| 21. | Missouri..... | 106 |
| 22. | North Carolina..... | 97 |
| 23. | Georgia..... | 93 |
| 24. | Iowa..... | 88 |
| 25. | Tennessee..... | 81 |
| 26. | Colorado..... | 76 |
| 27. | South Carolina..... | 71 |
| 28. | Montana..... | 70 |
| 29. | Alabama..... | 65 |
| 30. | Connecticut..... | 62 |
| 31. | Idaho..... | 61 |
| 32. | West Virginia..... | 56 |
| 33. | Mississippi..... | 54 |
| 34. | Indiana..... | 52 |
| 35. | Utah..... | 51 |
| 36. | Kansas..... | 48 |
| 37. | Arizona..... | 47 |
| 38. | New Mexico..... | 45 |
| 39. | Arkansas..... | 44 |
| 40. | Oklahoma..... | 41 |
| 41. | Maine..... | 39 |
| 42. | Nevada..... | 36 |
| 43. | Rhode Island..... | 36 |
| 44. | New Hampshire..... | 34 |
| 45. | Delaware..... | 33 |
| 46. | North Dakota..... | 33 |
| 47. | Nebraska..... | 28 |
| 48. | Hawaii..... | 28 |
| 49. | South Dakota..... | 21 |
| 50. | Vermont..... | 20 |



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