ENVIRONMENTAL MANAGEMENT PRACTICES, COMPETENCIES, AND EDUCATIONAL NEEDS OF MANAGERS AT SMALL INDUSTRIAL PLANTS

BY

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An Abstract of the Dissertation of

John F. Meister, for the Doctor of Science Degree in Workforce Education and Development, presented on July 12, 1999, at Southern Illinois University at Carbondale.

TITLE: Environmental Management Practices Competencies, and Educational Needs of Managers at Small Industrial Plants

MAJOR PROFESSOR: Dr. Richard Bortz

This research focused on environmental management at small industrial plants. Specifically, what tasks environmental managers performed on a routine basis and their competence in performing them, in order to better understand educational and training needs.

A list of environmental compliance and management tasks were developed and validated. Sixty-two specific tasks were grouped together into the following 9 categories:

1) Monitoring emissions and collecting wastestream data; 2) Complying with regulations in daily operations; 3) Reading and studying regulations; 4) Preparing reports; 5) Conducting audits; 6) Preparing permits and complying with them; 7) Developing environmental policy; 8) Interacting with consultants and contractors; 9) Managing environmental staff and operations.

Ninety-seven of 114 industrial plants, with less than 100 employees and a SIC Code between 3000 and 3999 located in Peoria County, Illinois were surveyed. It was found that 35 (36%) of the plants had an active environmental compliance program. Information as to tasks performed, attitudes, current competency levels and educational needs was obtained from the managers at these 35 "program" plants

Seventy percent of the "program" managers indicated that these nine task categories were performed on a routine basis. They were rated them at 4.0 out of five in importance. The majority of tasks related to managerial responsibilities as opposed to operational tasks.

Seventy-five percent of the managers perceived themselves as competent to handle environmental problems. In relationship to the nine task categories, the managers rated their competency at 3.0 out of five.

Education was considered important in obtaining and maintaining environmental managerial skills. Forty-three percent of the managers had previous educational training, yet 47 percent stated that they desired more and would be willing to expend the time necessary to become more competent. When related to the nine task categories, the managers rated their willingness to obtain further education at 3.2 out of five. Managers in certain SIC codes had very high levels of educational desire.

In summary, these nine task categories constituted the core of environmental management practices performed in small industrial plants. As such, they represented the core tasks that future environmental training curriculum should be based around.

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CHAPTER I
INTRODUCTION

Nature of the Study

Industrial Environmental Compliance

Numerous environmental laws and regulations were adopted after 1970 (Smith, 1995). These laws governed all environmental compliance disciplines including waste water, solid waste, air pollution, and hazardous waste. The majority of the regulations held industrial facilities to specific compliance standards (Corbitt, 1995). As a result, monitoring, permits and, in many instances, installation of pollution control equipment were required at all sites discharging waste material into the environment.

Reducing pollution at larger industrial plants has contributed significantly towards restoring environmental quality (Killian, 1989). Industries have expended large capital sums for waste treatment (Corbitt, 1995). This has resulted in a drastic reduction in the volume of pollutants discharged into the nation's air, water, and land (Smith, 1995).

Environmental compliance has been defined as those operational and managerial tasks undertaken by an industrial plant for reducing wastes and observing appropriate federal, state and local regulations. Compliance has required more than the installation and operation of mechanical equipment.

An entire series of operational and managerial tasks, including waste stream audits, monitoring, permit applications, pilot studies, and report writing, have been required for a successful compliance program

Environmental management has become essential to guide an industrial facility through the maze of environmental regulations and numerous compliance tasks. According to the authors of "Trends & Challenges..." (1996), "environmental managers are needed to oversee all of the operational steps" (p. 25). Davies (1970) understood this when he said "The control of pollution requires considerable resources, human, mechanical and financial" (p. 23). Thus, central to industrial environmental compliance at each plant was the environmental manager (Friedman, 1992; "Trends & Challenges ...", 1996). With or without the title, the environmental manager is the individual responsible for implementing and managing all of the firm's environmental compliance programs and other environ-mentally related tasks.

<u>Small Industrial Plant Environmental Compliance</u>

Small industrial plants, those with fewer than 100 employees, have also contributed much pollution. Now Vice President, Gore (1992) stated, "One doesn't have to travel around the world to witness humankind's assault on the earth" (p. 25). He was referring to the many local small industries not controlling their wastes. The EPA, according to Gore (1992), estimated that there were approximately 650,000 commercial and industrial sources of waste in the United States. In other words, the vast majority of waste generating sources were small local plants located in every city "just down the street" which was especially true in the Midwest (Gore, 1992, p. 26).

According to the Statistical Handbook of the United States (1995), approximately 43% of all small industrial plants were located in the Great Lakes Region of the country. Illinois alone accounted for 23,234 commercial and manufacturing establishments (Illinois Directory, 1995). Approximately 86% of these establishments employed fewer than 100 employees.

All industrial or manufacturing facilities, regardless of size, had to comply with environmental regulations (Hickman, 1984; "Hazardous waste regs...", 1986). As additional large industrial plants became regulated, it was believed that the EPA would increasingly direct their enforcement actions toward smaller industrial plants ("Trends & Challenges ...", 1996).

Environmental Workforce

Environmental compliance, especially for small to medium sized industries, has become increasingly complicated, frustrating, and expensive. Controlling industrial pollution no longer consisted of just installing equipment. Development of a qualified and trained industrial environmental workforce (individuals performing environmentally-related tasks) is also required.

Larger industrial plants had the financial resources to employ environmentally educated technicians and professionals to operate and manage their pollution control operations. However, few small industries had the operating funds for hiring or training full-time, in-house environmental staff. Instead, these responsibilities and tasks were often assigned to the industrial plant manager; the individual charged with the daily facility operation. Thus, environmental tasks were added to an already long list of physical plant and production responsibilities. Consequently, in many small industrial plants, the plant manager was also the environmental manager. While plant managers were trained and competent in production responsibilities, generally they had not received any environmental compliance education or training.

According to the literature, if a waste stream was generated, the same environmental compliance was required at small industrial plants as at larger ones. Yet, few articles have appeared in the literature regarding environmental management at small industrial plants. Specifically, little was found describing the tasks, competency, and educational needs of the plant/environmental manager. Information regarding present tasks and competencies would assist in the development of effective environmental workforce educational programs.

Purpose of the Study

Thus, the purpose of this study was to contribute to a better understanding of the industrial environmental workforce, and the role and responsibility of the environmental manager in the industrial setting. More specifically, the focus of this study was to determine what industrial environmental compliance tasks were performed and what was the competency of the managers responsible for environmental compliance employed at small industrial plants.

Statement Of The Problem

What is the current level of industrial environmental management performance, attitudes, competency and educational needs of environmental managers employed at small industrial plants?

CHAPTER II
CURRENT RESEARCH AND RELATED STUDIES

Introduction

Environmental compliance during the past three decades has been an ongoing concern for industrial plants (Arnold & Long, 1994). Appointing an environmental manager has recently become a common response to this problem (Arnold & Long, 1994; submittal, 1992; Nichols, 1992). The existing literature was reviewed to determine essential competencies associated with environmental managers' responsibilities and tasks.

An ultimate goal resulting from this research would be the creation of a competency-based educational training program for environmental managers. Educational research has increasingly emphasized linking learning outcomes to workplace task competencies and skills.

Essential to developing an effective curricula was a understanding of present workforce job-related demands. This literature review assisted in that process by reviewing the tasks and competency level of present environmental managers. Grantham (1991) stated that knowing the competency level of individuals working in the profession helps educators consider the requirements for, and provides a basis for reviewing current educational offerings.

Another pertinent concept related to effective educational and training curricula is "needs assessment."

Csete (1994) stated that "needs assessment is a means of identifying and describing 'real world' problems which result in priorities for action (p. 48). According to Menzel (1994), to be successful, the needs assessment, must be focused on identifying specific competencies that must be taught to the learner. This requires an initial analysis of successful practitioners in the field. Against that competency standard, entrants to the field can be evaluated, and specific needs can then be addressed by the proposed programs.

According to Heard (1994), "The literature review is a sufficient and adequate base for developing a list of competency statements" (p. 202). Thus, the central focus of this chapter is on the work environment, duties, tasks, and characteristics of the industrial environmental manager. A secondary topic is related research on needs and competency assessment.

Current environmental professional and trade journals from 1985 to present were considered to be the most relevant sources of literature. The following indexes and information searches were utilized. Pollution Indexes was the major resource. Others were located through the Engineering Index and the Science Index.

Computer searches included CARL (Colorado Alliance Research Libraries); IBES (Illinois Bibliographic Information Service); ERIC (Educational Resources

Information Center), including the Current Index to Journals in Education information research systems. ILLINET (Illinois Library Network), as well as Books in Print, were searched for books. Dissertation Abstracts International was a primary source for related studies. Numerous terms and combination of terms were used to ensure adequacy of the search. Related articles in each of the various environmental media--air, water, land--were searched for information about the tasks and competencies of environmental managers. Various internet search engines were also used to locate environmental competency information.

Current Research

Environmental Compliance and the Environmental Manager

Environmental Overview

Historical Background

Throughout history, man has exerted a destructive impact on nature. Jean Jacques Rousseau (1794; Foxley (1972), summarized this in his opening line of Emile where he stated, "God makes all thing good; man meddles with them and they become evil" (p. 5). Barry Commoner, one of the founders of the modern environmental awareness movement, stated the same thought in the environmental classic Closing Circle (1971).

During the industrial revolution of the 19th and early

20th centuries, humankind's impact on nature was symbolized by smokestacks' belching black smoke into the skies and the open pipes' spewing putrid sewage into the rivers. These were seen as symbols of mankind's domination over nature and of industrial progress. Andrew Carnegie, the founder of U.S. Steel, proudly pointed out to visitors the black smoke from his factories (Livesay, 1975).

Following World War II, a second industrial revolution based upon petrochemicals brought about the widespread use of chemicals such as DDT, PCB's, herbicides, and pesticides. While these chemicals ushered in the modern age of convenience, their indiscriminate use and disposal created environmental problems. Rachel Carson, in her major book Silent Spring (1960), showed that many of these chemicals were toxic and, in the natural ecosystem, caused widespread damage.

A significant amount of pollution and environmental damage has been the result of uncontrolled industrial discharges (Switzer, 1994). Prior to the 1970s, few if any federal, state or local regulations existed to controll industrial discharges. As a result, industrial plants, as well as municipalities, handled their wastes in the most expedient, inexpensive, and locally available method.

Another concern was the increase in waste production, particularly industrial waste. According to now Vice President, Al Gore (1992), "One ton of industrial solid waste is created each week for every man, woman and child--and this does not include the liquid and gaseous wastes steadily being vented into the environment" (p. 146).

There was little concern about either the short or long-term consequences that waste disposal practices had on the environment or public health. According to Gore (1992),

> In an earlier era, when the human population and the quantities of waste generated were much smaller and highly toxic forms of waste were uncommon, it was possible to believe that the world's adsorption of our waste meant that we need not think about it again. (p. 145)

Environmental concern was directly related to visual indications of degradation (Ausubel, 1992). Consequently, if the waste were "out-of-sight," it was "out-of-mind". However, residues of these wastes and, in particular toxic chemicals within them, eventually appeared far from their disposal site, and both environmental degradation and public health problems resulted (Cohen, 1986).

Documentation of the extent of unregulated waste disposal practices, as well as continuing reports of environmental and public health problems, resulted in a great deal of public concern (Binder, 1995; Smith 1995; Switzer, 1994; "Toxic Dump...." 1996). As a result, a series of various federal, state, and local environmental laws and regulations were quickly proposed and passed

(Henrichs, 1992). Within ten years, major legislation was promulgated covering every environmental medium. These included the Clean Air Act in 1970, Clean Water Act of 1972, Safe Drinking Water Act of 1975, and finally the Resource Conservation and Recovery Act of 1976 to control land disposal. All of these acts have been re-authorized, strengthened, upgraded and expanded. Public support for strong environmental legislation has remained constant during the past 26 years (Cohn & Glick, 1995; Dunlap & Mertig, 1991; Switzer 1994).

These legislative acts required the Environmental Protection Agency (EPA), which was established in 1969, to develop and implement specific regulations to control pollution and harmful discharges. A majority of the regulations focused on industrial pollution sources (Kahn, 1985). Improper industrial disposal was identified as a major source of pollution (Crawford, Bonnevie, & Wenning, 1994; Hlavay & Nagy, 1994; Winsemius & Guntram, 1992).

Federal regulations established environmental discharge standards. These standards set both maximum and long-term average levels of pollutants that an industrial plant could legally discharge into the environment (Corbitt, 1995). Many of the regulations also dictated the type of pollution control equipment that a particular industry must utilize.

Very little concern about the potential cost of compliance was shown in the development of these regulations

(East, 1991; Garber & Anderson, 1992; Heinrichs, 1992). According to Corbitt (1995), many of the regulations were "technology forcing" in that they established discharge standards beyond the capability of the then present equipment and technology. It was expected that the technology could be forced into being. Environmental clean-up was the goal, regardless of the cost (Patel, 1992; Switzer, 1994).

Social and Political Perspective

The attainment and protection of environmental quality has become a basic assumption of American society. Poll after poll has recorded public support (Switzer, 1994). Pope (1992) stated in his article "The Environmental Movement-- Alive & Kicking" that two out of three individuals express support for the environment, even to the extent that it should take priority over economic issues. A survey of readers published in Popular Science reported essentially the same degree of support ("The Sky Isn't Falling...," 1994). Rosenberg (1995) quoted a Wall Street Journal/NBC News poll wherein eight out of ten Americans identified themselves as environmentalists, and 85 percent regard environmental quality as very important.

Thus, protection of the environment has remained a high priority with the American public. Smith (1995) pointed out that this support transcended social-economic class as well as gender and age. While the continuing support of this issue after 25 years has baffled social scientists, Smith (1995) opined that it was the result of the numerous environmental crises over the past 20 years.

Following the conservative election victories of 1994, many stories appeared regarding the demise of the Environmental Protection Agency (Hebert, 1995). However, according to Waldman, (1995), some of the conservative congressional members have realized that "...they are on the wrong side of public opinion" (p.36) regarding this issue.

Despite press accounts to the contrary, Congress has not been attempting to repeal EPA regulations. According to Nichols (1995), Congressional efforts, to date, have focused on preventing new regulations' being placed on municipalities, not eliminating ones already in place. There has been no discussion regarding a scaling back of industrial pollution regulations (Benenson, 1995).

When asked "What impact a shrinking EPA budget would have on environmental protection?", a roundtable of environmental experts responded "that there would be little impact" ("Trends & Challenges...," 1996 p.41). Thomas Burke, Director of the Risk Sciences and Public Policy Institute, John Hopkins University, was quoted in the same article ("Trends & Challenges...," 1996), as saying "At the state and local levels--the levels at which national laws are implemented--I don't think there are many people all that concerned" (p.41). The majority of environmental regulations have been implemented and enforced at the local level, not by the federal EPA. Pollution abatement expenditures by state and local governments reached a new record high in 1995, and have consistently dwarfed federal spending by a factor of ten to one ("Statistical Abstracts...," 1995). Responding to the call for relaxed environmental regulations, William Reilly, former EPA Administrator (1989-1993), stated, "The environment in U.S. cities has become vastly cleaner, but the war is not won" (Reilly, Shabecoff, & Davis, 1995, p. 366A).

Industrial Environmental Compliance

The workplace activities of the environmental manager can best be understood within the context of overall industrial environmental compliance. Thus, the topic of environmental compliance, especially that related to small industrial plants, is relevant.

EPA Regulations

Industrial wastes have long been identified as one of the major sources of pollution in the nation's air, waterways, and land (Corbitt, 1995; Patterson, 1985; Porteous, 1985). According to Patel (1992), U.S. industry generated yearly over 600 million tons of non-hazardous wastes and 300 million tons of hazardous waste.

If small industrial plants generated a regulated pollution waste stream, they were subject to the same regulations as those for any large industrial plant (Hickman, 1984). This was clearly stated in the revised Clean Air Act. All owners and operators of emission sources were required to obtain an operating and discharge permit (Baratta, 1993). The result has been that many small businesses have had to install air pollution control equipment or face potential liabilities. All industrial plants, small or large, that discharged wastewater of any type, have had to obtain a National Pollutant Discharge Elimination System (NPDES) permit or an industrial discharge permit (Gray, 1991; Newman, 1995). Under the Resource Conservation and Recovery Act, all industrial generators of special industrial or hazardous waste were required to obtain a permit (Liebeman, 1994). The testing and reporting requirements for hazardous waste regulations placed greater burdens on small plants than on larger plants (Traverse, 1990).

According to Nichols (1992), all industrial plants sooner or later will be regulated under an EPA program. The type of waste or environmental media was immaterial. If waste were generated, the plant was regulated. Once in the EPA system, the plant was responsible for compliance with all applicable EPA regulations (Slavich, 1993). At a minimum, all plants were required to obtain permits and submit required monitoring data (Bromberg & Davis, 1993; Corbitt, 1995).

Generally, an industrial plant generates several different types of environmental contaminants, each into their respective mediums (Meister, 1989). Thus, within the industrial plant, all of the various environmental regulations and concerns simultaneously converge. Historically, the plant manager has been the individual responsible for ensuring that all of these regulations and concerns were addressed and complied with (Gammill, 1993; Meister, 1989).

Complex and Frustrating

Environmental compliance for all industries and particularly small-to medium-sized industries has been complicated, frustrating, and expensive (Tusa, 1990). The industrial plant has become subject to an increasing number of environmental regulations. Tusa (1990) concluded that "As the number of environmental regulatory programs increases, the details of each one, and the complex inter-relationships among them become difficult to decipher" (p. 28). Over the past ten years, the number of federal, state and local environmental regulations has continued to increase. In total, according to Nichols (1992), there are now over 80,000 environmental regulations, most of which apply to industrial generators. Hosford (1993) identified 12 new pollution programs just within just the re-authorized Clean Air Act.

Environmental regulations have expanded to cover all environmental disciplines including wastewater, solid waste, air pollution, hazardous waste, and storm water (Stilwell & Bailey, 1993). Others include SARA Title III (Fillo & Keyworth, 1992) and employee and community "right-to-know" (Corbitt, 1995). Within the plant, on-site handling of hazardous materials and wastes was regulated ("On-site industrial waste...", 1989). Environmental regulations even impacted the transfer and sale of industrial property ("Responsible property act...", 1989). Fognani (1992) reminded his readers that many activities companies routinely once did are now illegal and can lead to fines and criminal prosecution.

In addition to removal of conventional pollutants, industrial plants are increasingly expected to treat non-conventional pollutants as well (Corbitt, 1995). Industrial plants are required to determine and evaluate the presence of any toxics and remove them from their waste discharge streams (Druda, 1993; Falconne, 1993; Prescott, 1992). According to Friling (1993) and Prerrich (1993), storm water management has become another potentially difficult and costly area of environmental compliance.

Industrial pretreatment of wastewater has always been an area of concern (Prescott, 1992). In a new emission control program, the EPA desired that, in addition to the previous "end-of-pipe" treatment for each source, the industrial plant is to perceive its emissions as a whole and treat the total emission combination (Jones, 1993).

These newer regulations have been forcing industry to develop new solutions to their environmental problems. Removal of non-conventional pollutants has forced environmental scientists and engineers to develop new and different technologies than those used in the past (Krukowski, 1993). These innovative technologies were utilized to meet new tougher regulatory requirements (Andrachek & Sullivan, 1992; Hicks & Caplin, 1993; Tarquin & Chan, 1992). The problem has been how to comply without bankrupting the industrial plant.

Trying to operate a business in light of these complex, overlapping, and contradictory regulations "... is a risky business." (Heath & Millet, 1993, p. 37). To compound the frustration, the EPA administered these regulations without flexibility and maintained a large inspection and enforcement program (Hamper, 1992). Nichols (1992) quoted J. Thomas Robinson, who stated, "The EPA currently uses a shotgun approach to environmental protection....The use of legislation (in each separate environmental area) blasts away at the potential benefits of a coordinated policy" (p. 53). Nichols (1992) further suggested that "Regulatory standards are many times unrealistic, designed to provide a margin of public safety protection that is not warranted by science" (p. 54).

These comments have been repeated many times by the business community. When asked to comment on EPA regulations at the U.S. Senate Hearing on Small Business Environmental Compliance (1993), Peter Gebhard, a small businessman from Providence, Rhode Island, stated, "Number one, on the regulations what we have found is that many times regulations can be arbitrary, they can be obtuse and they can be conflicting; that raises a problem for us". (p. 3)

Because environmental regulations were complex and cumbersome, Fognani (1992) stated that, even with extra effort, companies may never feel secure regarding their compliance status because of the complexity of the regulations. However, compliance is essential, as non-compliance could lead to serious consequences.

Economic Considerations

Environmental regulations have imposed serious economic constraints on businesses (Andrachek, 1992). According to Arnold and Long (1994), environmental compliance consumed approximately three percent of the entire gross national product (GNP) and private industry incurred more than 60% of that total. This total was greater than that spent by any foreign nation. In 1993, the last year for complete records on environmental expenditures, private industry spent over seven billion dollars in capital expenditures to comply with environmental regulations and almost 18 billion dollars for ongoing operational expenses (U.S. Department of Commerce, 1995). Total environmental expenditures for U. S. businesses during the 1990s was expected to reach 200 billion dollars (Garvin, 1993).

Environmental compliance is a cost factor that must be deducted from the bottom line of profitability and thus is an important concern for the survival and prosperity of any business (Bringer & Benforado, 1993; Hamper, 1992). It has been a financial drain that industries have strived to reduce to a minimum to remain competitive (Evans & Savino, 1993; Sells & Jankousky, 1994). Many industrial plants have found themselves increasingly competing against international competition (Hudson Institute, 1987; SCANS, 1991) which has forced them to become more efficient or go out of business (Krugman, 1986). In this competition, American industrial plants have operated under much more strict environmental standards than industries in most other nations (Arnold & Long, 1994; Corbitt, 1995; Switzer, 1994).

Many industrial plants have been forced to utilize the most sophisticated and expensive technological solutions due to the stringent nature of American federal, state, and local environmental laws and regulations ("Expect more ..", 1993; Garvin, 1993; Smith, 1995). In summary, environmental regulations have contributed to the closure of industrial plants (Daleney & Gaylord, 1991). According to Elmendorf (1994), regulations, such as the re-authorized Clean Air Act, will "have an impact and substantially affect the way all U.S. businesses operate manufacturing plants" (p.6).

Enforcement

Enforcement has always been a major area of contention between the EPA and the regulated community. Many have perceived that the Environmental Protection Agency has become overbearing and excessive in its zeal. Hebert (1995) quoted Robert Crandall of the Brookings Institute, "The EPA is one of the most pervasive agencies with tremendous tentacles" (p.2). Representative Tom DeLay (R-Texas) called the EPA "the Gestapo of government" (p.2). Articles have routinely appeared in the local and national press describing the EPA's strong arm tactics and bureaucratic insensitivity (Boot, 1995). To others, the environmental movement itself has gone beyond common sense into a realm of overkill and self-serving ambitions (Dowie, 1995; Ray & Gusso, 1993).

All of the environmental laws contain mechanisms for the EPA to impose penalties for non-compliance (Corbitt, 1995). The EPA has long had the authority to assess fines that ranged from a few hundred dollars to thousands of dollars per day of for a number of violations (Corbitt, 1995). Additionally, the EPA has had the authority to issue "cease and desist orders" or actually close down polluters that were causing a serious threat to the environment or public health. Other economic threats included mandatory cut-off of federal funds or contracts to a violating source.

In addition to economic penalties, the EPA, according to Starr (1991), has also been seeking criminal prosecution of environmental violators. The "responsible person" was considered liable for the violation as well as the company or corporation (Holden, 1995). In addition to the company's paying a fine, plant managers have been fined or imprisoned (Fiorelli & Rooney, 1995). The goal has been to force officials at every level of management to understand and comply with environmental laws (Iwanski & Thurman, 1991). Due to the complexity of the environmental regulations and laws and uncertainty as to EPA's interpretation, most environmental attorneys recommended that corporate officers take all possible affirmative steps to comply with the regulations (Adams, Jonas, & Lee, 1992).

Long Term Liability

Delegating compliance to an environmental contractor has not eliminated an industry's responsibility. According to Firetog (1994), industrial plants were required to comply with numerous reporting and monitoring requirements regarding the safe disposal of wastes. If problems occurred in the treatment or disposal of its waste, the industry was still responsible. This liability remained even if the industry discharged the wastes into a municipal waste treatment facility, or had its wastes hauled off by an EPA- regulated and licensed waste disposal firm. Liability for industrial waste continued, even after the waste has been disposed (Eckenfelder & Musterman, 1994; Kim, 1995).

Thus, industries needed to be cognizant of not only present environmental problems, but also the long term liability resulting from their practices (Krugman, 1986). According to Evans and Savino (1993), liability continues even after termination of the company's operations. Environmental clean-up liability and costs have been extended, in some cases, to corporate officials, plant managers, and even stockholders (Gibson, 1994).

Holistic Approach

Many types of environmental waste discharges were generated at an industrial plant (Duchin, 1992; Freeman, Harten, Stringer, Randall, Curran, & Stone, 1995; Tavlarides, 1985). As a result, the plant was subject to many different regulations which sometimes imposed contradictory requirements (Corbitt, 1995; Reid & Christensen, 1994). In a prepared statement to the U.S. Senate Environment and Public Works Hearing (1993), a Rhode Island business owner, stated:

> We are in a regulatory crossfire. We have regulations including wastewater treatment, industrial pretreatment, We have RCRA, CERCLA, OSHA, Stormwater Regulations and about 15 more regulations that I don't care to remember the acronyms for. (p.11)

The above testimony continued:

> Each of these regulations were written with tunnel vision. Most of them are written as independent

> bodies of regulation and most of them have conflicts with each other and most of them are outdated as they're 10 years behind technology. (p.11)

The point was that while the regulations were written from a single media or waste perspective, compliance was required in the "real world" where there was no artificial media separation (Arnold & Long, 1994; Vincoli, 1993). According to Roy and Schaeffer (1993), the EPA has maintained the artificial boundaries among air, land, and water in spite of all the evidence that it did not reflect the real world. It has been maintained because it provided an easier (but artificial) way of categorizing the environment, pollution, regulations, and treatment processes. Accumulated data, according to Roy and Schaeffer (1993), documented that an integrated system would be more effective and efficient. Schmitt (1994) demonstrated a cost effective integrated waste management plan.

Another problem was that while the primary discharge from an industrial plant was in one medium, for example, wastewater or solid waste, the plant, due to its classification as an industrial facility, was required to monitor its discharges in all areas (Firetog, 1994). According to Firetog (1994), once a plant was in the EPA system for one waste, it was responsible for all EPA regulations.

An industrial plant's environmental status was always subject to modification. Changes in the industrial process often drastically changed the plant's waste streams and generated a whole regulated waste stream (Arnold & Long, 1994). Changes in the treatment process for one waste often impacted or created wastes in another medium (Hickman, 1984).

According to Podar and Klee (1993), it was important for the reasons listed above, to understand the industrial environmental pollution control field in its totality. An integrated approach provided the best defense to avoid costly EPA surprises (Podar & Klee, 1993). Reid and Christensen (1994) concurred that an effective industrial waste management plan required a comprehensive knowledge of the entire field.

Thus, an effective environmental compliance program would be one that considered the total, or holistic, view of the plant and all its operations (Garber & Anderson, 1992). This program focused on the industrial plant as a whole, waste generation as well as treatment (Callenbach, Capra, Goldman, Lutz & Marburg, 1993; Lowe, 1993). The goal was to develop a "proactive" understanding of the plant and its wastes, which can be used to assist in cost-effective compliance programs (Morton, 1993).

According to Iwanski and Thurman (1991) and Smith (1993), an "environmental audit" is the most effective means to determine the type and nature, as well as the concentration, of all waste discharges. Many resources have detailed the methodology (Environmental Resource Center, 1993; Mon, 1993). All emphasized the importance of sampling and testing all sources and all waste streams. If completed properly, this information could be incorporated into a compliance plan (Tusa, 1990). However, it is also important to evaluate the environmental audit itself to ensure that it is thorough, comprehensive, and accurate (Tusa, 1990). Otherwise, an ineffective compliance plan would be implemented and certain wastes would remain untreated (Hedstrom & Voeller, 1993, & Schmitt, 1994).

Pollution Prevention

According to Corbitt (1995) and Ayers, Deb, Fisher, Hattemer-Frey, Kelly, Knowles, et al, (1994), there are several ways to reduce waste discharges. One is to treat the waste with "end-of-the-pipe" pollution control systems. The other is to prevent the waste from being created through a "pollution prevention" program. In the latter process, the objective is to eliminate or reduce the quantity of waste, so that little or no waste treatment is required (Englehardt, 1994; Mitchell, 1992). This was accomplished via process modifications or changes in the plant's raw materials (Tavlarides, 1985; Duke, 1994). Freeman (1995) and Huang (1995) provided numerous details on the specifics of implementing such a program in an operating industrial plant.

The 3M Company was the first to institute the concept mentioned above (Zoss & Koenigsberger, 1984). Since then numerous other industrial plants have implemented similar programs (Litvan, 1994). These plants have found them not only effective, but also cost efficient (Hoffman, 1992). Pollution prevention programs have become the current major trend among industrial plants desiring to reduce waste disposal costs (Nichols, 1992; "Trends & Challenges...," 1996).

In the past several years, the EPA has stated that it was shifting from a policy emphasis on "end-of-the-pipe" treatment to one of "pollution prevention and waste minimization" ("Pollution prevention...," 1992); Becker & Ashford, 1995). However, while encouraging waste reduction through pollution prevention programs, the EPA has maintained their waste discharge concentration standards. Likewise, they have continued to require installation and operation of various treatment technologies. Hamper (1992) and Corbitt (1995) stressed the EPA's determination to enforce all current environmental regulations. According to Weinstock (1993), no matter how much the EPA administration said it would try to work in cooperation with the regulated community, bureaucratic and legislative obstacles would force the EPA field staff to continue in their old ways. According to a recent article, the EPA takes a

> rigid, cook-book approach (to compliance). That approach is easier from a regulatory point of view,

> from an environmentalist point of view, because it's easy to determine who is complying and who is not. But what is lost is good judgment and flexibility. It is a system that protects against gross failure, but it also stifles innovation. ("Trends & Challenges ...," 1996, p. 41A)

This dual approach has complicated industrial plants" pollution control operations. Pollution control equipment operations must be maintained in addition to striving to modify the plant's internal operations to reduce pollutant generation. This emphasis on internal pollution generation has forced the plant environmental manager to become even more knowledgeable about the inter-relationship between various industrial processes and waste production (Morse, Khan, Caldwell, Baxter, Veludhandi, Drake, & Smith, 1994).

<u>Summary</u>

Environmental regulations have become an accepted fact of life for industry. The presence of any contaminant in the industry's waste stream above a certain level places these plants into the EPA regulatory program. The impact of these regulations has been extensive and expensive, and has altered the entire way of conducting industrial operations.

<u>Small Industrial Plant Operations</u>

<u>Introduction</u>

According to the <u>Statistical Handbook of the United</u>

States (1995), 82% of all manufacturing industrial plants in the United States had less than 100 employees. Approximately 43% were located in the Great Lakes region of the United States (EPA Region 5).

While the volume of waste from each individual small plant was minimal, the overall volume was significant. However, EPA enforcement actions, to date, have focused primarily on larger industrial plants; thus, many of the smaller plants have not yet implemented compliance programs ("Trends & Challenges ...," 1996). Within this universe of small plants, there has been a large variability in types of and characteristics of individual waste streams. Environmental compliance has generally tended to be a lower priority at small plants (Corbitt, 1995). Yet, these plants are subject to the same environmental regulations as larger industries.

In contrast, most large industrial operations have acknowledged their environmental responsibilities and have committed funds and resources necessary to implement pollution control programs. Peacock (1993) reported that approximately 80 percent of the nation's largest 400 firms have adopted written environmental policies that included compliance with all environmental regulations. The majority of these plants have installed, or are in the process of installing, waste treatment facilities.

Challenging and Daunting Task

If a small plant generates and discharges a regulated waste into the environment, it is required to comply with the industrial environmental regulations pertaining to that waste and environmental medium (Corbitt, 1995; Hickman, 1984). Vincoli (1991) discussed the increased difficulties associated with small business environmental compliance.

Environmental compliance has appeared daunting to many small business owners. The complexity of regulations and the overlapping requirements were beyond the capabilities of most small industrial plants' staff. In testimony to the Committee on Environment and Public Works Hearing on Small Business Environmental Compliance, (Committee, 1993), Anthony Boscia, a small metal plating shop owner, stated:

> The reality for the present day small business owner is that regulatory business compliance is a full time job....When examining the regulatory process,...it must be initially recognized that there is no single regulation or category of regulations which apply. For example, the typical metal finishing or plating facility must deal with regulatory requirements associated with Industrial Wastewater, Pretreatment, RCRA, CERCLA, SARA, Air Emissions, Local Plumbing Codes. These regulatory requirements will involve Federal and State level agencies as well as local officials including the

> sewer authority, building department, plumbing inspector, Fire Marshall, et cetera. Modification of a single process operation can trigger the requirement to prepare extensive documentation and submittals to the various agencies and authorities for review and approval prior to implementation. ....The failure to comply with any single requirement has the potential to result in enforcement actions. (pp.14-15)

The Honorable Senator John H. Chaffee (Rhode Island), speaking at the Committee Hearings (1993), agreed that small businesses have "legitimate concerns" (p.1) in their dealings with the EPA and their attempts to comply with EPA regulations and requirements. Just like larger industries, they were subject to:

> excessive and duplicative reporting requirements and conflicting regulations....that require them to install sometimes expensive equipment,
> even when it doesn't seem to make sense or will result in no apparent or little apparent environmental protection. (p.1)

The problem, as repeatedly stressed in these hearings, was that small businesses did not have personnel to study and comprehend these technical and very complicated requirements. "When a small business is faced with volumes of complex rules and regulations, it often doesn't have the scientific or technical expertise to design and implement (operate) the proper controls" (Committee, 1993, p.2). Testimony from other affected small business owners concurred, "We can't make those investments today, if we don't have the financial, the technical and the managerial wherewithal to do them" (Committee, 1993, p.4). The implication was that many small businesses did not have full time in-house (educated) technical and professional environmental staff capable or available to respond to the requirements of this task.

Likewise, few small industries have the financial resources to implement costly pollution control programs, which has become a major concern. Testimony from the Committee hearing (1993) included several statements such as the following:

> Costs of compliance are increasing dramatically. Fixed costs for equipment in cleaning areas are up three to five times. Regulatory license fees are up, and the cost for equipment for small businesses are indeed the same for large businesses, but the percentage of cost as a percent of our sales is much greater. Our problem is, Senator, that financing for all of these things is not easily available, because we do find ourselves requiring financing; requiring bank financing; but unfortunately, the bankers don't quite understand the nature of the regulations and, therefore, we

> use our scarce resources in areas of complying to regulations rather than in areas of production increased and job increases. (p.5)

Obtaining environmental permits was another area wherein costs for small plants are proportionally higher. In large plants, the treatment process may have cost millions, but in small plants, due to the small volume, minor inexpensive changes generally have sufficed. However, the same permit applications and bureaucratic frustration have to be dealt with. Anthony Boscia, owner of a small electroplating firm, stated at the Committee (1993) hearing:

> I can tell you right now the cost to do the permitting in a lot of cases is more than the cost to do the engineering. That's kind of ridiculous, quite frankly. I have this happen repeatedly particularly for small businesses....I can design it for less than $1000, but the permitting process makes it up to $5000 with all the paper, the meetings, and the responses that generate about 500 pieces of paper. That's going to cost two, three, four times as much as the design costs. I've had situations where the engineering cost more than the equipment, which is pretty wild, because engineering should be ten cents on a dollar, maybe twenty cents on the dollar tops. So that's the dilemma we have. We've got to look at our

regulations and recognize that we're grossing over regulations with regulations which add to the cost with no benefit. (p.20)

In spite of the frustration and cost, small business owners were terrified of the aspect of being found in non-compliance. In testimony at the Committee hearing (1993) comments were made such as: "While it can be stated that the cost of compliance can be significant, the cost of non-compliance can be even greater...that even can result in the ultimate failure of that particular business." (p.13). Many times this fear was the driving force for compliance rather than understanding the environmental benefits that society would reap from reduced pollution.

Small Plant Staffing

As stated above, while environmental compliance was often a demanding task, many small plants did not have the financial resources to maintain an environmental staff. Generally, small industrial plants employed no more full-time, in-house environmental staff than absolutely necessary to meet regulatory demands (Committee, 1993). Small industrial plants had few, if any, environmental employees (Nichols, 1992). While this low number was often due to the reduced environmental requirements of a single discharge plant, many other plants did not have the economic resources to maintain any environmental staff.

With a minimum number of environmental workforce employees, the distinction and separation between professional, technical, and vocational tasks and work assignments often become blurred. The result was, just as in the modern high-performance work organization, many vocational, technical, and professional responsibilities were blended and performed by one individual.

Many of the professional-level tasks remained undone, due to the individual's lack of a educational knowledge and skills. These professional or managerial tasks are just as, if not more, important than the operational tasks. They include such matters as preparation of permit applications, submittal of required monitoring reports, review of analytical data to determine compliance, and the planning of new projects. According to Segal (1995), "The growing complexity of environmental regulations has spawned a need for additional professional help" (p.84).

Segal (1995) pointed out that due to the "far reaching and complex liability issues, industrial plants have need of environmental management assistance" (p.85). Small plants usually have one of two options in obtaining professional and managerial services. The first is to utilize an outside consultant. The second is to employ an in-house environmental manager.

Environmental consultants have offered a large number of services varying from engineering to public relations. (Segal, 1995). However, most were engineers, who by training responded to problems by designing and constructing treatment facilities according to textbook standards (Vesilind, 1991). As outsiders, they did not tend to perceive the industrial plant's on-going operational needs or concerns such as operating costs. Likewise, "end-of-the-pipe treatment" schemes were preferred over concepts such as pollution prevention. Such approaches have finally been recognized as not being in the best interest of the client. Jester (1989) stated that one reason many engineering graduates were not prepared for assignments that they would actually face in the real world was that "Solutions to engineering problems are no longer simply technical, but must consider other social, economic and political factors" (p.357). For example, when the project was finished, the consultant left, and the plant staff now had the responsibility of operating the waste treatment facility, plus preparing the numerous required reports.

Summary

Environmental compliance for small industrial plants has been a frustrating, complex and daunting task. They were subject to and responsible for complying with all appropriate environmental regulations. However, few have either the personnel or resources to comply with these regulations. In response, they have had to either retain expensive outside consultants with mixed results, or develop an in-house staff including the environmental manager.

The Environmental Manager

Introduction

In response to these economic, regulatory, and technological changes, industries have adopted their organizational structure and work assignments. As described in such classics as Education and the Next Economy (Reich, 1988), industrial plants have been forced to incorporate the concept of the "high performance work organization". Most modern industrial plants now resembled the workplace outlined by Carnevale, Gainer, Meltzer and Holland (1988) in Workplace Basics and America and the New Economy (1991). Consequently, an employee's educational background, skills, and characteristics have also changed (Carnevale, 1991). This has been especially true of the industrial environmental workforce, where they are working at the cutting edge of technological and regulatory changes.

According to Greenfield (1995), the complexity of environmental regulations, costs of implementation, as well as non-compliance penalties, have forced industrial plants to make compliance a top priority. Segal (1995) stated that full-time attention was required to deal with the complexity of current environmental regulations. Large monetary fines and bad publicity, as well as criminal prosecution could result from non-compliance ("Environmental Management...," 1995; Heath & Millet, 1993). Appointing an environmental manager from among current in-house employees has been an effective means to properly handle this issue (Arnold & Long, 1994; Nichols, 1992). According to Friedman (1992), "Environmental management like employee or financial management is not optional. Firms that do not make any effort to manage environmental affairs will manage poorly and incur great costs" (p.25).

Friedman (1992) and Nichols (1992) stressed that the environmental manager was the individual responsible for the industrial plant's environmental compliance. The concept of environmental management has become widespread only in the last 10 years (Friedman, 1992; Nichols, 1992). It was originally proposed by various MBA business schools as a management concept approach to solving environmental problems (Friedman, 1991). It spread rapidly among larger industries, as it effectively dealt with the increase in the number and complexity of environmental regulations foisted upon industry.

According to Friedman (1992) and Segal (1995), the environmental management position was even more essential for small and medium plants. This was due to the lack of good consultants and that management of a plant's environmental issues, even at the smaller plants, has become a full-time job (Friedman, 1992). "The success of a corporation's environmental program depends on its professional environmental manager" (Arnold & Long, 1994, p. 52).

The tasks and issues that an environmental manager addressed were varied and of a professional nature (Nichols, 1992). They have ranged from operational tasks utilizing vocational level skills in the daily operation of pollution control and monitoring equipment to interpreting regulations and attending meetings with the EPA.

<u>Selection and Recruitment</u>

There have been four common modes of selecting the environmental manager in small industrial plants. The first was to upgrade the present vocationally trained pollution control equipment operator. Promoting the operator has often been counterproductive due to the technical and professional skills required for regulatory compliance. A second option has been to upgrade environmental technicians, individuals who have received some post-secondary education regarding environmental matters. However, if environmental problems arose in a different environmental medium than the one in which they have been trained, these individuals often did not have the background to respond to this new problem area. Likewise, these individuals had not been trained to handle many of the managerial aspects required in modern environmental compliance. But, provided with additional education and experience, they have the potential to make good environmental managers. They came into their present positions with experience and had shown the capability to learn (Friedman, 1992). The third option has been to hire full time environmental professionals to serve as managers.

While technically this would provide the most qualified individuals, it was seldom done at small industrial plants for economic reasons. Few plants have employed such an individual unless compliance matters dictated. Small plant owners have resisted taking a proactive environmental position.

The fourth option, and the one most commonly seen in small industrial plants, has been to assign environmental responsibilities to an already employed production supervisory person, such as a line supervisor or, more commonly, the plant manager. This individual assumed the environmental responsibilities and duties in addition to already assigned duties. While utilizing an individual in a dual role is economical, there are potential problems since the plant manager is expected to perform the environmental duties, in addition to other plant operational duties. Thus, less than adequate time and effort are given to environmental compliance. Likewise, there also has been a concern as to their lack of any formal education in environmental compliance.

Environmental Manager Responsibilities

Introduction

According to Shrivastava (1993), a basic premise regarding United States environmental policy is that compliance is the responsibility of the industrial plant, the waste generator. The manager's responsibility is to ensure that the industrial plant remained in compliance with all appropriate environmental regulations (Friedman, 1991; Nichols, 1992). Determining the plant's environmental compliance status and obtaining and complying with any and all necessary permits are among the core tasks of this responsibility (Corbitt, 1995; Friedman, 1992).

Tasks--Review of Waste Streams

Discerning the need for and obtaining appropriate environmental permits have been identified as among the first of many of the environmental manager's tasks. According to Firetog (1994), failure to obtain permits was the most common violation for small industrial plants. The EPA has fined industrial plants for failing to obtain such a permit ("Record fines...," 1992).

A necessary step in this permitting process is the review and analysis or "environmental risk assessment" of the industrial plant's waste streams. Many small industrial plants had little information or idea of the nature, strength and environmental impact that their wastes created ("Environmental management...," 1995). According to Burnam, McDonald, Kido, and James (1994), the environmental risk assessment or audit was a relatively new discipline within the environmental pollution control field.

This audit documented: 1) type, 2) volume, and 3) concentration of pollutants in all of the plant's wastes discharges (Vincoli, 1993). According to Meister (1985), these environmental audits provided important information for future planning. Most importantly, the data documented the present environmental compliance status.

If the audit documented that a regulated waste stream was generated, then the plant was subject to EPA or local agency regulations (Environmental Resource Center, 1993). At a minimum, according to Corbitt (1995) and Mon (1993), this meant that the plant had to comply with EPA reporting and monitoring requirements. Often, it meant that a discharge permit was required (Firetog, 1994). The key point, according to Friedman (1995), was that the plant was now in the regulatory system and subject to EPA inspections and testing, as well as other regulatory requirements. Continued discharge of a regulated waste was a violation (Ayers, 1994; Corbitt, 1995), unless a discharge permit was obtained from the appropriate environmental agency (Corbitt, 1995; Vincoli, 1993). Both the industrial plant and the responsible individual, generally the manager, could face fines and criminal prosecution (Heymann, 1994).

The environmental audit should be repeated periodically (Environmental Resource Center, 1993). A new audit monitored changing waste stream characteristics, which resulted from internal plant modifications, such as installation of different manufacturing processes or changes in raw materials (Rice, 1995). A new audit also documented continued compliance or the need to implement a compliance plan.

Data from audits should be evaluated against proposed regulations as well as current ones (Nichols, 1992; "Trends & Challenges...," 1996). The regulations continually changed, particularly those for hazardous waste, as the EPA was continually re-defining what was "hazardous" waste characteristics (Dombrowski, 1986). Repeated audits helped plants comply prior to the onset a new EPA regulation (Environmental Resource Center, 1993).

Whenever the audit documented that the plant violated established or proposed standards, the environmental manager was responsible to establish a compliance plan (Friedman, 1992). The compliance plan was a course of action that reduced the volume or strength of the waste discharge (Vincoli, 1993). Generally, this was accomplished through designing, permitting, and operating an in-house waste treatment plant (Corbitt,1995). Miller (1992), Varney (1989), and Prescott (1992) cited examples where audits uncovered environmental problems that were corrected prior to EPA legal involvement.

Tasks--Treatment

Many industrial plants were forced to treat or pre-treat their waste streams. The waste from these plants, due to the nature of the industrial processes, was too strong or toxic for receiving media (Lambolez, Vasseur, Ferard, & Gisbert, 1994). This was true even for plants discharging into a municipal system. Each municipality had the right to refuse any waste that may inhibit or harm the municipal waste treatment system (Corbitt, 1995; "Wastewater pretreatment...," 1993). According to Baratta (1993), all industrial plants emitting air pollutants were required to install their own treatment systems.

Treatment--plant construction.

When a treatment system was installed, the environmental manager's responsibilities greatly increased (Friedman, 1992). Equipment had to be selected, purchased, permitted, and then installed. Consultants and contractors had to be selected (Wiebusch, 1994). According to Wiebusch (1994), the manager needed to be involved even though the actual installation was done by others. Following construction, the manager, in the operational phase, was responsible for the actual day-to-day treatment of the waste streams.

In the construction phase, meetings with environmental engineers, consultants, and equipment vendors were held to determine the appropriate course of action (Corbitt, 1995; Wiebusch, 1994). Process and equipment selection was made (Ayers, et al., 1994). Installation and operation of pilot-scale equipment were often required to determine if the process met EPA discharge standards (Corbitt, 1995). Recommendations had to be made and approvals obtained from top plant management (Ballantyne & Gerber, 1994; Post & Altman, 1994). According to Friedman (1992), the ability to successfully communicate the operational needs of the plant to the corporate ownership is a very important task of the environmental manager.

Treatment--permits.

EPA approvals had to be secured prior to project implementation (Freeman, 1995). This was done by preparing and submitting construction permits (Vincoli, 1993). A series of meetings with the EPA were generally held to discuss details of the project. Once the permit was obtained, actual construction began. While the installation may be performed by others, it is in the manager's best interest to be involved as much as possible (Greenfield, 1995). Information obtained during construction assists the manager in comprehending the mechanics and operation of the pollution control equipment. It also ensures that the equipment is installed in accordance with the plans, contracts, and the EPA specifications.

Following construction, an operating permit is obtained (Corbitt, 1995). Start-up operations are conducted to ensure that the equipment is properly installed and that the effluent meets the EPA discharge permit conditions. The EPA inspects the plant to ensure that it has been constructed according to the permit and that it is operating properly (Freeman, 1995).

Treatment--operations.

The real task of environmental compliance begins with completion of the construction phase and the initiation of waste treatment operations (Corbitt, 1995; Freeman, 1995). Review of waste streams via environmental audits are performed periodically. Installation of new equipment is done on an as-needed basis. However, operation of the pollution control equipment is performed on a daily basis (Blumenthal, 1993).

Once in operation a major portion of the manager's time is consumed in preparing and submitting required EPA self-monitoring and in-house operational reports (Rice, 1995). Failure to maintain these records is considered a violation of the permit condition. Records that the EPA demand include, but are not limited to:

> Records of permit compliance, operational and daily records, disposal records, maintenance records, sampling records, laboratory records, calibration records, quality assurance records, self monitoring records, records and forms, notification of changes or noncompliance, calculation records, and off-site sampling and laboratory records. (Rice,1995, p.211)

Also, the manager is responsible for the storage and dissemination of these records in accordance with EPA standards (Neet 1992; McDonald & Bacon, 1993).

The manager has to address many other operational matters. A certified waste treatment operator has to be appointed (Vincoli, 1993). In many small plants, the manager serves as the operator. Training, and often certification, are needed (Rice, 1995). As the responsible person in charge, the manager who oversees the operations of others also has to become certified, (Vincoli, 1993). In addition to personnel matters, supplies have to be secured for the equipment, and maintenance has to be performed to ensure that the equipment is operating properly at all times (Smith, 1993). These daily operational and maintenance requirements demand considerable amounts of the manager's time and attention (Blumenthal, 1993).

All industrial plants that operate their own waste treatment operations have a number of monitoring, testing and reporting requirements (Firetog, 1994). Samples are gathered and analyzed in accordance with certified procedures on a routine basis. These certify that the waste has been properly treated and that the effluent does not exceed the discharge standards allocated to that industrial plant ("Environmental management...," 1995). It is the manager's responsibility to ensure that all such reports are properly prepared and submitted (Firetog, 1994).

All industrial waste treatment plants periodically experience "upsets" or episodes when the process is not working properly. According to Breton (1993), the manager was responsible to determine the cause and implement solutions. Many times, internal industrial process modifications or changes in raw materials affect the waste stream characteristics and subsequently the treatment plant operations ("EPA effort...," 1993). The manager needs to anticipate these impacts and modify the treatment plant operation to ensure that the new waste stream, which has different characteristics, is properly treated (Freeman, 1995). Reports of all plant upsets are made to the EPA (Firetog, 1994; Vincoli, 1993). Rice (1995), a compliance inspector for the Texas Natural Resource Conservation commission, stated:

> If you are having problems, such as a plant upset or spills, report these things within the required time frame....The more open you are about problems and their causes, the greater the likelihood of receiving understanding and cooperation from the government. (p.210)

If the changes in either the waste stream characteristics or treatment plant capabilities are significant or permanent, then the EPA should be notified. Rice (1995) again stated, "If any large-scale changes are planned, like a plant expansion, keep the regulators informed" (p.210). In such cases, the EPA, according to Freeman (1995), requires a new waste treatment operating permit. The potential of having to obtain a new permit was often the reason why the plant management did not want to notify the EPA.

Treatment--inspections.

A standard condition in all operating permits was that the EPA be allowed to inspect the industrial facility and its waste treatment plant (Rice, 1995). This authority to make unscheduled inspections was granted under all federal environmental acts. Thus, the manager must be prepared at any time for an EPA inspection (Environmental Protection Agency, 1991). Hawkins (1989), stated that the EPA inspection was often a harrowing and demanding ordeal for the manager.

According to Rice, (1995) "everything was fair game" as the inspectors wanted to look at "paper, people and plant" (p.211). During an inspection, the EPA not only routinely inspects the waste treatment plant, but also reviews all sampling and laboratory data (Environmental Protection Agency, 1991). According to Rice (1995), "The vast majority of problems cited by inspectors were paper problems" (p.211). The actual operator was questioned regarding operational procedures. Operational problems, such as upsets and solutions, were reviewed (Rice, 1995).

The EPA also inspects the waste generation areas of an industrial operation to see that all wastes are being treated and to determine whether additional discharge permits are needed (Environmental Protection Agency, 1991). The manager has several tasks during the inspection. The manager serves as the host and is the official representative of the plant management (Friedman, 1991). Additionally, there are the specific tasks of serving as guide, procuring documents, and answering questions (Rice, 1995). Following the inspection, the manager, according to Hawkins (1989), has several follow-up activities to complete. The manager normally prepares a summary of the inspection for management and sends any requested follow-up information to the EPA (Friedman, 1992). If problems or violations were uncovered during the inspection, then the manager is also responsible to correct the problems and provide verification of the corrections to the EPA within a specific time limit (Environmental Protection Agency, 1991).

Other Tasks

In addition to waste permitting and operational treatment duties, the environmental manager has a number of other tasks (Friedman, 1992; Nichols, 1992). According to Smith (1993), the environmental manager is expected to be the in-house expert regarding any and all matters relating to the environment and safety. The environmental manager, according to Shrivastava (1993), needs to "have an impressive technical knowledge base that needs to be mastered if managers are to deal with them (their assigned tasks) proficiently" (p.30). According to Friedman (1992), the manager is expected to communicate recommendations to management; work with plant legal staff; articulate plant environmental policy and plans to both the regulatory officials and the general public; work with other managers regarding waste minimization; prepare written documents, such as permits, contracts, and reports; and lastly, manage the operational staff.

According to Smith (1993), other safety and health related matters often are also assigned to the environmental manager. Lowe (1992) stated that the industrial plant should be viewed as a whole and therefore similar concepts should be managed together. Occupational safety and health matters (OSHA) often dove-tail with environmental concerns and thus, assigned to the manager (Friedman, 1991). This was especially true regarding the labeling, handling, and storage of hazardous materials (Porteous, 1985).

These other subject areas have been as complex and time demanding as environmental compliance. OSHA matters are themselves "...another mass of confusing, overlapping bureaucratic regulations which impose themselves upon the on-going operations of the industrial plant" (McGregor , 1992, p.49). The industrial plant is subject to OSHA inspections in the same way as it is to EPA inspections (Calmbacher, 1992). Interactions between the industrial plant and the local community regarding worker and community "right-to-know" regulations are also often handled by the environmental manager (Filo & Keyworth, 1992). The reality is that all of these additional responsibilities consume additional time and attention.

Summary

The tasks of the environmental manager are varied, complex, and extremely responsible (Friedman, 1992). Blumenthal (1993) summarized it when stating that the manager "must wear many hats" (p.72). Likewise, "There's no such thing as a typical day in this business (Blumenthal, 1993, p. 72), as each day presents a new challenge, problem, or assignment to be completed.

Conclusion

Industrial pollution control has become a part of doing business in America. Environmental regulations have mandated that wastes cannot be indiscriminately discharged, untreated into the air, water, and ground and have been expanded to regulate every type of industry. All industrial plants regardless of size must comply if they produce a waste. While many have complained about these regulations and the resultant cost of compliance, there has been no serious discussion about reducing them. Increasingly, it is expected that the EPA will be focusing their enforcement actions upon the smaller industrial plants.

Environmental compliance has become a complex, frustrating and demanding task. This has been especially true for small and medium-sized industries. Many of these smaller firms have only recently attempted to implement pollution control programs. Environmental compliance has required an effective trained workforce. It has been recently recognized, due to the complexity and multi-faceted demands of compliance, that an environmental manager is required. This environmental manager has become a key individual.

Many small plants have not had the financial resources to retain in-house environmental staff beyond operational personnel required to operate pollution control equipment. An environmental manager will be needed by many of these plants as they become required to comply with more and more of the regulations. A number of these smaller firms have responded to this situation by assigning environmental management responsibilities to an already employed line manager.

A review of the literature showed that the environmental manager's responsibilities are broad and demanding. Many professional attitudes and abilities are required to fulfill this position. Consequently, most environmental managers employed in larger plants receive their technical and professional education prior to employment.

However, many of the environmental managers in small industrial plants came from production and other supervisory assignments. As such, they did not have formal environmental compliance education. A germane question has been "What environmental competencies do these managers currently possess?".

Related Studies
Needs Assessment and Competency Analysis

Introduction

This portion of the literature review focused on current studies relating to competency analysis and needs assessment. In particular, the methodologies of performing such research were investigated. No studies on environmental compliance competencies or needs assessments were located. However, studies in other professional fields, such as the health professions, were found. These were reviewed as to objectives, style, and methodologies. That information, presented in this section, was ultimately used in the final design of this study.

Needs Assessment

Introduction

Rossett (1989) stated that needs assessment should be the first step in any strategy to increase the employee's skill or knowledge level; in other words, assessment of needs should be accomplished prior to any training or development activities. Miller (1994) defined the term "training need" as the gap between what individuals perceive as the level of expertise needed to carry out their assigned activities in an optimum manner and what they currently possess. Needs assessment is a means for identifying the gaps of "what is" and "what should be" between current and desired competencies and proficiencies (Galbraith, 1990). Nowack (1991, p. 69), stated that "True training needs are different than training wants". Thus, it is important to discern, or to know what are the workforce's true needs. Nowack continued with an important first step as "conducting a job profile", as it "can help determine the specific tasks and behaviors that are important to a particular job" (p.69). Against that standard, the current status of the workforce could be evaluated; in other words, a competency based needs assessment is needed.

Definition

Needs assessment, according to Kaufman, Rojas and Mayer (1993), is a valuable tool for identifying where you are--the current results and consequences, and where you should be--the desired results and consequences" (p.4).

A more specific definition of needs assessment according to Csete (1994) was: "a process for identifying and measuring gaps between what is and what ought to be, prioritizing the gaps, and determining which of the gaps to work on to gain closure" (p.5). This definition pointed out that: 1) some form of data collection and analysis were required; 2) "needs" were discrepancies between the current state in the real world and some defined desired state; 3) because many needs could be identified, they must be ordered for importance or value according to some criteria; and 4) the process resulted in a description of what "needs" to work on, prior to deciding how they should be worked on.

According to Guenther (1989), needs existed along a continuum from minor to monumental deficits. This determination of the nature and degree of need came from the assessment. Assessment was thus defined as the appraisal and estimation to determine the importance and size of a need.

"Needs do not show themselves. Someone must establish what constitutes a need" (Kimmel, 1977, p. 12). One definition, (Kaufman, Rojas, & Mayer, 1993), was based on the discrepancy view (the gap between actual and desired). Thus, "need" could be conceptualized many ways when establishing the desired state. It is relatively easy to collect data on the actual state, but some referent groups' opinions were the only source of "what should be" (Witkin, 1984).

Kristjanson and Scanlon (1992) referred to needs as desires, interests, or deficiencies that could be described for a single person or groups and organizations. Monette (1977) referred to both felt needs and normative needs. According to Timms (1992), real needs may or may not be congruent with felt needs. Felt needs were those that an individual perceived as a need and wanted a service without really needing it. Likewise, an individual may never express that need. Toornestra (1993) described a normative or real need as one that is quantifyable against a set standard. A third type of need is an educational need. Sork (1988), defined that as the gap between an individual's present level of competencies and a higher level required for effective performance as defined by the individual, the organization, or society. Timms (1992) referred to the same as a learning need. Others defined an educational or learning need as a deficiency that could be eliminated through a learning experience (Miller, 1994; Toornstra, 1993).

Process

Hughes (1992) stated that a needs assessment process has three phases. In the first phase, a model of the characteristics of ideal performance is developed and presented to learners so that they have a vision of this performance. In the second step, learners are provided a method of self-diagnosis to assess their performance in light of the ideal performance. In the third step, learners measure the gap between their performance and the ideal, creating a feeling of dissatisfaction or tension that would drive them to learn.

Hiebert and Smallwood (1987) stated that there are two approaches to needs assessment, the objectivist and the interpretive. In the objectivist approach, key managers are interviewed; based upon the results of these interviews, objectives to be met by the training are established. A training program is then developed and presented. According to Hughes (1992), this method is ineffective in a dynamic environment because of the rate of change and increases in technology as the training needs of employees rapidly change.

If managers were the only source of data in a dynamic environment, only some of the employees' development needs would be met--those that line up with management's perceptions. In comparison, most authors contended that individual employees are the best source of data concerning their individual training needs; therefore, they should be included in any needs assessment (Byrant, 1988; Waidelich 1995).

In the interpretive approach, according to Hiebert and Smallwood (1987), information concerning employee training and development needs is obtained from several sources, including the employees themselves. This information is then interpreted, and a training program to meet these perceived needs was then developed and offered. This methodology relies on primarily subjective input. Objective, quantify able results are more desirable according to Hughes (1992). A combination of the two (the objectivist and the interpretive), known as the integrative approach, is superior to either (Hiebert & Smallwood, 1987).

Rossett (1989) listed four different types of information that should be gained from needs assessment. They were: determining optimal performance; determining the actual performance level; determining employees' feelings about the subject, skills, a new system, or technology; or determining the cause(s) of the problems.

Techniques

Rossett (1987) noted that a variety of techniques exist for determining individual training needs. They include: review of extant data, interviews, observation, focus groups, and questionnaires. Jones (1994), referred to the same combination in his methodology review. Timms (1992), in her study on gerontological nurses, examined critical incident response to determine training needs. Opinions of supervisors, administrators, and experts and specialists in relevant content areas are also considered as good sources (Scissons, 1982; Betz, 1984; Cherry, 1987; Farley & Fay, 1988). However, original sources, appear to be the most commonly used by most of the researchers.

One problem discussed by Timms (1992) and Byrant (1988), among others, is the reliance on data provided by individuals other than the targeted person or group who are to receive the education or training. Baptise (1992), stated, "All too often needs are identified by others than those who have the needs and consequently inappropriate training is imposed" (p.45). Anglin (1986) and Knox (1986) stated that incorporating the learners in the needs study enhances their involvement and learning. Henretta, McCellan and Swanson (1984) documented that the self-expressed needs of nurses typically were not elicited in the development of nursing training programs. While self-expressed needs may not completely reflect the total educational needs, they provide important information for program planners and should be considered along with other strategies to produce viable programs (Scissons, 1982; Betz, 1984; Cherry, 1987).

Extant Data

Hughes (1992), stated that an often overlooked source of information is the available current or extant data. Extant data is that information usually generated in the course of business, which may shed light on performance problems. This data can be found in personnel records, production records (both quality and quantity), union records, or financial performance records.

Focus and Discussion Groups

Interviews and focus groups are similar (the obvious difference being the number of subjects with whom the researcher works). Spruell (1986) described the focus or discussion group as,"ideal when the issue to be explored is vague and undefined. The group provided insights which could be to followed up with a focused survey as part of studies such as needs analyses" (p.3). Venable (1988) and Spruell (1986) stated that focus groups are often used with additional quantitative needs assessments.

Observation

Observation of the work performed by the subject often provides insight into a deficiency. The format consists of a trained observer's watching employees as they perform assigned tasks. However, this is extremely time consuming according to Hughes (1992). Data generated often relates to time and motion, the work flow, or a particular work process. Byrant (1988) stated that observation's main advantage is that it focuses on job-related skills and behavior, instead of job knowledge or attitudes.

Interview

According to Jones (1994), interviewing is the most prevalent tool in training needs assessment. Jones (1994) suggested that it is important for the researcher to prepare for the interview. The interviewer needs to understand the vocabulary and terms of the profession, follow a script, and schedule the interview at a time convenient for the subject.

Survey

Written survey instruments, questionnaires, are often used to gain responses from large samples. Spruell (1986) stated that written questionnaires should be used to determine employees' opinions concerning training and development opportunities, to gain information about broad, quantify able data that is not sensitive.

Although Rossett (1989) stated that standard sampling techniques should be used to determine development needs, she advised caution. Despite the fact that representative samples may be used to survey larger populations, in many cases, the population should be the sample. The reason for this is that individual needs vary greatly from level to level, and from organization to organization. For example, Wagner-Westbrook (1989), determined that there were significant differences among the training needs of managers at varying ages, position titles, and lengths of tenure in their position. However, many researchers have concluded that surveys were still the best overall tool (Bryant, 1988; Guenther, 1989)

Combination

Venable (1988) contended that best results were often obtained when a combination of two or more of these techniques were employed. For example, questionnaires could be combined with focus groups or individual interviews.

Cameron (1988) identified the following disadvantages of relying solely on self-perceptions of potential learners in needs assessment: 1) people generally tend to indicate needs in areas in which they already have some area of expertise, and 2) it is inappropriate to ask individuals who supposedly lack critical knowledge or skills to function as accomplished practitioners to set criterion levels and assess competence. Cameron viewed this as analogous to asking people with limited knowledge to diagnose their own illness and select an appropriate treatment.

Spruell (1986) provided an additional perspective on the benefits of using a combination of techniques. When asking sensitive or exploratory questions, he recommended that two techniques be used in tandem. For example, the written questionnaire (with forced choice items) and the face-to-face interview (in which open-ended questions are asked) are combined. After the questionnaires have been completed and the results tabulated, a small portion of the sample is selected for interviews. During the interview, the results of the questionnaire serve as the springboard to initiate the discussion.

Unevenly Practiced and Under Researched

Although the importance of needs assessment is undisputed, Csete (1994) stated that it continues to be one of the most inconsistently practiced and poorly researched areas within the human performance technology field. According to her, a person may be familiar with available techniques, but unable to conduct one effectively. Needs assessments suffer because people experienced a variety of obstacles when trying to conduct them (Rossett, 1990).

According to many authors, much of what has been written about needs assessment in books, articles, and courses has become remarkably hard to implement in actual situations. As a result, needs assessments are often not well done or skipped entirely (Wanamaker, 1986; Witkin, 1984). Rossett (1987) stated, "While the professional literature abounds with exhortations to do needs assessment, it is short on prescriptions for how to do them" (p.68, emphasis in original). Waters and Haskell (1989) concurred by noting that while educational needs assessment literature is abundant, the tools and methods for the process are less abundant. Consequently, the art of conducting a needs assessment is considerably behind the science (Cross, 1979). To date, there has been no "proof" that needs assessment produces valid and reliable results (Burton & Merrill, 1991). Thus, in summary "Despite the best of intentions, needs assessment is still more a goal than a reality" Csete, 1994, p. 46).

Even worse, Csete (1994) stated that the results of the needs assessment are seldom used. A search of the literature revealed few incidents where the results were actually applied. Although the literature supported the idea of conducting formal needs assessments as a prerequisite to planning programs, Timms (1992) found in her research that few program planners actually conducted them.

The information gathered in a needs assessment is often not applied (Benjamin, 1989; Wanamaker, 1986). Csete (1994) identified several factors that hinder utilization. Local politics could seriously curtail what data may be collected and the types of problems and solutions that may be chosen (Sarthory, 1977). Organizations often are not willing to supply the resources to conduct a needs assessment or implement the results (Rossett, 1990; Witkin, 1984). Even a well-funded and supported needs assessment often suffers from the communication gap between the needs assessors and the policy makers who could use the results.

Another factor, according to Csete (1994), is that existing models contained weaknesses when it comes to making the leap from theory to practical application. Many models skip or gloss over important steps, such as how to report results and measures or how to encourage application of the results (Wanamaker, 1986). Other models are highly theoretical and lack explicit "how-to" advice for conducting needs assessments (Rossett, 1987; Wanamaker, 1986).

Models

Most models fall into one of four groups based on their approach to identifying needs: discrepancy, democratic, analytic, and diagnostic (Stufflebeam, 1985). Each group possesses distinct strengths and weaknesses.

According to Stufflebeam (1985), the "discrepancy view" is the most widely used. It defines a "need" as a gap between the desired and actual performance. Because the discrepancy view emphasizes measurable data, it relies too heavily on available data sources, such as tests, without questioning their validity. Others criticized the discrepancy view for overemphasizing the size of the gap at the expense of smaller gaps that may be more important (Witkin, 1984).

The "democratic view" defines a need as something that the majority of a particular group desire. Although the democratic view tends to involve many peoples' perspectives and promote positive public relations, the "needs" identified are dependent upon how well informed the people are. Many of the needs turned out to be preferences that would not lead to substantive change.

The "analytic view" defines a need as "the direction in which improvement can be predicted to occur, given information about current status" (Stufflebeam, 1985, p.8). This future-oriented view asks questions as, "What skills must our graduates have to compete successfully in the work setting?" (Stufflebeam, 1985). The goal is to establish broad goals for improvement. It requires highly skilled contributors and often results in abstract goals difficult to implement.

Finally, the "diagnostic view" defines a need as something that when lacking causes harm--and when present is beneficial. This view tends to emphasize basic survival needs because it is difficult to determine the causes of more complex needs.

The methods used for a needs assessment vary depending upon the model chosen. The discrepancy view of needs assessment is the most popular in workforce analysis (Mager & Pipe, 1984; Herman 1991). Even among these well-known discrepancy models, there is disagreement on terminology, major emphases, and precise starting and ending points.

Task And Competency Assessment

Competency assessment is a specific type of needs assessment. In the discrepancy model, a need is viewed as a gap between what is and that which is desired, and relies upon measurable data. The gap, in this case, is a competency required to perform a task. Normative needs, as previously described by Monette (1977), constitutes a deficiency or gap between a desirable standard and the standard that actually exists, in other words the ability to perform a task. Finally, competency assessment is also related to learning needs as defined by Cooper (1983) in that they are generally performance gaps that training or education could overcome.

Relating to competencies, Scissons (1982) stated that discrepancy needs refer to those activities important to individuals but in which they are incompetent. A discrepancy need thus, includes both relevance and competence, but does not include the motivation component. In contrast, a derived need includes all three need components: competence, relevance, and motivation.

Witkin (1984) discussed competency needs assessment at two levels. The primary needs level resides in the individuals who are actual or potential receivers of the educational or training benefits. The secondary level is the institution, agency, or organization. Further, "at the individual level, the needs of students or clients or members of a community are assessed. At the organizational level, the needs of the agency or school system or government body and its resources, delivery systems, and personnel are assessed" (Witkin, 1984, p.6). The assumption is that an increase in the capability of the individual would benefit not only them, but also the organization.

According to Miller (1994), a competency assessment is a process that essentially follows the same format as a conventional needs assessment. Thus, the steps are: 1) identification of the specific activities where gaps exist. (This implies that a valid list of required competencies is available.) 2) next, the gaps were prioritized; and 3) the highest priority gaps were selected for training action. Miller's (1994) approach was unique in that he prioritized the competencies or gaps, based upon the amount of harm that would most likely result from inadequate performance of the activity. All of these approaches to competency analysis and training needs are similar to the perceived differences approach to training needs suggested by Seppala (1978) and Breitler and Phillips (1982). These authors proposed that needs analysis, and in particular competency training, should focus on the differences between a worker's present level of ability to carry out job activities and the level of ability needed to carry out those activities at some specified quality/ quantity standard.

Competency Identification

The first step is the identification of competencies. According to Baptiste (1992), competency development usually includes identification and definition of competencies (skills and knowledge) and behavior indicators or illustrators of what a person should be able to do or demonstrate. Thus, Baptiste (1992) stated "A discussion of the definition of competencies must precede the delineation of competencies" (p.37). Harris, McIntyre, Littleton and Long (1985) also noted, "Because professional competencies tend to be very complex and the outcomes may be difficult to describe clearly, efforts to specify such competencies must be carefully undertaken and subjected to critical review before being finalized" (p.81).

In established professions, the identification of competencies is much easier than in new or rapidly changing professions (Baptiste, 1992). Jones (1994) studied the safety profession and found that because of its newness, there is confusion as to required competencies. Baptiste (1992) reported the same in her study on childcare administrators, a relatively new profession that has not established many formal rules and regulations.

<u>Types</u>

Waidelich (1995) stated that competencies must come from the employer. Each occupation tends to develop three types of employer-verified competencies. They were:

1. Academic competencies--The knowledge necessary to prepare for and secure a career, facilitate lifelong learning, and assure success in a global economy.

2. Employability competencies--Those personal development and leadership abilities essential for increased productivity, economic self-sufficiency, career flexibility, business ownership, and effective management of work and family commitments.

3. Occupational competencies--Those technical abilities used to perform required workplace tasks, including problem solving and critical thinking. (Waidelich, 1995, p. 19)

Heard (1994), identified several different types of competencies. According to him, the three most important are: 1) cognitive-based competencies, 2) affective competencies, and 3) performance-based competencies. Cognitive-based competencies are those that identify the knowledge and intellectual skills and abilities that the individual entering the profession must develop. Affective competencies are those that defines the values and attitudes employed in the profession. The psycho-motor skills and actions constituted the performance-based competencies.

Methods

A variety of methods have been utilized to determine which workplace tasks are performed. A number of these procedures have also been used to establish task importance. Competency has also been studied with these same procedures.

Delphi method.

The Delphi method of inquiry was used in many studies to establish competency lists. Naas (1990), in a two-round Delphi procedure, utilized an expert panel of 24 construction superintendents to validate a list of competencies obtained from the literature. Johnson (1990) used a jury of 15 experts with proficiency in maintenance departments and operations in his study of training maintenance supervisors. A focus group of 12 experts refined a list of 33 secretarial competencies from an initial list obtained from the literature in a four-round modified Delphi technique (Ewing, 1991). Heard (1994) utilized 30 individuals in a modified Delphi study to develop a workable list of 58 competencies for management of family practice medical centers.

Some researchers used a smaller number of experts to validate competencies. Morris (1986) used only six, and Sleezer (1990) had three experts evaluate the content and face validity of her competency list. Nine experts were utilized by Saeed (1994). Timms (1992) relied upon the expertise of five gerontological nurses in developing her list of skills. Pierson (1993) used a nine-member panel with the members taken from four different career fields.

Professional experts.

Guenther (1989) stated that having professionals generate or respond to task lists was a valid means to obtain information on current job task competency requirements.

According to Guenther, the interview is the most appropriate means to obtain that information. He subsequently interviewed 15 correctional officers to validate the competencies he had previously identified from the literature. Essentially Miller (1990) utilized the same process in her study of small Illinois businesses. She interviewed a jury of six marketing experts to develop an initial list of marketing competencies. Next, an intensive review of the literature was undertaken to confirm these competencies. A second panel then reduced this list to a manageable number of competencies that the survey audience could rate within a 15-minute time period. Rojanniti (1990) concluded her research with the statement that greater emphasis should be placed on using interviews to obtain a better grasp of the subjects' capabilities and needs.

Observation.

Observing the individual in the workplace is also a valid means of documenting competencies. Jones (1994) stated that, while observation was not used as much as other means, its use should be encouraged. According to Rossett (1987), observation allowed the researcher to visualize the tasks and its component steps. He continued that observation often allowed a more truthful evaluation than interviews and survey. Kuhne (1991) spent five days with each of five subjects observing his actions to prepare a task list of competencies. Timms (1992) stated that both interviews and workplace observation are among the best sources of information about nursing staff responsibilities.

Literature review.

Twenty-five research studies were located in which the literature review constituted a key step in generating the competency list. Worker environmental and occupational health and safety competencies were determined solely from the literature by Felitti (1990) in her study on training needs. Traits and behaviors of successful food service managers identified in the literature served as the initial list for a modified Delphi review consideration (Dawson, 1991). Hale (1992) documented training competencies that were first identified in the literature with an expert panel of academics, employers, and practicing training managers.

In addition to research literature, vocational and trade journals are an important source of information regarding present tasks performed within a profession. Womble (1992) researched computer trade magazines to determine competencies in that field. Speech-language pathology research literature and vocational journals were the only sources that Rupp (1995) used to prepare competency skill lists.

Combination.

Information from the literature review was occasionally supplemented with interviews or workplace observation. Aukerman (1991) used both interviews and observation to confirm competencies identified in the literature. Earshen

(1995) concluded that literature review, document analysis, intensive interviews, and site visits are valid means of staying current with present task requirements for entry level managers.

Competency validation also ran in the opposite direction. Many researchers used the literature review to confirm the validity of tasks obtained from an earlier workplace analysis. Zirbel (1991) validated a list of identified tasks with a literature review in his study on the competency level of manufacturing engineering technologists. In that study, a panel of experts prepared an initial list of 37 tasks. Zirbel then searched the professional and trade journals in the field. He not only located literature that verified all of the listed tasks, but also found an additional 13 tasks. The explanation for the additional tasks was that many of them were site or job specific. Individuals interviewed or observed on the job would be familiar with those tasks that they utilized in their own specific location. Thus, a literature review was essential to identify the whole spectrum of tasks that individuals performed in separate functions or locations.

Number

The number of competencies listed in various studies ranged from 7 (Combs, 1992) to 288 used by McCabe (1991) in her study of family early intervention practitioners. The majority of studies utilized between 50 and 100 competencies.

Some researchers found that they had an unmanageable competency list. Heard (1994) initially had over 38 pages of potential tasks and competencies for management of a family practice medical center. Overly lengthy lists of competencies tended to reduce the response rate. McCabe (1991), who used a list of 288 competencies, had a response rate of only 23%. Miller (1990) had a difficult task of reducing a list of 256 competencies to under 100. Miller stated that subjects would not be willing to take more than 15 minutes to evaluate a competency list. He considered the amount of time adequate.

One approach to reduce the time required or the subjects' confusion is to group competencies into categories. The subjects then evaluate the categories, rather than the individual tasks, as relevant or not. Nixon (1990) utilized this approach in determining the competencies of superior middle managers. Deluca (1995) found that survey subjects were more comfortable evaluating seven clusters of administrative competencies rather than 62 specific tasks. The study subjects were provided information on the specific tasks within a cluster, but were told that they did not have to evaluate the individual tasks, only the cluster.

Task cluster evaluation is also done when there could be confusion and uncertainty as to the reviewer's ability to relate to a specific task. A task might be relevant, even important, to individuals at one location due to the specific requirements at that location, but not relevant to other members of the profession at another location due to site-specific factors. Queitzsch (1993) undertook a needs assessment of rural science teachers. A total of 53 task competencies in seven categories was established. It was found that, while all the individual tasks were relevant to some of teachers, not all of the tasks were listed by all of the subjects. However, all seven categories were valid. The conclusion was that while all teachers were teaching science, not all were teaching the same subject. Teachers in separate subjects require different knowledge domains and field and laboratory skills.

Broader categories or clusters are a better indication of required skills than specific tasks. Lasater (1994) divided 70 vocational administrators' competencies for program reviews into 11 categories, which then served as the basis for the study. The study subjects evaluated these 11 categories rather than the 70 specific tasks, as they were more broad based and easier to understand.

Critical Competencies

Both Guenther (1989) and Waidelich (1995) stated that some competencies are of higher importance to the employer than others. For example, some workers may spend larger amounts of time on some competencies than others. Miller (1994) stated some are more important because of the harm that could result from inadequate performance. Jones (1994) classified those competencies that require some training and education as more "critical" than others.

According to Heard (1994), it is important to differentiate between "must have" and "should have" competencies. "Must have" competencies are those essential to the profession, while "should have" skills are those desirable, but not currently essential. Knowing which competencies are of major importance and require a large amount of time, assist educators in setting priorities (Waidelich, 1995). Earshen (1994) stated that this was especially true in the 1990s with its rapidly changing and evolving competency demands. Thus, the first step, as stated before, must begin with identification of workplace competencies. The next step is determining whether or not a particular competency is important.

Determining the level of importance is necessary for successful education and training programs. The lack of time and resources often prevents educators from developing competencies in all occupational aspects. Again, the workplace is the most logical place to identify important competencies, those needed by incumbent and new workers (McCracken & Yoder, 1987).

Most researchers used a two-step method to develop competency lists and identify the most important competencies. First, from various sources such as a literature review, valid lists of competencies for the respective occupations were prepared. Next, surveys or other research means were undertaken to verify the validity of these lists and, if possible, to determine the ranking of the competencies.

However, not all professions have job tasks that can be ranked in order of importance (Baptiste, 1992). Waidelich (1995) reported that while safety tasks rank higher in importance than other agricultural competencies, there is no way to rank specific safety tasks, as each is vitally important at a set time. Timms (1992) found the same in her study on competencies of gerontological nurses. Likewise, Jones (1994) reported the same in his study on safety personnel. The timeliness of the task performance establishs the importance of the task. In these situations, the conclusion was that to be considered competent, a degree of competency is required in all the tasks (Jones, 1994).

The majority of professions have identifiable competencies that could be objectively studied, listed, and ranked. As Waidelich (1995) pointed out since some competencies are of higher importance, workers spend larger amounts of time on them than on others. Thus, a discussion of various means of establishing priority ranking is relevant.

Task importance

The most obvious and common factor is the importance of the task in determining the critical nature of the competency. Generally, this factor is determined by questioning the employer (Miller, 1990). Another valid source, according to Hughes (1992), are experts knowledgeable about their profession. Lastly, the employees are sometimes considered qualified to address the subject (Baptiste, 1992; Csete, 1994; Jones, 1994; Timms, 1992). Waidelich (1995) stated that "...expert workers are as qualified as anyone to understand the significance of their tasks" (p.50).

The information was generally obtained through the use of a closed Likert scoring system. The resultant score would be totaled and averaged to provide a quantitative summary as to the task significance (Roudebush, 1987). This score could then be compared to the score of other competencies and a numerically ranking of tasks prepared.

Relative time spent

The relative amount of time spent on any particular competency has been a popular method of determining essential competencies. Employers and employees both are logical sources to identify the relative time spent on various competencies by incumbent and new workers (Hater, 1992).

Most researchers used one of two methods to identify the relative time spent on competencies. One was direct observation by the researcher (Woolsey & Bula, 1973). The other was a questionnaire method suited for large surveys (Hayton & Loveder, 1992).

Frequency

Frequency analysis is similar to relative-time spent. Instead of actual time spent on a task, the number of times it is performed is evaluated. The assumption is that commonly performed tasks are more important. Frequency was determined by marking a Likert-type scale. Bryant (1988) and Guenther (1989) used a five- or seven-point scale. Others have used a simpler three- point frequency scale (Hater, 1992). The three options were: a) never, b) frequently, and c) constantly.

Many researchers have used the frequency approach to identify competency requirements (Baptiste, 1992; Impara, 1993; Timms, 1992; Toornesta, 1993). Often times, the subject was asked to rate the importance of the task along with the frequency. The numerical means of both the frequency and importance were reported and provided a basis for establishing the importance of the competency.

Several researchers have reported little relationship between the importance of some competencies and either relative time or frequency. Woolsey and Bula (1973) analyzed the tasks that industrial supervisors actually perform. The authors reported no real correlation between frequency of tasks actually performed and their reported levels of importance. Miller (1990) reported the same in her study of small business owners, as did Jones (1994) in his study of safety personnel. Jones (1994) concluded that while time and frequency may be relevant to manual or factory positions, it was not for professional tasks. Professional tasks may be done only infrequently, but must be done properly and correctly. When referring to professional tasks, Waidelich (1995, p, 30), contended there was "...not a real correlation between frequency and reported level of importance."

<u>Harm</u>

Miller (1994) developed a model based upon a harm factor. Stufflebearm (1985) included harm as a type of the diagnostic needs assessment model. According to Miller (1994), in some professions, such as law enforcement, a lack of proficiency in certain tasks could result in harm to the individual or the organization. These then are the essential competencies and the ones that training programs need to be directed towards. Thus, in summary, he believed that harm needed to be addressed, as well as other factors, in establishing the critical competencies.

As a result, Miller (1994) included questions regarding harm in his survey of rural sheriffs. He established a formula for including the harm factor along with all the other conventional ones, such as time spent in the task, competency gap, and proportion of workforce needing the training. The result was a formula for calculating a competency's priority score: "P = T + 2H + 3G + 3R, where P = priority score, T = time score, H = harm score, G = gap score, and R = proportion score (Miller, 1994, p, 36).

The above equation provides the training needs priority for the purpose of Miller's study. It is consistent with the contention of Mattimore-Knudson (1983) and Sork & Buskey (1986) that contextual circumstances and focusing procedures are required to expand the practical utility of needs assessment.

Combination

Most researchers utilized a combination of factors to properly analyze professional competencies (Bratkovich, 1991; Guenther, 1989; Hughes, 1992; Jones, 1994; Miller, 1994; Timms, 1992). Hater (1992) used two factors--importance and relative time spent--to determine the competencies critical to a job. This allows for an effective method of determining the critical (core) competencies for instructional purposes. Woolsey and Bula (1973) also used this two-dimensional profile in determining core competencies. Mattimore-Knodson (1993) and Sork and Buskey (1986) both stated the logic that a rank ordering of training needs based solely on the magnitude of the performance gap is deficient in that it ignores the importance to the job of the activity in which the gap exists.

Proficiency

The goal of most competency surveys is to determine an individual's proficiency in performing a task. Schrick, (1992), stated that a goal of needs analysis is to establish the individual's degree of expertise. Once this is decided, then training needs can be determined.

In contrast to identifying competencies, the employees themselves are the individuals best qualified to assess their own capabilities regarding a particular competency (Grantham, 1991; Wan, 1991). However, some researchers felt that supervisors and other experts should be consulted, as they are objective observers of an individual's proficiency (Wright, 1991).

Generally, the information was obtained through a Likert-type scale rating (Roudebush, 1987). This allowed a comparison of proficiency between individuals or groups. Often times information was also obtained on demographic factors, such as age or educational background, in an attempt to assess influences on that proficiency (Baptiste, 1992; Grantham, 1991; Miller, 1990; Richardson, 1991; Timms, 1992).

Competency Assessment Instruments

In the literature, studies containing several different types of research instruments for employee competency evaluation were located. Some were developed and utilized to establish professional training or educational needs. Others documented current workforce competency levels. Several were used to develop task competency lists in professions where such an identification had not been previously undertaken. Regardless of their ultimate use, all these instruments were developed to obtain information about workplace task competencies or to determine the current workforce competency level. All were designed to be completed by either experts knowledgeable in the profession or individuals employed in the field.

A review of these studies has been included as they illustrate valid competency assessment instruments. All of them utilized the closed question format. The respondents were not allowed to write out their opinions. Rather, they either checked or circled the written response that most closely approximated their opinions. A 5- or 7- point Likert scale was most commonly used. One researcher preferred a 4-point scale to avoid the middle point. The number of competency statements in these examples ranged from 38 to 221. The majority of the authors separated competencies into common categories.

The most common and simplest form of competency instrument was that utilized by Wolfson (1986) in identifying agribusiness leadership competencies. They were grouped under common categories. The reader was asked to circle on a 7-point Likert scale the number that most closely paralleled their opinion of the competency that a leader must possess, with choices from one (nonessential) to seven (essential).

Waidelich (1995) expanded this basic concept. He asked subjects to rate their perception of the importance of various agricultural tasks. In addition, he asked them to also indicate the amount of time spent on the task. Biwot (1988), in his study on competencies of adult educators, utilized the same approach, with the exception of using a 4-point Likert scale (not, low, average, and major) and 3-points for time (small, medium and large).

Bratkovich (1991), in his study on competencies of Ohio sawmill operators, included a 5-point Likert scale rating for required knowledge and perceived importance. Toornstra (1993) created a two-level, five-point scale to assess an individual's competency. The goal was to have the subjects comment on both their current level of competency as well as their desired level. The difference in the ratings provided a numeric level of desired training need. Regarding training needs, Bryant (1988) directly asked the subjects to circle the Likert number that indicated the amount of training that they felt would be helpful. Their scales were 3-points for the importance to the job and 5-points for the amount of training desired.

Guenther (1989) asked correctional officers to identify competency tasks and training needs in a four-tiered approach on a 7-point Likert scale. In addition to importance and time factors, he asked the subjects to rate their perception of responsibility level and need for training.

Miller (1994) conducted an analysis of training needs for rural Oklahoma county sheriffs through a 7-point Likert scale. Because of the uniqueness of the profession and the potential harm that could result from improper training, he developed a slightly different competency identification instrument. He asked the normal questions relating to amount of time and size of gap, referring to the individuals' self-perceived gap in training. He also asked respondents to rank the task according to the harm that would result from the lack of this competency and to what proportion officers felt they needed this competency.

In summary, numerous models of various competency assessment instruments exist. These have been successfully developed, validated, and utilized in competency analysis of other professions.

Environmental Competencies

Many competency studies were located. However, no studies on environmental managerial task competency were found. Likewise, no studies dealing with an individual's environmental proficiencies were located. However, studies focusing on identification of competency task lists in other professions, most notably the health profession and personnel were located and studied.

The most closely associated research was that completed by Felitti (1990) and Chung (1991). Both studies dealt with environmental health and safety topics. However, they did not deal with industrial environmental compliance. Another closely related work, one that contained considerable detail on competency task list development, was done by Miller (1990). His focus was on marketing competencies considered essential for the operation of small businesses with fewer than 20 employees. Those businesses were located in Illinois. Earshen (1995), Krueger (1992), and Pless (1995) researched competencies of industrial supervisors and managers, but environmental compliance was not among the topics covered. Competency task lists for other professional and vocational areas were developed by other researchers. These included a list by Baptiste (1992) of competencies for early childhood program administrators, an area similar to that of environmental industrial managers in that there have been no recognized educational or training programs for them. Jones (1994) developed a list of required competencies for injury control professionals, a new profession, as is industrial environmental management. Guenther (1989) completed an excellent study on training needs of correctional officers. Nelson (1995) examined the holistic range of competencies required by safety professionals. Other professions, outside of the educational field, for which competency lists were found, included gerontological nurses (Timms, 1992), landscape architects (Yakimovicz, 1995), long-term care nurses (Kessler, 1989), paraprofessional health care givers (Van Fleet, 1994), commercial construction superintendents (Naas, 1990) and aerospace industry metal workers (Walo, 1995).

<u>Summary</u>

A review of literature relating to needs assessment and competency analysis was undertaken to understand how best to design and implement the study. No studies on environmental compliance competency in the industrial field were located. However, the literature was ripe with studies documenting training needs assessment in numerous other professions. Information and design models in these studies were studied and incorporated into this research.

CHAPTER III
RESEARCH QUESTIONS AND RATIONALE

Statement of the Problem

What is the current level of industrial environmental management performance, attitudes, competency and educational needs of environmental managers employed at small industrial plants?

Research Questions

Question #1:

What environmental compliance and management tasks are performed by these managers?

Question #2:

What are the managers' attitudes towards environmental regulations, industrial compliance, and their environmental responsibilities?

Question #3:

How important do these managers rank various environmental management tasks and what level of competency do they currently have in performing them?

Question #4:

Do environmental managers desire additional education and training in these tasks?

Rationale

These questions have been arranged in a logical sequence. A collation of the answers to the four research questions provide a complete understanding of the tasks and responsibilities, attitudes towards, competency level of, and need for training by environmental managers in small industrial plants.

All four research questions were answered from information obtained from a self-developed mailed survey instrument. The subjects were environmental managers at small industrial plants located in Peoria County, Illinois.

Research question #1 focused on which activities and tasks the environmental managers in these small plants actually performed. This was an essential starting point as no comprehensive relevant list was located in the literature. Individuals' competency and need for education were predicated upon their actual work assignments and responsibilities.

Answers to research question #2 determined what attitude these individuals had toward their environmental responsibilities in particular and environmental issues in general. Individuals' attitudes influenced their commitment and dedication to the work they performed. Survey questions related to research question #3 allowed the subjects to rate the importance of various environmental management tasks.

It has long been understood that educational programs are well received only when the participants recognize the need for such education. Thus, this study concluded with obtaining the subjects' self-perceived levels of environmental competency and their need for education, research questions #3 and #4. The subjects were asked on a 5-point Likert scale to rate their competency and educational desire on a variety of environmental tasks and responsibilities.

In conclusion, the research questions provided information regarding what tasks were performed, as well as an understanding of the managers' attitudes about them. Next environmental managers' self-perceived competence and their educational needs were surveyed. The results provided an understanding of the small industrial plant environmental manager's environmental compliance tasks and competence.

CHAPTER IV
RESEARCH PROCEDURES

Introduction

Research was defined by Fetro (1991) as the process of discovery seeking to explore, describe, and explain things. The purpose of scientific research was to contribute to theory, explain phenomena, and add to a body of knowledge. This study contributed to the body of knowledge related to environmental management at small industrial plants. This chapter describes the design and the logic and principles that guided this research and the data collection.

Type of Research

Fetro (1991) defined research design as the plan that gave direction to the process of research. This research described the tasks performed by and the competencies of industrial environmental managers employed at small industrial plants located in Peoria County, Illinois.

Methods

The primary research method in this study was the mailed survey. Two different questionnaires were developed and used. The first survey, conducted as a preliminary step, validated a previously compiled list of environmental management tasks. This was accomplished by asking environmental managers, employed at large (greater than 100 employees), industrial plants in Illinois to identify tasks they considered important and which were performed on a routine basis. That information was then used to develop the environmental management task list. This task list and other information obtained from this survey were tested in the final research instrument.

The next step was the development of the research questionnaire. A mail survey instrument was prepared and approved by the Doctoral Committee as well as the SIU-C Human Subjects Review Committee. It was pilot-tested and those results were incorporated into a revised questionnaire.

The final instrument was sent to the entire population of 114 managers employed at the industrial manufacturing plants of less than 100 employees, which have an SIC Code of 3000 to 3999, located in Peoria County, Illinois. Information about the environmental compliance status of the plant was obtained. In addition, the managers provided information on their environmental responsibilities, as well as their self-perceived level of environmental management competency and desire for education.

A condensed follow-up and telephone survey questionnaire were also developed. Their purpose was to obtain information from non-respondents to incorporate with the information obtained from those who completed the initial full length instrument.

Population and Sample

Introduction

Central to this study was the concept of environmental management practices at small industrial manufacturing plants. Thus, the terms "industrial manufacturing" and "small" were defined, and a study site selected in accordance with the following procedures.

Industrial Manufacturing

For this study, the term "industrial manufacturing" was defined with the use of the Standard Industrial Classification (SIC) System. The SIC system assigns a unique identification number to all industrial plants based upon their products. The Standard Industrial Classification Manual (1987) defines "manufacturing" as the "mechanical or chemical transformation of materials or substances into new products." All manufacturing plants were placed in Division D of the SIC Code and assigned a number of 2000 to 3999. Due to the broad scope of various products and industrial activities, Division D for "manufacturing" was divided into two major classes 20-29 and 30-39. Major groups 20-29 focused on food, housing, and petroleum refining. Major groups 30-39 contained the more traditional industrial manufacturing categories.

The 1996 Illinois Manufacturers Directory, from which the actual population was taken, described "manufacturing industrial plants" as firms with SIC major codes between 30 and 39. This study utilized this definition. Table 1 describes the industrial activities and products of plants with SIC major codes of 30 to 39. Within each major SIC group, a 4-digit SIC number identifies the specific type of industrial activity conducted at a particular site.

Small Size

The population for this study was further defined to include only those industrial plants with less than 100 employees. The U.S. Department of Commerce defined "small businesses" as those firms that "have less than 500 employees" or "less than 5 million dollars in annual business." For this study, these figures were inappropriate. According to the literature, the majority of all manufacturing plants in the United States have less than 100 employees. Environmental problems confronting small plants are different than those of large industrial facilities. A plant with over 100 employees generally has resources for funding an active environmental program with a full-time environmental staff.

In contrast, most small plants had neither the funding nor trained staff. Very little was found in the literature describing environmental compliance practices for such plants. Thus, a small industrial plant was defined as one with fewer than 100 employees.

Location

Criteria

A wide assortment of census data and other demographic information has long been accumulated and recorded based upon the geographic unit of the "county". By utilizing a

Table 1

SIC Codes 30 - 39

Major Group 30	Rubber and Miscellaneous Plastic Products
Major Group 31	Leather and Leather Products
Major Group 32	Stone, Clay, Glass, and Concrete Products
Major Group 33	Primary Metal Industries
Major Group 34	Fabricated Metal Products, except Machinery and Transportation Equipment
Major Group 35	Industrial and Commercial Machinery and Computer Equipment
Major Group 36	Electronic and Other Electrical Equipment and Components, except Computer Equipment
Major Group 37	Transportation Equipment
Major Group 38	Measuring, Analyzing, and Controlling Instruments; Photographic, Medical and Optical Goods; Watches and Clocks
Major Group 39	Miscellaneous Manufacturing Industries

single unit such as a county, a number of small industrial plants with variable SIC codes could be included. Several criteria were examined in selecting the county. First, the county needed to be known as an industrial area; however, the number of industries should not be so large as to make the study unmanageable.

Second, the types of industry was also important. A mix of both "heavy" (SIC classification 3300, 3400, and 3500) and "light" (SIC codes 3000, 3600, 3800, and 3900) industries was required. The older style of "smokestack" or "heavy" industrial plants generated much more pollution and subsequently, required more environmental compliance activities. Light industries produced less waste and were less regulated by the EPA.

Peoria County, Illinois

Peoria County, Illinois, was chosen as the study location. Based upon 1990 census figures, Peoria county had 182,827 individuals (U.S Census Bureau, 1993). The city of Peoria has had a long history and reputation as an industrial town (Peoria Area Information, 1996). Located on the Illinois River midway between Chicago, Illinois, and St Louis, Missouri, Peoria has been a center of commerce and manufacturing since its earliest days. The first commercial farm tractor, the "Avery", named for an industrial section of the city was manufactured there. The first automobile, the "Duryea", was initially assembled in Peoria. Caterpillar Tractor Company was founded and remains there, today employing over 17,000 individuals. Seventeen other firms, each employing over 500 employees, are located in Peoria County.

Because of these large firms, a number of support or "jobber" industrial plants with SIC codes 3300, 3400, and 3500 are also located in Peoria. In addition, according to the Downstate Industrial Manufactures Guide, a number of modern light industries producing plastics, telecommunication equipment, and other modern industrial products have also located there. Thus, a "good mix" of industries by size and product was found.

Study Population

According to the 1996 Illinois Manufacturers Directory, a total of 239 manufacturing firms with SIC codes between 3000 and 3999 were located in Peoria County. Out of this total, 118 (49.3%) had less than 100 employees.

During the study, it was found that ten of these 118 firms were no longer in business, but six new firms meeting the study criteria had replaced them. Thus, the total population for this study became 114 industrial plants. A list of these 114 firms with their size and SIC code is presented in Appendix A.

Analysis by SIC code.

An analysis of the 114 subjects was undertaken. All SIC Code manufacturing categories, with the exception of 3200, leather and leather goods, were represented. Table 2 describes the number of plants in each SIC code.

In summary, industrial plants in all but one SIC code category were represented. The predominate concentration occurred in "heavy" industrial categories. However, there was also a number of "light" industries. This allowed a comparison of environmental compliance practices among manufacturing processes.

Forty-seven (41%) of all plants were in SIC categories, 3500 (Industrial and Commercial Manufacturing), and 3400, (Fabricated Metal Products). The high percentage of plants in these two major groups reflected the concentration of "heavy" or "smokestack" industries long associated with the Peoria area.

"Light" industry (SIC major codes 3800-Measuring and Analytical Equipment, 3600-Electronics, and 3000-Rubber and Plastics) was represented by 26 plants (22%) of the population. It was believed that this was a sufficient number to allow a comparison with the "heavy" industrial plants.

Analysis By Number Of Employees.

An evaluation of environmental practices could also be

Table 2

Peoria, Illinois Small Industrial Plants by Sic Code

SIC Code	Category	Number of Firms	Percentage of Total
3000 - 3199	Rubber & Misc Products	13	11.4
3100 - 3199	Leather & Leather Products	0	0
3200 - 3299	Stone, Glass, & Concrete Products	13	11.4
3300 - 3399	Primary Metals	13	11.4
3400 - 3499	Fabricated Metal Product	20	17.0
3500 - 3599	Industrial & Commercial Machinery	27	23.7
3600 - 3699	Electronics & Other Electrical Equipment	5	4.4
3700-3799	Transportation Equipment	4	2.5
3800-3899	Measuring & Analytical Equipment	8	7.6
3900-3999	Miscellaneous	11	11.0
	Total	114	100.0%

based upon size as well as SIC code. Thus, while all of the plants employed fewer than 100 individuals, it was decided to further subdivide the population by size. Environmental compliance and management activities were different for a plant with five employees than one with 75 employees.

Five approximately equal groupings of plants were established. The groupings were 0 to 5, 6 to 10, 11 to 20, 21 to 50, and 51 to 100 employees. Table 3 provided a listing of plants by size. Forty-eight plants (42%) had ten or fewer employees. Seventy-five plants (66%) had fewer than 20 employees. This high percentage of very small plants represented potential problems regarding the subjects' willingness to respond to a questionnaire on such a sensitive subject as environmental compliance.

The plants ranged in size from one employee to 100. Table 4 presents a cross tabulation between SIC codes and size. The greatest range of plant size occurred in SIC category 3000 (2-100), and the smallest range (2-20) was in SIC category 3600. SIC categories 3400 and 3500 each had four plants with 51 to 100 employees. Category 3700 contained no businesses employing less than 20 employees. SIC categories 3600, 3800, and 3900 predominately consisted of firms with less than 20 employees.

Table 4 provides a more detailed breakdown of the size of plants within each SIC code. The large number of small plants with less than 10 employees is readily apparent. A total of 48 out of the 114 plants had less than ten employees.

Table 3

Firms by Size

Number of Employees	Number of Firms	Percentage of Total
0 - 5	23	20.2
6 - 10	25	21.9
11 - 20	27	23.7
21 - 50	26	22.8
51 - 100	13	11.4
Total	114	100%

Task Validation Survey

A list of competencies was developed and validated as a first step of this research. It was important to ensure that the list of environmental management tasks and responsibilities used in this research was current and reflected those competencies performed in the workplace.

This project was accomplished by the author for MCT Consulting, a private environmental consulting and training company, and was included in this document with their permission. However, it was reviewed and overseen by the Doctoral committee because of its application and pertinence to the dissertation.

Table 4

SIC Code And Plant Size

SIC Code	Number of Plants	Range	Size Category
3000	13	2 - 100	A =3, B =2, C =2, D =4, E =2.
3100	0	--	--
3200	13	1 - 70	A =5, B =3, C =1, D =2, E =2.
3300	13	2 - 84	A =1, B =4, C =3, D =4, E =1.
3400	20	4 - 90	A =3, B =5, C =4, D =3, E =5.
3500	27	1 - 75	A =5, B =5, C =7, D =6, E =4.
3600	5	2 - 20	A =2, B =1, C =3, D =0, E =0.
3700	4	23 - 72	A =0, B =0, C =2, D =1, E =1.
3800	8	2 - 40	A =3, B =3, C =0, D =2, E =0.
3900	11	2 - 30	A =2, B =3, C =5, D =1, E =0
TOTAL	114	1 - 100	A =23, B =25, C =27, D =26, E =13

* A = 0 to 5 employees, B = 6 to 10, C = 11 to 20, D = 21 to 50, E = 51 to 100

Methodology

Appendix B contains a detailed description of the rationale and history of the development of that project. In brief, the task list went through three stages of maturation. An original list of environmental management tasks was prepared from interviews with environmental managers. It was then verified through a literature review of current trade and professional journals. Finally, the tasks were validated through a modified third-round Delphi survey.

The Delphi review was conducted with 15 environmental managers randomly selected from the 1995-1996 Downstate Illinois Business Directory. They were asked to review, confirm, delete, or modify the task listing resulting from the literature review. These managers were from manufacturing plants employing over 100 employees with a SIC classification between 3000 and 3999. Larger plants were chosen because they had an active environmental compliance program and subsequently an environmental manager with the work experience, education, and training to evaluate the tasks. One randomly selected plant from Peoria County was included to ensure continuity with the main research.

Results

The results confirmed that this list of environmental management tasks were valid. Only four specific tasks were eliminated. The remaining tasks were validated by at least 75 percent of the subjects, with most confirmed by 95-100 percent of the subjects. Numerous comments were received indicating that the list was "comprehensive and good". The survey was considered valid due to the high degree of internal consistency observed within the responses and the calculated reliability factor of 0.884 using the Pearson correlation coefficient analysis. The nine functional categories, or groupings, of specific tasks were also confirmed as valid. The results are presented and discussed in detail in Appendix B.

Several comments stated that the task categories should be rewritten in sentences. This was done to increase readability and understanding. The following are the restated functional groups.

1. **Monitoring** emissions--air, waste water and solid waste, which are produced by the industrial plant and collecting data on these emissions for use in making decisions and preparing reports.

2. **Complying** with all federal, state or local environmental regulations regarding operational matters, which apply to the plant.

3. **Reading and studying** environmental regulations and pollution control technologies that might be applicable to your industrial plant.

4. **Preparing and submitting reports** on environmental matters. These reports might go either to in-house staff or off-site to the EPA or another

regulatory agency. A part of these reports would be to recommend and communicate company environmental policy and plans.

5 **Conducting environmental compliance audits** or assessments on all of the plant's waste streams to determine environmental compliance.

6. **Preparing, submitting, and obtaining all necessary EPA and local agency permits**, such as discharge permits, pretreatment permits, and waste generator permits.

7. **Establishing environmental policy** for the plant in light of regulations and present compliance status, and be able to communicate and defend that policy.

8 **Determining the need and scope for environmental consultants and service contractors**, such as laboratories and waste haulers, and prepare the documents to retain their services.

9 **Managing and supervising** all environmental projects. May include supervising personnel that operate pollution control equipment. Also serve as the plant's official representative to the EPA and other agencies in meetings and inspections.

Instrument Development

Work began on the development of the main research questionnaire following the completion of the task validation study. The results of that study, along with the statement of the problem and the research questions, were examined to determine which items should be included in the final instrument.

All instruments were self-developed since no related studies on environmental management task competency were identified. The instruments were approved by the Doctoral Committee and the SIUC Human Subjects Review Committee.

Practices and Task Competency Survey

Task Identification Model

A task identification and competency model was selected. Pertinent models, from the related literature, included ones by Bratkovich (1995), Bryant (1988), Guenther, (1989), Miller (1994), Toornstra (1993), and Waidelich (1995). In each of them, the subject was asked, in addition to identifying the tasks that they performed, to provide information on such factors as time spent, importance, need for training, proportion of workforce requiring training, and harm resulting from lack of competency.

Guenther's model using a four-question matrix, appeared to be the most adaptable to this study. However, the germane questions for this study would be different from those used by Guenther.

The amount of time spent on the task was not pertinent. The preliminary task identification study (Appendix B) established that time spent did not indicate importance. While time spent in performing a task was an indication of the importance regarding routine tasks, it was not relevant in professional managerial tasks. The time spent on an individual environmental management task may be minimal, yet the task could be very important due to regulatory demands.

The same study also established that the importance of a specific environmental management task was independent of other tasks. Many of the subjects of the task validation study noted that a task's importance was determined by a regulatory demand to perform the task, not any inherent trait of the task itself. Because of this, few of the subjects interviewed in Phase I of the task identification study were willing to rank the tasks in comparison to one another.

As a result, the subjects in this study were asked to consider and rate the importance of each task separately, based upon its importance itself, not in comparison to other tasks.

Similar to Guenther's model, the last two questions in the matrix, asked the subjects to identify their self-perceived competency level and their desire for additional education or training. These two subjects were interrelated according to Toornstra, (1993). By comparing scores from these two question, a numerical value representing the subject's educational drive could be calculated.

The format of the task statement matrix was important. According to the literature, it needed to be clear and attractive to keep the subject's attention. The format, style, and presentation of the tasks and related questions used by Jones (1995) and Toornstra (1993) was considered appropriate and was modified only slightly for this study. All questions related to a single task category were placed in a single text block such as the following:

8. Determine the need and scope for environmental consultants and service contractors such as laboratories and waste haulers and prepare the documents to retain their services.

Perform	Yes ___		No ___		
Important	1	2	3	4	5
Competent	1	2	3	4	5
Desire	1	2	3	4	5

Instructions were provided, along with an example to explain what each term meant and the response required from the subjects. A copy of the entire task identification matrix and instructions is located in Appendix C.

Survey Items

This task identification matrix was developed to answer research questions one, three, and four. Other items were included to answer research question 2 and complement the information from the task identification matrix. Background information was also sought to determine if the manager worked at a plant with an active environmental compliance program.

A master list of various environmental management topics, tasks, and attitudes was developed (Appendix D). Several questions were prepared within each topical area. This master list served as a Table of Specifications to ensure instrument validity and provide control in developing and selecting survey items. Each topic had been previously validated as germane and pertinent by environmental managers employed at large industrial plants (Task Validation Study).

Research Questions

Each of the four research questions contributed information that, when combined, provided data to answer the problem statement. Therefore, survey items were developed to answer each of four research questions. Table 5 lists which survey items were related to which research question in the full instrument.

First it was pertinent to determine whether or not the subject, the manager was employed at a plant that had an active environmental program. Many small plants did not generate any industrial waste; therefore, they had neither EPA permits nor any type of compliance program.

Several questions were thus developed under the "background" topic to determine the extent of the plant's environmental compliance program (Table 5). From these responses, it could be determined whether the manager was performing actual environmental tasks. If so, then the responses to the remaining questions were considered relevant.

Research Question 1 focused on the tasks and activities routinely performed. The research question was answered primarily by information from the task identification section. Several other questions related to every day environmental compliance activities tasks, such as preparing permit applications, laboratory sample gathering, reading data sheets and operating pollution control equipment were also added. These also provided a reliability check against information supplied in the task identification section. The majority of the questions were answered with a "yes" or "no". The amount of time or frequency was not sought in accordance with the above discussion.

According to the literature, the manager's attitude toward the environmental compliance responsibilities could be an important consideration, particularly at smaller industrial plants. Thus, Research Question 2 focused on the manager's perceptions and attitudes towards the EPA, regulations, the importance of their job, future expectations, and whether they preferred to handle environmental problems in-house or use consultants.

Table 5 identifies the topics and questions in the survey instrument used to answer Research Question 2. Since these questions dealt with attitude, a 5-point Likert Scale

Table 5
Survey Items Identified by Research Questions

Question #1

What environmental compliance and management tasks are performed by these managers?

Background:	Questions 9-14, 35
Workload:	Questions 20-32, 34
Consultants:	Questions 14, 17, 18

Tasks 1-9 Perform and Importance

Question #2

What are the managers' attitude toward environmental regulations, industrial compliance, and their environmental responsibilities?

Attitude:	Questions 40, 41, 42, 45
Importance:	Questions 36, 43
Future:	Questions 37, 38, 39, 46, 47, 48

Question #3

How important do these managers rank various environmental managements tasks and what was the level of competency they currently have in performing them?

Competency:	Questions 15, 44
Tasks 1-9	Competence

Questions #4

Do environmental managers desire additional education and training in these tasks?

Education:	Questions 8, 16, 33, 49
Tasks 1-9	Desire for education

was used, allowing the subjects to answer on a continuum rather than either "yes" or "no". Several questions had the middle 3 removed to force a positive or negative response. Research Question 3 addressed the manager's self perceived level of competency as well as the importance of the environmental management tasks. Using a 5-point Likert scale, the subjects were asked to assign an "importance" value to each task, as well as rate their competence in performing it. Competency was related to importance according to several authors. A comparison could be made between the tasks that subjects ranked as important and their competency in that task.

The subjects were also asked whether or not they felt competent in a "general" sense to deal with environmental problems. This "general" self-perceived competency could then be compared to task-specific competency.

Research Question 4, related to education. General questions relating to previous education, general desire, and willingness were asked (Table 5). This information was compared to the rated desire for task specific education.

Competency and desire for education were interrelated. A person with low competency could be expected to have a higher desire for education or training than an individual having a high competency. The difference in the score assigned to these questions could be used as an indicator of the individual's educational drive.

Survey Instrument Construction

A number of factors was considered in the construction of the final instrument. These included, among others, validity, reliability, and attempts to encourage a high rate of participation.

Validity.

Validity, the measure of ensuring that the instrument measured what it intended to measure, was the lesser problem. The tasks utilized as the core of the study had all been previously validated. All survey items were taken from the master list of environmental topics and questions (Appendix D). In so doing, all items were pertinent to environmental management.

Reliability.

Reliability, the accuracy or precision of the measuring instrument, had to be built-in during the instrument's construction. Reliability of this research instrument was tested by comparing the responses to three sets of duplicated or similar items. Although identical responses on duplicated topics did not guarantee that identical responses would occur on all items, it was believed that it was sufficient for the purposes of establishing the reliability of this study. The three topics were: Reports, Permits, Reading and Studying Regulations. They are listed in Appendix E, along with a copy of the reliability evaluation work sheet. The Pearson correlation coefficient was used to calculate the reliability.

Participation.

A maximum number of responses was essential to draw meaningful conclusions. A clear, easily readable, eye catching format was used to encourage completion of the instrument.

Several things were done to increase participation. The words "IMPORTANT RESEARCH" were stamped with red ink on the outside of each envelope to separate it from "junk mail". The instrument itself was printed on light green stationary to attract the subject's attention and to set it apart from other documents. The cover letters were printed on Southern Illinois University-Carbondale, Department of Workforce Education and Development letterhead (Appendix F). An appeal was made for the subjects' cooperation and assistance in the cover letter, as well as in all telephone contacts. This included a one-page attachment to the cover letter printed in bold 6-point type requesting the subject's assistance (Appendix F).

Concern that information from this study would be used by the EPA potentially could prevent some subjects from participating. The subjects were thus told that all information would be confidential and that the data would not be given to the EPA. This assurance was provided through statements in the cover letters as well as in all verbal contacts. Such statements were highlighted with bold underlining.

All attempts were made to keep the instrument readable and easy to complete. While the number of pages could have been reduced with a smaller print font, the instrument was printed in a 10 point font size. All questions were read by non-technical individuals to ensure that the language used was appropriate.

The easiest-to-complete survey items, such as demographic information, were placed first. Items that used the same answer choices were placed together to maintain simplicity. Highlighted boxes provided directions for the various sections. An example was included in each set of directions to illustrate the type of question and the responses to be used. Subjects were encouraged to provide comments and were told that the back of the page could be used for this purpose.

A low participation rate was expected. Survey participation rates have generally averaged less than 50 percent in surveys of small firms according to related studies. Busyness and a unwillingness to discuss their plant's environmental compliance status would contribute to a low participation rate.

A critical factor affecting participation was length or number of items. A lengthy instrument increased reliability but reduced participation. The goal was to keep the instrument short while maintaining acceptable reliability. Several individuals were recruited to test the final instrument to ensure completion in 15-20 minutes.

Pilot Study

A pilot study was conducted. The instrument was evaluated by both a group of employed environmental managers and a committee of subject matter experts. Based upon their comments, the instrument was revised and modified prior to submission to the 114 subjects. The pilot study established that the instrument was valid and reliable. An indication of how the subjects would respond was also determined from the pilot study.

Pilot Study Development

Several logistical matters were concluded prior to the actual field testing. These included, among others, developing a review form to evaluate the instrument, selecting the subjects, developing a reliability calculation work sheet, and a data answer form.

Approvals

The pilot study instrument and cover letter were evaluated and approved for format, internal validity, understandability by the doctoral committee. The instrument, cover letter, and telephone scripts were approved by the SIUC Human Subjects Committee.

Questions

The pilot study survey items were taken from the master topic list to ensure validity. Two topics,"Reports" and "Reading and Studying Environmental Regulations," were selected for reliability testing. The topic "Reports" contained five direct questions, and the topic "Reading and Studying" used three questions. Both topics were repeated in the task identification section.

At least three questions were taken from each of the master list topics. The final pilot study (Appendix G) contained 75 questions and was 16 pages long.

A validation review form was developed for the pilot study and attached to the instrument. On this form the subjects were asked questions regarding the time required to complete it, overall impression of the instrument, its validity, and relevance. Comments on this validation form were of as much, if not more, value, than the completed questionnaire.

Subjects

Two separate groups of subjects were utilized. Both groups were asked to review the instrument to ascertain if it provided a comprehensive coverage of environmental manager tasks and responsibilities. The directions and questions were reviewed to determine if any needed to be deleted or modified. Suggestions for additional questions were sought. A stamped self-addressed envelope for returning the completed instrument was provided.

The first pilot study group consisted seven subject matter experts, individuals who were familiar with industrial environmental problems and pollution control activities. They came from regulatory agencies, municipal waste treatment plants, academia, and industry. Several of these were from Peoria County as that would be the final test location.

As these reviewers were not environmental managers, their primary task was to review the validity of the document as a whole. They were not required or expected to complete the survey.

The second group consisted of 20 randomly selected industrial plant managers. They were asked to complete the pilot survey and evaluation review form. This group was similar in all respects to the main study subjects, except that their companies were not located in Peoria County.

Methodology

Twenty 4-digit Standard Industrial Classification (SIC) code numbers between 3000 and 3999 were randomly selected. From the 1996 Illinois Manufacturers Directory, two firms were then randomly selected from each of the 20 selected SIC codes. The plant or environmental manager at each was contacted and asked to participate. The previously approved telephone script was used. If an individual refused to participate, another name from the list was randomly drawn and contacted. This was repeated until 20 individuals had agreed.

Each of the 20 subjects were mailed the survey instrument and the validation review form along with a cover letter (Appendix G). All instruments were mailed with sufficient first-class postage from the Carbondale, Illinois, post office. Ten days after the initial mailing, a second copy was sent to all who had not responded. One week later, all remaining subjects were contacted by telephone. The data from each response was recorded onto a results evaluation form.

Results

Table 6 provides a summary of the responses. Fifteen out of the 20 subjects (75%) eventually returned the questionnaire. However, only seven (35%) were completed. Eight (40%) were returned unanswered; five of these had post-it notes attached to the returned instrument with comments such as "too busy to do", or "does not apply". The reasons provided by the 13 managers for not completing the survey were as follows:

"Does not apply"	4 Responses	(20%)
"No Time or Too Busy"	6 Responses	(30%)
- No Comment -	3 Responses	(15%)

Table 7 provides the completed/non-completed percentages. Only seven (35%) of the subjects completed the instrument. Of these, one was only partially completed as the respondent noted, "Since my firm does not deal with environmental concerns, I am unqualified to answer the remainder of the questions." The 35 percent completion rate was in line with expected participation. The fact that eight respondents (40%) returned the questionnaire unanswered was unexpected.

A review of the comments on the validation review form was informative and useful in the construction of the final survey instrument. No items were marked to be deleted, modified, or added. The majority of the subjects stated that they required more than 20 minutes.

Overall, the subjects indicated that the instrument was relevant and valid. No changes, other than length, were recommended. No specific questions were marked as inappropriate. A total of five positive and no negative responses was received.

Table 6

Pilot Study Results

SIC Code	(Number of Employees)	Product	Status
3255	(20-49)	Clay Refractory	Completed
3944	(12)	Games Completed	Partial
3086	(20-49)	Plastic Foam	Not Done - Returned
3296	(20-49)	Mineral Wool	Not Done - Returned "Too Busy"
3999	(20-49)	NEC	Not Done - Returned "Doesn't apply"
3599	(10-19)	Machine Shop	Not Done - Returned
3823	(10-19)	Industrial Measurements	Not Done - Returned "Doesn't apply"
3366	(72)	Copper foundry	Completed
3599	(11)	Machine Grinding	Completed
3499	(50)	Fabricated Metal	Completed
3429	(14)	Tank Construction	Completed
3471	(50-99)	Electroplating	Not Done - Returned "Too Busy"
3086	(29)	Styrofoam	Completed
3944	(40)	Toys	Not Done - Returned
3446	(12)	Ornamental Metal	Not Done - Returned

Table 6 CONTINUED

In addition to the fifteen instruments described earlier in Table 6, the following five possible subjects were contacted twice with no response. They were called and declined to respond due to "no time" or "does not apply".

3315	(57)	Wirenails	"Too busy- "no time"
3366	(83)	Foundry	"Too busy- "no time"
3631	(10)	Cooking Equipment	"Doesn't apply to us"
3599	(60)	Farm Trailers	"Too busy- no time"
3471	(29)	Metal Polishing	"Doesn't apply and too busy"

Six written comments were received on the review evaluation form. The most common comment dealt with the length of the instrument, such as the following:

"Too long" (two times)
"Too long for average manager"

Other comments regarding overall opinion of the instrument were:

"Good thorough survey of duties"
"Comprehensive" (two times)

In summary, the managers felt that the instrument provided comprehensive coverage of the industrial environmental compliance and management field. The calculated Pearson correlation coefficient was 0.813 indicating that the instrument was both valid and reliable.

Table 7

Percentage Returns

RETURNED .... (Not Completed)	8	40 %
NO RESPONSE	5	25 %
Sub-Total	13	
COMPLETED	7	35 %
Total	20	100 %

In general, the comments from the subject matter experts paralleled and confirmed the opinions of the industrial managers. No survey items were noted as inappropriate or were marked as needing to be deleted, modified, or added. Five out of the seven subject matter experts affirmed that the survey provided a good coverage of the field.

As with the other group, their primary comment related to the overall length of the instrument. Other comments expressed that the survey was good and should be helpful. The comments were: -"Too long" (three times)

-"Forget academia; make a shorter survey"
-"Good comprehensive survey"
-"Should provide a thorough understanding of these managers--if they will take the time to fill it out."
-"This would be better for an interview, as it is too long for an individual to complete in writing, but all the questions are good."
-"Hope you get a lot of responses as this will be an interesting picture of these individuals who have been able to hide so far from the EPA."

Summary

A pilot study was conducted to evaluate the survey instrument. A review of the completed surveys and the validation review forms revealed that the survey was both valid and reliable. However, the instrument was viewed as too long. It was recommended that the number of items be reduced.

Final Instrument

The pilot study results were reviewed by both the doctoral and the subject matter experts committees. They agreed that the survey instrument needed to be shortened. Suggestions were made and incorporated into the final document, which resulted in a shortened questionnaire (Appendix H).

While the task identification matrix section required four pages, it was agreed that this section should not be shortened as it constituted the instrument's core. It's present format allowed comparison to other task identification and competency studies. Therefore, all modifications to shorten the document were taken out of the 79 questions and 12 pages in the general section.

The pilot study instrument contained at least three questions on each of 15 topics. While this ensured validity and reliability, the downside was the length and the resultant 35% return rate.

It was agreed that a compromise between reliability and length could be made. Several of the topics were combined, and the number of questions used from each topic was reduced. The topics that were eliminated were ones the subject matter experts felt to be the least important, or could be considered sub-sets of other topics. All of the questions used in the final instrument had previously been tested and found acceptable in the pilot study.

The revised questionnaire was reviewed by members of both committees. No negative comments were received. It was believed that the revised document retained sufficient reliability. Validity also remained high due to the use of the master topical list. As a result, it was agreed that the study could proceed without another pilot study.

Brief Form

A significant number of industrial plant managers did not attempt to complete the pilot instrument. Ten (50%) of the subjects stated that they were "too busy" or "this does not apply to us". From this, it was summarized that many subjects did not have an environmental program or gave it a low priority. One comment illustrated this fact. When asked to list any additional tasks, one individual wrote, "Produce a product and make a profit.". Under importance, he wrote in and circled a 10.

A concern arose that with almost 50% of all Peoria County industrial firms having ten or less employees, the majority of these managers would have a similar attitude and not respond. The number and type of industrial plants with environmental programs was significant information in its own right. Failure to complete and return the questionnaire eliminated the opportunity to determine this.

It was thus decided to develop an additional second, very brief mail survey instrument, along with cover letter and telephone script (Appendix I). This would be used as a second mailing to those non-respondents.

This questionnaire was only three pages long and contained 19 questions. The majority focused on the background topic or level of environmental programs that existed at the plant. Many of the original topics were eliminated, and only one question was asked in each of those remaining. Only one question each was asked regarding the manager's attitude, competency, and educational desire in the event that the subject did complete the survey. All questions were ones that had previously been field tested in the pilot study and had been used in the full survey. This was done to retain a degree of validity and reliability. The environmental task identification matrix was removed.

Manager's employed at plants with no environmental management programs had little or no opportunity to perform environmental management tasks or to develop competency. Such managers would not relate to the tasks and competencies described in the instrument. Information from "no-program" managers was irrelevant to determine the job tasks, competencies, and educational needs of environmental managers.

Determining whether these very small plants had an environmental program was important. With this in mind, the first step of interpreting the results was dividing the responses into two groups: those that worked at industrial plants with an environmental compliance program ("program") and that who did not ("no-program"). This determination would be made from responses to the "background" topic questions.

Telephone Interview

A telephone interview was also developed (Appendix J) to contact all subjects who did not responded to either the first and second mailing. The objective was the same as with the second survey instrument, to document whether or not the subject's plant had an environmental compliance and management program, and obtain minimal information about the manager's environmental capabilities. The subjects were asked if they would answer several questions. If not, they were thanked for their time. The questions were a summary of the key points in the above first and second mailings.

Data Collection

All of the instruments were approved by the SIUC Human Subjects Review Committee (Appendix K). All surveys were mailed first class, with a stamped self-addressed return envelope. The initial full survey instrument was mailed out on April 30, 1997. This was preceded by a telephone call to each business, wherein the name of the plant manager was obtained, and he was asked to participate. This phone conversation followed the pre-approved script. The second shorter survey instrument was mailed to all non-respondents on May 8, 1997, again with a prior telephone notification.

During mid May 1997, attempts were made to visit and interview the managers at as many of the remaining non-responding industrial plants as possible. Prior to this time, only 34 responses had been received. A priority was set on obtaining completed surveys from plants in each SIC major group represented in the population. The interview was with the plant manager, not the owner, as this study focused on the knowledge, skills, and work habits of the manager, the individual working "on the floor".

A determination was made at the site location whether to use the longer full questionnaire or the second shorter survey instrument. If the manager was busy, the short form was used. Likewise, if the firm appeared to be primarily an assembler or packager of final products with little actual manufacturing or production, the short form was used.

The manager was asked to complete the survey. Any instructions or discussions were limited to those provided in the initial cover letter to avoid influencing the participant's response. An informal discussion was often held afterwards about the firm's product and the subject's environmental tasks and responsibilities.

An additional 37 subjects completed the survey during the site visits. Five declined to participate. The most common reason was that the individual was "too busy". Two subjects stated that the owner had told them not to discuss the plant's environmental status.

To conclude the data gathering phase of the study, all remaining non-participating subjects were contacted via the telephone. The interview followed the previously prepared and scripted telephone questionnaire. Twenty-six individuals agreed to be interviewed by telephone. Eight individuals refused to participate due to their busy schedule or general reluctance to discuss their environmental status.

Treatment of Data

All returned instruments were labeled and stored. Information was translated from them to the answer evaluation forms. The questions relating to background environmental status were evaluated first. From this information, the subjects were placed into either the "program" or "no program" category. The research questions were next answered. Statistical means and standard deviations were calculated on topical summary scores. Statistical comparisons were made between the "program" and "no program" means.

CHAPTER V
RESULTS

Introduction

This study was conducted during May 1997. A total of 97 (85%) responses were obtained out of a population of 114 subjects. The total included 34 (35%) responses returned by mail, 37 (38%) from site interviews, and 26 (27%) from telephone interviews. Forty five (46%) of the 97 subjects completed the full questionnaire. The reliability of the instrument was 0.670 as determined by the Pearson correlation coefficient.

The responses paralleled the composition of the population. Responses were received from at least 50 percent of the subjects in each of the various SIC code and size groupings. Consequently, the data and results from this analysis was representative of the population as a whole.

Program Status

As previously stated and discussed in the methodology section, the respondents were divided into two groups. The first group consisted of the managers employed at plants that had an environmental compliance program. These were labeled "program" managers and plants. The second group was managers employed at plants without an environmental compliance program, which were labeled "no-program".

Managers from a "program" plant had an awareness of the plant's waste streams and an "in-place" set of activities to reduce both its wastes and its overall impact on the environment. Subjects answering "yes" to at least two questions in the background section of the questionnaire or three in the activity section were categorized under "program". When possible, additional questions and observations were made for determining the category to which each plant belonged. For example, when the respondent's answers indicated no environmental activities, but compliance activities were observed, that facility was given "program" status.

Background Environmental Status

Thirty-five managers (36%) of the 97 respondents were employed at plants that had environmental programs and were placed in the "program" category. Sixty-two (64%) of the companies did not have environmental programs and were labeled "no-program". Twenty (58%) of the "program" plants had a 3300, 3400, or 3500 SIC major group classification code number. Appendix L provides additional information on the comparison and breakdown of responses by SIC code and size categories between the "Program" and "No-program" plants.

Five items (questions 9-13) on the full instrument, provided information on the environmental status of the

Table 8

Comparison of Program/no Program Environmental Status

	Question	Program (%)	No-Program (%)
9-	Generate Waste	24	0
10-	In-house Treatment	27	0
11-	EPA Notice	32	2
12-	EPA Inspection	44	9
13-	Permit	59	5
	Mean	38	4

industrial plant. They were evaluated and compared between the "program" and "no-program" categories. On the average, 13 (38%) of the "program" plant managers responded affirmatively that one or more of these environmental situations existed at their plant. Five (24%) of the "program" plants generated industrial, non-domestic waste streams. Six (27%) treated their waste streams. Nine (28%) had received a notice from an environmental agency within the past year. Twenty (58%) of the plants either had an EPA permit or had been inspected by the EPA in the past year.

In contrast, the comprehensive mean for the "no-program" subjects was four percent (Table 8). Only four (9%) "no-program" plants had ever been inspected by the EPA and only two (5%) had an EPA permit. None reported any industrial, non-domestic waste production or waste treatment.

Two areas of agreement existed between the "program" and "no-program" groups. Both viewed their degree or level of interaction with the EPA, 1.6 and 1.0 respectively on a 5 point Likert scale, as low. Likewise, both groups reported that environmental compliance efforts accounted for only 1%-10% of their time.

Specific Conclusion

Only 35 (36%) of the industrial plants surveyed in this research were actively involved in an environmental compliance "program". In terms of environmental compliance activities, such as waste treatment and permits, there was a statistically significant difference at the 0.05 level between "program" and "no-program" plants.

Findings

Research Question 1.

Research question #1 focused on the tasks and responsibilities performed by the environmental manager.

> What environmental compliance and management tasks are performed by environmental managers?

The respondents completing the full instrument were asked to identify their responsibilities and job tasks they routinely performed from a list of 9 categories and 13 specific tasks. Appendix M present a breakdown of the results.

Task Identification

Thirty-six (33%) of the 97 respondents completed the task identification sections. Twenty-three (64%) of the 36 valid responses were from "program" managers and 13 (36%) from "no-program" managers. The following is an abbreviated description of each of the nine task categories identified in this study as pertinent environmental management tasks:

1 -Monitoring emissions and collecting waste stream data.
2 -Complying with regulations in terms of daily operations.
3 -Reading and studying regulations.
4 -Preparing reports, both in-house and to EPA.
5 -Conducting audits.
6 -Preparing permits and complying with them.
7 -Developing environmental policy.
8 -Interacting with consultants and contractors.
9 -Managing environmental staff and operations.

Fifty-four (54%) percent of all 97 plant managers marked one or more of these environmental task categories (Table 9). The difference between "program" and "no-program" plants was statistically significant at the 0.01 level, as 70 percent of the "program" plant managers identified these tasks compared to only 26 percent of the "no-program" plants.

The number of "program" managers performing specific tasks ranged from 9 respondents (39%) for audits (task 5) to 21 (91%) for task 2 (general compliance). Task 5 was the only task identified performed by less than 50 percent of the "program" managers.

Table 9

Task Identification

	Program			No Program			Total		
	Yes	No	%	Yes	No	%	Yes	No	%
Task 1	14	9	(61)	2	11	(15)	16	20	(44)
Task 2	21	2	(91)	11	2	(84)	32	4	(89)
Task 3	18	5	(78)	6	7	(46)	24	12	(67)
Task 4	16	7	(70)	2	11	(15)	18	19	(50)
Task 5	9	14	(39)	0	13	--	9	27	(25)
Task 6	16	7	(70)	1	12	(8)	17	19	(47)
Task 7	15	8	(65)	3	10	(23)	18	18	(50)
Task 8	15	8	(65)	3	10	(23)	18	18	(50)
Task 9	20	3	(86)	2	11	(26)	22	14	(61)
Average			(70)			(26)			(54)

With the exception of task 2 (complying with operational regulations), less than fifty percent of the "no-program" managers acknowledged performing any of remaining eight tasks. Forty-six percent of the "no-program" respondents identified task 3 (reading and studying regulations) as the most common task. However, 78 percent of the "program" managers indicated they performed the same task (nearly twice that of the "no-program" managers). With tasks 2 and 3 removed from the total, only nine (14%) of the "no-program" managers performed any of the remaining tasks.

Environmental Compliance Task Activities

The subjects were asked if they performed any of 13 individual tasks selected from the task categories. Earlier research (Appendix B) indicated that these 13 tasks were important environmental compliance activities within the task categories mentioned above.

Fifty-two percent (18 respondents) of the "program" managers routinely performed these tasks. In contrast, only 12 percent (8 respondents) of the "no-program" managers performed them, a statistically significant difference at the 0.01 confidence level. Table 10 shows that "program" managers performed these tasks approximately four times more often than "no program" managers.

The questions in this portion of the questionnaire which were related to a common work topic were grouped together into one of five topical areas. These were:

A. Management
B. Waste stream sampling and laboratory analysis
C. Pollution control equipment operation
D. Supervision of other employees
E. Contact waste treatment and transportation contractors.

Seven survey questions related to plant management as it was the major focus of this study. Management skills included such tasks as report writing, making recommendations, reading regulations, interacting with the EPA, and communications. Under Waste stream Sampling and

Table 10

Environmental Task Activities

Question	Program	No-Program	Total
20- Prepare Permits	55	12	35
21- Attend Meetings	30	00	16
22- Write Letters, Make Calls	28	03	13
23- Take Samples	50	00	27
24- Make Reports	75	06	43
25- Study Lab Data	45	00	24
26- Written Reports	37	13	35
27- Operate PC Equipment	25	06	16
28- Read Study Regs.	75	18	49
29- Collect Data	42	06	21
30- Supervise Employees	29	54	
31- Contact TSD	88	34	57
32- Reports to EPA	65	18	43
Total	52	12	32

Laboratory Analysis (topical work area B) three questions were included. These were concerned with monitoring the plant's waste streams and utilizing the resultant laboratory data for writing various required reports. The last three topical work areas (C,D,E) contained only one question each, as they were narrow in focus.

The results appear in Table 11 and Appendix M. Contacting outside haulers and treatment contractors (TSDs) was the most commonly performed task. It was performed by both "program" and "no-program" managers. Operating pollution control equipment received the lowest ranking of all tasks by both "program" and "no-program" managers.

Excluding topical areas D and E, less than six "no-program" plant managers (10%) performed any of the tasks under the remaining topics. In summary, few "no-program" managers performed any managerial, waste stream monitoring or operational tasks.

TABLE 11

Environmental Task Activities by Topics

Topic	Program (% yes)	No-Program (% yes)
A Management	54	07
B Data	48	06
C Operation	25	06
D Supervision	75	29
E Contact TSD	88	34

Specific Conclusion

Seventy percent (24 respondents) of the "program" environmental managers employed at small industrial plants surveyed in this study performed one or more of nine general areas of responsibility on a routine basis. Fifty-two percent (18%) of the managers stated that they performed one or more of the 13 specific tasks.

The most common task was contacting outside environmental contractors, such as haulers for treatment, storage, disposal (TSD) units, for disposal of the plant's waste. Fifty-four percent of the "program" managers waste. Fifty-four percent of the "program" managers performed environmental management tasks, such as preparing reports to either management or the EPA, attending meetings, and reading regulations. Forty-eight percent reported that they were involved in waste stream monitoring, laboratory analysis, data collection, and handling tasks.

Therefore, based upon these findings, managers at small industrial plants with active environmental programs performed a wide variety of environmental tasks and activities. These ranged from strictly operational to policy development. The most important were those related to securing EPA permits and maintaining regulatory compliance.

Research Question 2

Research question #2 addressed attitudes held by managers towards the EPA, regulations, and other environmental compliance topics.

> What are the managers' attitudes towards environmental regulations, industrial compliance and their environmental responsibilities?

Fifteen questions were asked. They were grouped in the following five topical areas:

A. Attitudes toward preference to use consultants.
B. Attitudes toward the EPA and their regulations.
C. Attitudes towards their environmental responsibilities.
D. Future expectations--EPA and small industrial plants.

Appendix N contains a breakdown of the responses. All of the answers, with the exception of two, utilized a 5-point Likert scale. Thus, a mean and standard deviation could be calculated and compared.

Consultants

The first topical area addressed the hiring of outside consultants. See Table 12 and Appendix N. Only "program" plants employed environmental consultants (engineers, lawyers, or testing firms) for solving waste handling and management problems. Eighty-two percent of the "program" plants utilizing consultants were found in SIC major groups 3300, 3400 and 3500.

Table 12

Consultants

Question	Program (%)	No Program (%)
14- Used consultants	55	0
17- Would use	48	48
18- Prefer to solve In-house	62	88
	56	44

Both "program" and "no-program" plant managers indicated that if an environmental problem arose, they would utilize a consultant. Four "program" and five "no-program" managers wrote comments stating that the basis for employing managers wrote comments stating that the basis for employing consultants was associated with the type and size of the problem. If the problem were small, plant staff would attempt to resolve it. On the other hand, consultants would be utilized in response to major environmental problems. Consistent with both "program" and "no-program" managers was the desire to manage environmental problems internally. This was true in all SIC classes and size groups. Only two "no-program" managers out of 17 (12%) stated that they preferred to hire outside consultants.

In summary, only "program" plants surveyed in this study employed consultants. However, both "program" and "no-program" managers indicated that they would possibly use consultants in the future. Both groups preferred to internally manage their environmental problems as opposed to employing external consultants.

General Attitude

Little difference (0.1 unit out of 5.0) existed between "program" and "no-program" managers regarding attitudes toward the EPA and environmental regulations. Table 13 and Appendix N summarize the responses to the three questions listed under this topic. Neither group expressed anxiety at being found in EPA non-compliance. In general, environmental compliance was not a major concern.

The mean scores for questions 42 and 43 were close to 3.0, despite the fact that the mid-point (3) had been from assuming a "middle-of-the-road" position. This fact, plus the observed high standard deviations, indicated that the means resulted from a number of extreme scores on both sides of the neutral point. Twelve respondents (12%) expressed very strong negative verbal and written comments in response to questions 42 and 43.

Table 13

Summary General Attitude Towards Epa and Environmental Regulations

Question	Program N	Program Mean	Program SD	No Program N	No Program Mean	No Program SD
40"Fearful"	19	2.0	(1.2)	19	1.9	(1.3)
42-Excessive"	21	3.0	(1.5)	17	3.4	(1.4)
43-Small comply with all"	29	3.3	(1.4)	39	3.0	(1.6)
	75	2.7	(1.3)	75	2.8	(1.6)

In summary, small industrial plant managers did not express fear of the EPA for noncompliance. Neither "program" nor "no-program" managers strongly believed that EPA regulations were excessive. Likewise, their responses were ambivalent when asked if small plants should comply with all environmental regulations.

Importance of Environmental Compliance Responsibilities

Three questions were asked about the manager's perception of the importance of environmental compliance. Table 14 and Appendix N present the individual and collective means as well as a detailed representation of the responses by SIC code and size.

Table 14

Summary Importance of Environmental Compliance Responsibilities

Question	Program N	Program Mean	Program SD	No Program N	No Program Mean	No Program SD
36-Importance	27	2.2	(1.2)	40	1.3	(0.7)
41-Hindrance	24	2.2	(1.2)	18	1.7	(1.1)
43-Concern	23	3.3	(1.2)	18	1.9	(1.4)
	74	2.5	(1.2)	76	1.5	(1.0)

It was observed was that the "program" mean scores were consistently higher than the "no-program" scores at a 0.05 confidence level. This difference was found in all three questions. Collectively, "program" managers rated the importance of environmental compliance one point higher, (2.5-1.5), than "no-program" managers. This was the largest difference in mean scores of any topic. Therefore, "program" managers perceived that their environmental responsibilities were significantly more important than did the "no-program" managers. Likewise, "program" managers expressed more concern about the impact of environmental regulations on their plant than their "no-program" counterparts.

The "no-program" mean score for each of the three

The "no-program" mean score for each of the three questions was between 1 and 2 out of a possible 5 points. Again, this indicated that environmental compliance was not an important issue among "no-program" managers. While "program" managers scores were significantly higher, their collective mean score of 2.5 indicated that environmental compliance was not the highest priority topical area when compared to all other plant operational responsibilities and tasks.

According to Appendix N, only in SIC classes 3300 and 3500 did "no-program" managers score the topical area above 2.0 out of five. "Program" managers' scores were fairly consistent throughout all SIC classes. The importance of environmental compliance at "program" plants tended to increase with the number of employees, so that the highest score (2.7) occurred in plants with 51 to 100 employees. The opposite was seen in the "no-program" plants, where the mean score of plants with under 20 employees was 1.8 versus 1.2 for all larger plants.

In summary, there was a significant difference between the "program" and "no-program" manager's perception of the importance of environmental compliance. The "program" manager perceived it to be much more important and was more concerned about its impact on the plant.

<u>Future Directions--Small Plants and Environmental Compliance</u>

This section addressed the managers' expectations of future environmental compliance requirements for small plants in general and at their plant in particular. The managers were first asked three questions regarding small plants in general. The summary results for these three questions are presented in Table 15. Other information such as breakdown by SIC code and size groups is also provided in Appendix N.

Both "program" and "no-program" plant managers believed that environmental compliance would increase and become stricter at small industrial plants in general. Both groups also believed that there would be more regulations, more enforcement and that there would be more emphasis on plants' installing pollution control equipment. The cumulative mean for all respondents for all three questions was 3.8 out of 5.0, the highest found in the entire study. "Program" managers held this opinion slightly more than "no-program" managers (3.9 vs 3.6).

In summary, plant managers stated that they believed that environmental compliance would increase in the future. This opinion was consistent between both "program" and "no-program" managers. Likewise, it was reported throughout all SIC code classes and size groups.

Future Directions--Your Plant and Environmental Compliance

The last topical area was the managers' perceptions regarding future environmental compliance requirements at their own plant. Two questions were asked, which were

Table 15

Summary: Future Directions Environmental Compliance - Small Plants

Question	Program N	Program Mean	Program SD	No Program N	No Program Mean	No Program SD
46-Install PC	23	4.0	(1.1)	16	3.8	(1.2)
47-More Regs	23	4.0	(0.8)	17	3.9	(1.2)
48-More Enforce	29	3.7	(1.1)	37	3.4	(1.2)
		3.9	(0.9)		3.6	(1.2)

similar to those in the "Future- -Small Plants" section. Responses to these questions could be compared to those made in the earlier section. A third question (49) asked about their perception regarding anticipated work levels in the future. Both Table 16 and Appendix N present the results.

In contrast to the anticipated high level of regulatory enforcement actions expected in the future towards small plants in general, both "program" and "no-program" managers expected future environmental compliance activities within their plant to remain marginal. The overall mean for all questions for all managers was 2.2 out of five. Throughout all questions, the "program" managers scores were statistically higher at the 0.05 level of confidence.

"Program" managers had the lowest expectation for more specific regulations impacting their particular operation. The greatest difference between scores (0.6) related to future installation of pollution control equipment. "No-program" managers had low expectations that pollution control equipment would be required (1.9).

The highest scores in this topic for both "program" and "no-program" managers related to increased workloads. Both groups expected that they would have more environmental compliance duties in the future (2.7 and 2.4).

With scores of 1.9 and 1.8 respectively from questions 37 and 38, the "no-program" managers indicated that environmental compliance was not expected to be a major concern in the future at their particular plants. However, the high standard deviation and occurrence of 4's and 5's in the raw scores indicated that some managers foresaw significant changes occurring.

The difference in mean scores between future requirements for small plants in general and their plant in particular was statistically significant at the 0.05 level. The "program" managers' expectations for installing pollution control equipment at their plant was 1.5 units (out of five) less, and their expectation for more regulations and enforcement of them at their plant was 1.8 units less than for all small plants. The decrease was even more marked for "no-program" perceptions.

Table 16

Summary: Future Direction Environmental Compliance--your Plant

Question	Program N	Program Mean	Program SD	No-Program N	No-Program Mean	No-Program SD
37-Install PC	35	2 .5	(1.4)	58	1.9	(1.3)
38-More Regs	24	2.2	(1.3)	19	1.8	(1.1)
39-Increase	22	2.7	(1.1)	19	2.4	(1.6)
	81	2.5	(1.3)	96	2.0	(1.4)

In summary, plant managers expressed a relatively low overall mean of 2.2 in response to questions about future environmental compliance regulations and activities for their own plant. This was significantly less than their overall expectations (3.8) regarding future environmental compliance obligations for small plants in general. An expected increase in their individual environmental workload responsibilities had the highest score.

Specific Conclusion

The attitudes and perceptions of "program" and "no-program" managers, with one exception were similar to one another. The "program" managers' values generally were higher, with a mean score for all four topics of 2.9, some 0.4 units higher than those of the "no-program" managers. The topic "Future & Small Plants" was the only topic that had a numerical mean above 3.0 out of five.

These low values indicated that environmental concerns and compliance were not high priority. However, the high standard deviations indicated that there were a number of extreme scores on both sides of these issues. There was a significant difference between the "program" and the "no-program" managers regarding both the importance of environmental compliance and the future of environmental compliance at their own plant. "Program" managers perceived importance a point higher than the "no-program" managers. By a large majority, both "program" and "no-program" managers stated that they preferred to handle environmental problems internally with their own staff as opposed to employing outside consultants.

Research Question 3

Research question 3 focused on the importance of the environmental compliance tasks and the managers self-perceived competency.

> How important do these managers rank various environmental management tasks and what is the level of competency they currently have in performing them?

The managers were asked to rate both the importance of and their competency towards the nine task categories. Two questions regarding overall competency were also asked. Table 17 and Appendix O provide information regarding the importance of these tasks. Table 18 and Appendix O offer the same for competency scores.

Table 17

Task Importance

	Program			No-Program		
	N	Mean	SD	N	Mean	SD
Task 1	23	4.0	(1.2)	12	3.2	(1.5)
Task 2	22	4.3	(0.9)	12	4.1	(1.2)
Task 3	18	3.7	(1.2)	12	3.3	(1.4)
Task 4	22	3.9	(1.3)	12	3.2	(1.5)
Task 5	21	3.6	(1.3)	12	3.0	(1.5)
Task 6	22	4.6	(0.8)	12	3.2	(1.7)
Task 7	21	4.1	(0.9)	12	3.1	(1.5)
Task 8	23	4.1	(0.9)	12	2.9	(1.3)
Task 9	23	4.1	(0.9)	13	3.0	(1.6)
		4.0		3.2		

Task Importance

All plant managers considered the nine environmental compliance responsibilities above average in importance.. "Program" managers rated them with an overall importance rating of 4.0 out of 5. Obtaining EPA permits was the most important task performed by managers. The lowest was performing audits.

The "no-program" managers perceived their importance lower (3.2). Only one task received a score below three. Eliminating the task 2 score, the highest "no-program" score was 3.3 for reading and studying regulations. The lowest was task 8, working with consultants and contractors, which received a 2.9.

Task Competency

The "program" managers rated themselves more competent (3.0) in the nine task categories than the "no-program" managers (2.0). The "program" managers' competency scores ranged from 2.8 to 3.5, while the "no-program" scores were from 1.7 to 2.9. Removing task 2 score, the highest "no-program" competency rating was 2.2 out of five.
The highest "program" competency score was 3.5 for task 9 (management). The lowest, 2.4, occurred for task 5 (audits), which also had the lowest importance rating.

Two general questions regarding overall environmental compliance competency were also asked. The first asked if the managers felt competent handling environmental problems. The second asked them to rate their overall self-perceived level of competency on a scale of one to five. Appendix O contains detailed information on the responses.

Seventy-five percent of the "program" managers and sixty-five percent of the "no-program" managers perceived themselves competent to handle environmental problems. In summary, a majority of managers from both groups perceived themselves generally competent.

Table 18

Task Competency

	Program			No-Program		
	N	Mean	SD	N	Mean	SD
Task 1	23	2.8	(1.2)	12	1.7	(0.9)
Task 2	22	3.1	(1.2)	12	2.9	(0.9)
Task 3	18	2.9	(0.9)	12	2.2	(0.9)
Task 4	22	2.8	(1.0)	12	2.0	(1.0)
Task 5	24	2.4	(1.1)	12	1.7	(0.8)
Task 6	22	3.1	(1.2)	12	1.9	(1.0)
Task 7	21	3.2	(1.3)	12	2.1	(1.0)
Task 8	21	3.1	(1.2)	12	2.0	(1.0)
Task 9	23	3.5	(1.1)	12	2.1	(1.0)
		3.0			2.0	

On a rating scale of one to five, the "program" managers rated themselves at 3.4, while the "no-program" managers rated themselves only slightly lower at 3.2. These scores were not directed towards any specific tasks, but purveyed an overall sense of competency towards environmental compliance in general.

Specific Conclusion

All nine task categories were considered important. Those actually performing them, the "program managers," rated them at 4.0 out of 5 in importance. In general, all of the managers perceived themselves as slightly above average regarding competence in handling environmental problems. However, when related to specific tasks, the competency rating score fell. The "program" managers rated their competency a point higher (3.0 to 2.0) than "no-program" managers at performing the identified tasks.

Research Question 4

Research question #4 was concerned with the educational needs and desires of the managers.

> Do environmental managers desire additional education and training in these tasks?.

Questions relating to the educational desire of the subjects were contained in both the background and task identification section. Appendix P supplies detailed information from the responses.

General

According to Table 19, ten (43%) of the "program" managers had previous formal environmental compliance education. In contrast, only one (1%) "no-program" manager reported the same. "Program" managers with previous education were primarily employed at firms with more than 20 employees and at plants with SIC classifications 3300, 3400, or 3500 as shown in Appendix P.

Fourteen (47%) of the "program" managers felt the need for additional education and were willing to obtain it.

Thus, a substantial portion of the "program" managers recognized the importance of, and a need for education in to satisfy the requirements of this position.

Over twice as many "program" managers (47%) as "no-program" managers (22%) indicated both the need for and the willingness to obtain additional education. This was statistically significant at the 0.05 level. Only 20 percent of the "no-program" managers felt that additional education was necessary, and only 32 percent were willing to spend the time required to obtain additional education.

Table 19

Summary: Education

	Program			No Program			Total		
	Yes	No	(%)	Yes	No	(%)	Yes	No	(%)
8-Past Education	10	18	43	1	18	05	11	36	23
16-Need	16	18	47	12	47	20	28	65	30
33-Spend Time	11	12	48	6	13	32	17	25	40
Total	27	30	47	18	60	22	45	90	33
49-How Willing (Mean)	2.9					2.4			2.6

These trends persisted in the data in terms of SIC code or plant size according to Appendix P. "Program" plants with 51-100 employees contained the highest percent of managers expressing both the need (83%) and the willingness to obtain education (60%). The same was true of the "program" managers employed at SIC group 3500 plants.

"Program" managers rated their willingness to actually attend classes at 2.9 on a scale of 1-5. This was 0.5 greater than the "no-program" managers' score of 2.4. While both groups' cumulative scores were under 3.0, several of the individual SIC class and size "program" managers group means were above 4.0 (Appendix P). All of the "no-program" scores were at or under three.

Task Related Education

The mean scores for education related to the nine task categories was presented in Table 20. The overall "program" managers mean score of 3.2 was one point higher than the "no-program" managers' mean of 2.2, a statistically significant difference at the 0.05 level. The "program" managers mean scores ranged from 3.0 to 3.4, while the "no-program" managers scores were much lower at 1.8 to 2.6.

The "program" managers' highest score, 3.4, was found with both task 2 (general compliance) and task 6 (preparing permits). The lowest score, 3.0, was associated with task 1 (monitoring). The highest "no-program" education desire score, aside from task 2, was 2.3, which was in conjunction with both task 3 (reading regulations) and task 9 (management). The lowest, 1.8, occurred with task 5 (audits).

The difference between the competency rating and the desire for education was calculated. This value was an indirect method for measuring desire or willingness to seek education. An individual with a high difference would potentially have the greatest drive to actually obtain that education.

Table 20

Task Educational Desire

	Program			No-Program		
	N	Mean	SD	N	Mean	SD
Task 1	23	3.0	(1.3)	12	2.2	(1.1)
Task 2	22	3.4	(1.3)	12	2.6	(1.2)
Task 3	18	3.3	(1.1)	12	2.3	(1.1)
Task 4	22	3.1	(0.9)	12	2.2	(1.0)
Task 5	24	3.1	(1.3)	12	1.8	(0.8)
Task 6	22	3.4	(1.2)	12	2.2	(1.2)
Task 7	21	3.1	(1.2)	12	2.0	(1.0)
Task 8	23	3.2	(1.2)	12	2.1	(1.3)
Task 9	23	3.3	(1.4)	13	2.3	(1.2)
		3.2			2.2	

Table 21 indicates that there was a collective 0.2 difference average between competency and educational desire across all tasks. The highest "program" difference (0.7) was observed with task 5 (audits). A negative score was found with tasks 7, 8, and 9. The highest "no-program" score difference (0.5) was associated with task 1 (monitoring). The second (0.3) related to preparing permits, task 6. Negative scores were associated with tasks 2 and task 7.

Table 21

Task Competency-educational Desire Difference

	Program	No-Program
Task 1	0.2	0.5
Task 2	0.3	(0.3)
Task 3	0.4	0.1
Task 4	0.3	0.2
Task 5	0.7	0.1
Task 6	0.3	0.3
Task 7	(0.1)	(0.1)
Task 8	(0.3)	---
Task 9	(0.1)	0.1
	0.2	0.2

Specific Conclusion

Only 33 percent of the respondents indicated they needed and would be willing to spend the time to obtain environmental compliance education. However, the percent of "program" managers (47%) was significantly higher. The difference between the "program" and "no-program" managers was significant to the 0.05 confidence level. The "program" managers' overall willingness to spend time and money to obtain this education to increase their competency, was rated at 2.9 out of five, which was significantly higher, at the 0.1 confidence level, when compared to willingness of the "no-program" managers.

The desire for education increased when it was related to the nine task categories. The "program" mean score of 3.2 out of 5 was significantly higher than the "no-program" score of 2.2.

In summary, there was a moderate overall desire for additional environmental education. However, the felt need and willingness increased among those actually performing environmental tasks and responsibilities. Education was important to those managers performing environmental compliance tasks and responsibilities. Forty-three percent of the "program" managers versus only five percent of the "no-program" managers had previously received formal instruction. At the same time, 48 percent of the "program" managers expressed a need for additional education. Their willingness rating was above average when the education was related to specific tasks. In several SIC classifications, many "program" managers indicated desire and willingness for education approached 4.0 out of 5.

CHAPTER VI
SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The subject of this research was environmental management at small industrial plants. The purpose to identify specific job tasks and the degree of competence performed by present environmental managers to assess educational and training needs. The study population consisted of 114 industrial plant managers located in Peoria County, Illinois, working at facilities with fewer than 100 employees and a SIC Code classification of 3000 to 3999. Four research questions were developed to address the above purpose. They were as follows:

1. What environmental compliance and management tasks are performed by these managers?

2. What are the managers' attitudes towards environmental regulations, industrial compliance and their environmental responsibilities?

3. How important do these managers rank various environmental management tasks and what is the level of competency they currently have in performing them?

4. Do environmental managers desire additional education and training in these tasks?.

A list of 62 environmental management tasks, consolidated into nine groups of tasks, was developed as part of this research. The list was based upon information obtained from interviews with environmental managers employed at a wide variety of industrial plants, as well as an exhaustive literature review (Chapter II). This task listing was validated via a random survey of environmental managers working at industrial plants throughout Illinois.

A mail questionnaire was developed to answer the above research questions. A committee of subject matter experts and a group of randomly selected small industrial plant managers both evaluated the instrument. The results from the pilot study indicated that a low response rate could be expected since many industrial plants did not generate wastes or have an environmental compliance or management program.

Based on the results of the pilot study, the instrument was shortened to increase the response rate. A second, condensed version of the original survey, as well as a telephone interview script, was also developed. These were used to obtain information from non-responders to the initial mailing. Information from these two instruments was used to determine whether or not the manager was employed at an industrial plant that had an active environmental program.

The questionnaires were mailed to the entire population of small industrial plant managers. Following an elapsed time of ten days, the second shortened survey was sent out to all non-responders. On-site visits were conducted to obtain completed questionnaires from firms in each SIC major code. Finally, staff at all remaining plants were contacted by telephone to gain information about their plant's environ-mental status. Responses were obtained from a total of 97 out of the original 114 subjects for a 85 percent return rate.

The returned surveys were divided into two groups. The largest one consisted of 62 responses (64%) from managers employed at small industrial plants that did not produce wastes or have an environmental compliance program. These were labeled "no-program" plants and managers. The second group consisted of 35 responses (36%) from managers employed at "program plants". These plants had active environmental management programs because they either produced wastes, had an EPA permit, were routinely inspected by the EPA, or were concerned about the impact of their wastes on the environment.

The managers working at these "program" plants were responsible for that firm's environmental compliance. Therefore, a review of their work tasks and attitudes provided the essential information for evaluating what an environmental manager in a small industrial plant did and had to know.

The managers responsible for environmental compliance at "program" plants performed numerous compliance tasks and activities. These tasks were rated high in importance with a mean score of 4.0 out of five.

Environmental compliance was not the major topic among plant managers' operating concerns. However, it rated slightly above average in importance and concern (3.3 out of five). The managers indicated a high expectation of additional environmental compliance requirements in the future (3.9 out of five). Sixty-two percent of the managers preferred to utilize their own in-plant skills when responding to environmental compliance problems or needs as opposed to hiring outside consultants and contractors.

These managers perceived themselves above average (3.4 out of five) in competence in dealing with environmental compliance problems. However, their perception of their level of competence decreased when related to specific tasks (3.0 out of 5).

Education appeared to be important in the performance of the environmental manager position. Forty-three percent of the "program" managers stated that they had previously received some type of formal education for facilitating environmental manager responsibilities. Forty-seven percent perceived that they needed more education and training associated with environmental compliance issues and would spend the time and effort necessary for increasing their competence as environmental managers. The degree of willingness increased when the education and training were linked to specific tasks.

Conclusion

Environmental Compliance--General Observations

Based upon the results of this research, it was determined that less than 10 percent of a plant manager's time at either "program" and "no-program" plants was spent on environmental matters. Only two managers indicated that environmental compliance required more time. The level of interaction with the EPA was rated at only 1.0 out of 5 by the "no-program" managers and only slightly higher by the "program" managers (1.6).

Environmental managers experienced a number of plant responsibilities apart from environmental responsibilities. Many managers indicated that their other plant responsibilities dwarfed their environmental tasks. Anxiety about the EPA and worries about non-compliance were rated by these managers at only 2.0 out of 5, very low and contrary to media perceptions.

Waste treatment was not commonly practiced at either "program" and "no-program" plants. Thus, work consisted of more managerial than operational tasks. Commonly reported tasks included "contacting outside waste disposal sites and haulers", "preparing permits" and "submitting reports". None of the plants in the study had in their employ a full-time environmental manager. These individuals performed the tasks and functions of environmental manager along with that of plant manager.

While the number of environmental tasks performed by environmental managers was small and consumed little time, environmental compliance remained important. Environmental compliance was implemented to prevent contamination resulting from improper industrial waste disposal. On-going operation of an environmental compliance program was mandated by legislation and numerous local, state, and federal regulations. Thus, environmental compliance was not optional. Failure to comply with EPA's many regulations could result in fines and imprisonment.

Difference Between "Program" and "No-Program" Plants

Environmental compliance practices differed significantly between "program" and "no-program" plants. There were also significant differences in the environmental managers' tasks, attitudes, and educational needs between the two categories of plants. Environmental compliance was considered more important within the "program" plants and placed additional demands upon these managers.

On a percentage basis, over ten times (48 percent versus 4 percent) as many "program" plants generated waste, had EPA permits, or otherwise exhibited environmental background status characteristics compared to "no-program" plants. Likewise, four times (52 versus 12 percent) the number of "program" plant managers routinely performed environmental tasks compared to "no-program" plant managers.

Their work experience, and thus the knowledge and skills required, differed greatly. Seventy percent of "program" managers stated that they performed the nine task categories. Only 26 percent of "no-program" managers stated that they performed the same. This difference persisted even into the managers' self-perceived attitudes towards the EPA and the importance of environmental compliance and their jobs. One whole point (2.5 to 1.5) separated the "program" managers' perceptions mean score from the "no-program" managers' mean. The "no-program" managers' responses were all below 2.0, again indicating low importance attached to environ-mental compliance.

In summary, there were major differences between "program" and "no-program" environmental compliance activities and attitudes. The "program" managers exercised much greater responsibilities and performed more tasks relating to the role of environmental manager. They had a more realistic perspective since they were actually performing environmental compliance as part of their plant's operations. The "no-program" managers, who were not actually complying with the regulations because they did not generate waste or have permits, expressed attitudes about the EPA similar to those held by the media.

Characteristics of "No-Program" Plants and Managers

Thirty-four percent of "no-program" managers contacted outside haulers and off-site treatment for storage or units to dispose of the waste generated in their plants. Other than this, few of these managers performed environmental management tasks. Two managers reported that they prepared permit applications, only three wrote reports to the EPA, and three read and studied environmental regulations. None of the "no-program" managers collected waste stream data. This suggests that they were not actively involved in compliance activities, and, consequently, were not satisfying the requirements to be considered environmental managers.

Eighty-four percent of the "no-program" managers identified task 2 (operational compliance) as performed routinely. However, only four percent of these managers worked at plants that generated waste or had an EPA permit. Furthermore, less than ten percent of the "no-program" managers identified any of the more operational topics for which a permit and compliance activities would be required. One might safely conclude that while 84 percent of the "no-program" managers desired to be in conformity with environmental regulations, few were actually in a work situation in which they were called upon to perform the duties and activities associated with compliance.

There was a divergence between the "no-program" managers' perceptions of environmental compliance duties and the tasks that they were actually performing. They consistently marked those activities that one might presume regularly occurred in an industrial plant, while they themselves were not actually accomplishing them. For example, 67 percent of "no-program" managers marked task 3 (reading and studying regulations), yet in the background section of the instrument only three of the respondents cited this task as one that they routinely performed. Only two out of 64 "no-program" managers indicated that they prepared EPA permits; however, 47 percent indicated that they did so in the task identification section.

"No-program" managers did not foresee environmental compliance requirements or activities increasing at their plants in the future (2.0) despite their anticipating increases in regulations and EPA enforcement (3.6 out of five). In a sense they were sticking their "heads in the sand" and ignoring their own projections by not presently implementing environmental compliance activities.

In summary, the "no-program" managers did not perform many environmental responsibilities or tasks. Because they were not actively involved in these activities, they did not have realistic perceptions about their future responsibilities. While they predicted increased environmental compliance requirements in the future, they did not perceive that these applied to them. The "no-program" industrial plant managers were ignoring both present realities and their predictions.

Key- "Program" Managers

The perspective of environmental compliance at small plants as presented by the sum total of all the respondents in this study would be misleading. As indicated above, the majority of small plants had neither significant waste streams nor active environmental programs. Consequently, the managers performed few, if any, environmental compliance or management activities.

One might conclude that environmental compliance and management at small industrial plants was an irrelevant topic. Few waste streams were produced. Consequently, there should be little concern about environmental compliance education and training for managers. However, a more accurate understanding of environmental compliance and management problems, responsibilities, and tasks at small industrial plants was discerned by studying the "program" plants and their managers identified in this research. These were the plants that had active environmental programs. Consequently, the managers were cognizant of the EPA regulations, involved with regulatory agencies, and performed numerous environmental compliance tasks. Thus, the workplace activities, job-related knowledge requirements, and educational background and needs of the "program" managers were pertinent to determine an accurate assessment of environmental compliance and management at small industrial plants.

Education

Both "program" and "no-program" managers stated emphatically that they preferred to handle or solve their environmental problems internally. This required an educated and trained plant staff.

Forty-three percent of the "program" managers stated that they had previously received formal environmental compliance education in contrast from only five percent of the "no-program" managers. The "program" managers who had previously received education or training were closely associated with those actually performing environmental compliance tasks.

From the data, it may be hypothesized that active environmental managers considered environmental education of importance. Despite having had previous education, 47 percent of these same managers perceived a need for additional education. In contrast, a history of and desire for education was not found among the "no-program" managers.

When additional education was joined to knowledge of specific tasks, willingness to attend classes increased even more. Seventy percent of the "program" managers identified the nine task categories as ones that they routinely performed and rated them at 4.0 out of 5 in importance to environmental compliance. Therefore, these tasks should be central to any environmental management curriculum.

The desire and willingness of managers for additional education at plants in SIC major groups 3300, 3400, and 3500 were statistically higher than at plants in other SIC groups. Therefore, an analysis of the local industrial demographics would assist in determining not only need but also relevant course material.

Future Projections

A majority of all managers (3.8 out of 5) perceived that environmental compliance, including more regulations and enforcement, would increase in the future. This could result in a number of current "no-program" industrial plants being required to implement environmental compliance programs, while other plants would have to expand programs already in place.

A number of "no-program" plants would remain. However, the subjects (3.5 out of 5) perceived that the EPA would more closely scrutinize all plants in the future, including those that produced no waste. Thus, all plants would be required to actually monitor and test their wastes. Only those with documented zero waste production would be exempted from increasing compliance requirements. No longer would small plants presume that the regulations did not apply to them merely because they were small. Many industrial plants, having ignored environmental compliance to date, will be forced to install pollution control equipment and implement active environmental compliance and management programs.

In the future, small industrial plants that produced wastes would assume more of the characteristics of the environmental compliance status of the "program" plants described in this study. Thus, "program" plant managers' activities and attitudes seen here were pertinent in establishing projections regarding future task activities and educational needs of plant managers. Since education was viewed as a critical part of preparing current environmental managers for effective job performance, it would remain important.

Recommendations

Application

1. Courses in environmental management should be offered as options in environmental compliance educational programs.
2. Environmental management education should be based upon the tasks performed by managers already employed in industrial plants.
3. Environmental management consists of numerous activities relating to management, not necessarily operational tasks. Thus, courses in environmental management should include instruction in general management, such as report writing, communication, supervision, and

permit application preparation.

4. The curriculum should be designed around the tasks identified in the task identification section.
5. A survey to determine the SIC code composition of the local industrial plants should be conducted to determine the types of wastes and environmental problems that are present prior to developing the course.
6. Environmental management courses should be offered by community colleges, which can best respond to the specific needs of a technically trained industrial workforce.

Replication

1. This study should be replicated in other geographic areas where the SIC code mix of industries is different.
2. A study focusing on the perceptions and attitudes of plant owners would provide a different perspective.
3. More attempts to ascertain the non-environmental responsibilities of managers should be included to better determine the importance of this topic.

4. A study on the relevance of past and present course offerings of two- and four-year academic institutions, which relate to environmental management, should be undertaken.

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APPENDICES

APPENDIX A

LIST OF SUBJECTS

SMALL INDUSTRIAL PLANTS IN PEORIA COUNTY WITH SIC CODE 3000 - 3999

BARTONVILLE

ACME MFG. CO
45 Entec, PO BOX 4170
Bartonville, IL 61607-0170

309-633-9966 (800-325-1816)
SIC 3498 - Galvanized Pipe & Fittings
50 Employees

ARTITAGE MACHINE CO. INC
6035 S. Washington ST
Bartonville, IL 61607

309-697-9050
SIC 3599 - General maching job Shop
15 Employees

ILLINI FOUNDRY CO
7100 S Adams St.
Bartonville, IL 61607

309-697-3142
SIC 3366 - Non-ferrous castings
9 Employees

PAGE TWO, INC.
7000 S Adams
Bartonville, IL 61607-9998

309-697-4000 (800-624-4044)
SIC 3315 - aluminized steel wire
19 Employees

SOMMER PRODUCTS CO.
7100 S Adams
Bartonville, IL 61607-2711

309-697-1216
SIC 3548 - Welding Equipment
50 Employees

CHILLICOTHE

AC GENTROL INC
5407 W Rome RD.
Chillicothe, IL 6152-9429

309-274-5486
SIC 3613 - Generator control panels
20 Employees

ALLIED WELDING INC
1801 Logan PO Box 410
Chillicothe, IL 61523-1119

309-274-6227 (800- 447- 3221)
SIC 3599 - Welding job shop
65 Employees

J&J MFG. CO INC
110 W Walnut
Chillicothe, IL 61523-1864

309-274-3141
SIC 3469- Metal stamping, 3544- Tools, 3599- Welding
10 Employees

MEISTER & SHANE LTD
1017 Third ST
Chillicothe, IL 61523-0274

309-274-2800
SIC 3599- Welding, 3715- Truck repair
9 Employees

QUALITY MACHINE & ENGINE PARTS
134 N. Fourth St.
Chillicothe, IL 61523-2056

309-274-5444
SIC 3599- Automotive machining job shop
5 Employees

CREVE COEUR

LB DRIVELINE PRODUCTS INC
404 S Main
Creve Coeur, IL 61611

309-699-9161 (800 747-2953)
SIC 3568- Drive shaft parts
3 Employees

PEORIA LOCOMOTIVE PARTS
101 Wesley Rd.
Creve Coeur, IL 61611-9998

309-694-8662
SIC 3743- Locomotives
30 Employees

DUNLAP

BIG RIVER GAME CALLS
509 S. 4th
Dunlap, IL 61525-9755

309-243-7515 (800-752-7426)
SIC 3949- Game & hunting calls
14 Employees

PEORIA NAMEPLATE CO.
Lake of the Woods Plz
Dunlap, IL 61525-9998

309-243-9332 (800-828-4022)
SIC 3089- Plastic & metal name plates
2 Employees

EDELSTEIN

CUSTOM POWER PRODUCTS INC
RT 40 North
Edelstein, IL 61526-9998

309-249-2704
SIC 3613- Switchgear
16 Employees

INTERNATIONAL SUPPLY CO INC
419 Main ST PO BOX 17
Edelstein, IL 61526-0017

309-249-6211
SIC 3599- General Machine Shop
60 Employees

ELMWOOD

BLUNIER CONCRETE CO.
304 E Hawthorne St, PO Box 745
Elmwood, IL 61529-0745

309-742-4011
SIC 3273- Ready-mix concrete
4 Employees

HANNA CITY

ILLINOIS WELD & MACHINE INC
3313 N. Eden Rd
Hanna City, 61536

309-365-4515
SIC 3599- General machine job shop
10 Employees

PEORIA

A T S MACHINERY & EQUIPMENT
515 Maxwell Rd.
Peoria, IL 61607

309-697-5530
SIC 3541 - Reconditioned machine tools & metal working machinery
13 Employees

ACADEMY OF AWARDS
1316 War Memorial Dr.
Peoria, IL 61614-7725

309-686-0026
SIC 3914 - Trophies, plaques & signs
7 Employees

ACT BENDING & STEEL CO INC.
900 SW Adams ST
Peoria, IL 61602-1609

309-637-1114
SIC 3498 - Tube brazing, bending, flaring & expanding
12 Employees

ADAMS OUTDOOR ADVERTISING OF PEORIA
1015 W. Detweilier Dr.
P.O.Box 3796
Peoria, IL 61612-3796

309-692-2482
SIC 3993 - Outdoor advertising panels & painted bulletins
16 Employees

ADVANCE MACHINE SHOP
2200 W. Altorfer
Peoria, IL 61615

309-693-5764
SIC 3599 - General machining & welding job shop
2 Employees

ADVANCED RADIOGRAPHIC TECH
1915 W. Altorfer Dr.
P.O. Box 5883
Peoria, IL 61602

309-655-0140
SIC 3842 - Medical Control Kits
2 Employees

AIMEN'S MARKING DEVICES
3921 N. Sheridan Rd.
P.O. Box 1429
Peoria, IL 61655-1429

309-673-5200
SIC 3953 - Rubber Stamps, stencils & engraving
8 employees

AIR VENT, INC.
4801 N. Prospect Rd.
Peoria, IL 61614

309-688-5020
SIC 3564 - Roof ventilation products
15 Employees

ALCAST CO.
8821 N. University St.
Peoria, IL 61615-1674

309-691-5513
SIC 3365 - Permanent mold aluminum casting
38 Employees

AMERICAN VINYLCRAFT, INC.
2400 S.W. Adams St.
Peoria, IL 61602-1807

309-637-5561
SIC 3089 -- Vinyl replacement windows
95 Employees

AMERICAN VISION CENTERS, INC.
5001 N. University
Peoria, IL 61614-9431

309-692-2525
SIC 3851 - Eyeglass & lens grinding
5 Employees

BEMIS HYDRAULIC
817 N.E. Adams
Peoria, IL 61605

309-682-1380
SIC 3492 - Hydraulic steel braided hose & fittings
6 Employees

BIGGS AWNING & WINDOW CO.
2301 S.W. Adams
Peoria, IL 61602-1868

309-674-6116
SIC 3231; 3442 - Windows doors & awnings.
15 Employees

BRINKLEY MACHINE CO.
2403 S.W. Adams
Peoria, IL 61602-1852

309-676-2600
SIC 3599 - General machining job shop
9 Employees

C WAY FABRICATORS INC.
7010 N. Galena rd.
Peoria, IL 61614

309-692-5290
SIC 3312 - Steel Fabrication
10 Employees

CERTIFIED HEAT TREATING CO.
8917 N. University St.
Peoria, IL 61615

309-693-7711
SIC 3398 - Commercial heat treating
7 employees

CHAMPION FURNACE PIPE CO.
120 Morton St.
P.O. Box 957
Peoria, IL 61653-0957

309-676-0877 (800-452-7473)
SIC 3444 - Furnace pipe, fittings, elbows & ductwork
90 Employees

CHIP'S TOOL & MACHINE WORKS, INC.
3012 S.W. Adams St.
Peoria, IL 61602-1971

309-673-2437
SIC 3544 - Tool & die job shop
16 Employees

COBATCO,INC.
1327 N.E. Adams St.
Peoria, Il 61603-4103

309-676-2663 (800-462-2282)
SIC 3556 - Bakers, mixers & accessories
21 Employees

CONSTRUCTION MATERIALS CO.
100 Cass St.
Peoria, IL 61602-1724

309-676-0576
SIC 3273 - Ready mix concrete
70 Employees

COPE PLASTICS, INC.
8728 N. Pioneer Rd.
Peoria, IL 61615-1518

309-691-0905 (800-322-2826)
SIC 3089 - Industrial plastic fabrication
15 Employees

CUSTOM PLASTICS
4415 Enterprise Dr.
Peoria, IL 61607-2756

309-697-2888
SIC 3089 Industrial Plastics
4 Employees

CUSTOM SIGNS
2721 S.W. Adams
Peoria, IL 61602

309-673-7937
SIC 3993 - Interior & exterior signs
3 Employees

DP SYSTEMS INC
2706 SW Washington St
Peoria, IL 61602-1956

309-676-1161
SIC 3564 - Heating, ventilation & air conditioning
9 Employees

DOOLEY BROTHERS
1201 SW Washington St
Peoria, IL 61602-1634

309-674-5101
SIC 3532 - Electric coal drills & mining equipment
9 Employees

DOUBET ALUMINUM WINDOWS
7008 N Galena Rd
Peoria, IL 61614-0242

309-691-0242 (800-622-8913)
SIC 3442 - Jalousie windows, doors & screens
5 Employees

DU-MONT CO.
1122 W Pioneer Pkwy.
Peoria, IL 61615-1917

309-692-7240
SIC 3444 - Sheet metal & plate
60 Employees

E-G PRODUCTS
9121 N. Industrial Rd.
PO Box 3880
Peoria, IL 61612-3880

309-692-0968
SIC 3499 - Metal fabrication
4 Employees

ELECTRICAL CONTROLS INC
7000 N Galena Rd
Peoria, IL 61612-3880

309-692-2500
SIC 3625 - Electrical control panels, machine tool & motor controls
11 Employees

ERLICHMAN CO. INC.
3213 SW Washington St
Peoria, IL 61602-1964

309-637-4491
SIC 3341 - Scrap iron, metals, paper, cartons, wiping materials, high grade corrugated paper & aluminum can
34 Employees

FP WEBKOTE INC.
1016 SW Adams
Peoria, IL 61614-1611

309-676-2847
SIC 3089 - Lid heat seals
50 Employees

FELDE TOOL & MACHINE CO. INC.
2324 W. Altorfer Dr.
Peoria, IL 61615-1890

309-692-5870
SIC 3544 - Tool & die & general machining job shop
18 Employees

FIRST PLACE TROPHIES
3113 N Prospect Rd
Peoria, IL 61603-1505

309-685-2216
SIC 3479 - Engraving, trophies, plaques & pins
5 Employees

GETZ FIRE EQUIPMENT CO
1615 SW Adams St
Peoria, IL 61602-1782

309-673-0761
SIC 3569 - Fire servicing equipment
50 Employees

GETZ MFG
1525 SW Adams
Peoria, IL 61602-1709

309-674-1723
SIC 3559 - Fire extinquisher repair equipment
20 Employees

GRAWEY GLASS CO
901 SW Adams
Peoria, IL 61602

309-674-9129
SIC 3231 - Glazed glass
6 Employees

HANGER INC. J E
1907 N Sheridan Rd
Peoria, IL 61604-3478

309-682-9586 (800-899-9586)
SIC 3842 - Artificial limbs & braces
8 Employees

HANLEY STEEL INC
8811 N Industrial Rd
Peoria, IL 61615-1574

309-692-5250
SIC 3312 - Steel fabrication
18 Employees

HARDIN SIGNS INC
3663 Meadowbook Rd
Peoria, IL 61604-1214

309-688-4111
SIC 3993 - Neon, plastic & painted signs, computer cut & illuminated letters, logo design & graphics
15 Employees

HAWKEYE RUBBER MFG - PEORIA DIV.
1 Spring St
Peoria, IL 61603-4099

309-676-1951
SIC 3069 - Rubber mechanical goods
40 Employees

HOLLAND SPECIALTY CO INC
4611 Middle Rd
Peoria, IL 61605-1055

309-697-9262 (800-369-6584)
SIC 3843 - Denture cleaning device
10 Employees

HOPPE CO
1200 N Bond St
Peoria, IL 61603-4012

309-674-7880
SIC 3069 - Rubber compound materials
10 Employees

IBS INC.
2424 Clarke St.
Peoria, IL 61607-2017

309-637-4422
SIC 3312 - Scrap iron & steel processing
84 Employees

ILLINOIS CRANE INC
8811 N. Industrial Rd
Peoria, IL 61615-1574

309-692-0856 (800-642-7478)
SIC 3536 - Overhead cranes & factory trolley systems
25 Employees

ILLINOIS INDUSTRIAL METAL PLATING INC
503 Abington St
Peoria, IL 61603-3515

309-674-2989
SIC 3471 - Brass, copper, nickel, tin & zinc plating
8 Employees

ILLINOIS VALLEY GLASS & MIRROR CO
3300 NE Adams St
Peoria, IL 61603-2310

309-682-6603 (800-244-2206)
SIC 3231 - Glass & metal fabrication
10 Employees

INDUSTRIAL TOOL & REPAIR CO
4010 SW Adams
Peoria, IL 61605

309-674-6215
SIC 3599 - Machine parts
5 Employees

JOAN'S TROPHY & PLAGUE CO
414 NE Jefferson
Peoria, IL 61603-3726

309-674-6500
SIC 3499 - Engraved Nameplates
25 Employees

JOHNSON HYDRAULIC MFG CO
6315 W Fauber Rd
Peoria, IL 61607-3934

309-697-3934
SIC 3537 - Dump bodies, hoists pumps, hydraulic cylinders & stabilizers
55 Employees

KEMP MFG CO
4310 Voss St
Peoria, IL 61614-6543

309-682-7292
SIC 3519 - Diesel engine & agricultural machine parts
37 Employees

KUHLMAN SOUND, LIGHT & VIDEO
1111 Gift Ave
Peoria, IL 61604-2620

309-691-0100
SIC 3651 - Speaker, sound ,lighting & video systemes
2 Employees

LAMPLIGHTER MFG. INC.
604 W. Muller Rd.
Peoria, IL 61611-4745

309-694-6412 (800-245=2677)
SIC 3646 - Specialty lighting
4 Employees

LIGHT'S ARTICICAL EYE CO
425 Jefferson BLD
331 Fulton St
Peoria, IL 61602

309-676-3663 (800-465-7610)
SIC 3842 - Plastic eyes
1 Employees

LUCAS & SONS
1318-28 SW Washington St
Peoria, IL 61602-1798

309-673-8547
SIC 3441 - Steel & iron fabrication
20 Employees

LYNCH ALUMINUM MFG CO
8810 N University
Peoria, IL 61615

309-692-3230
SIC 3444 - Aluminum rainware
25 Employees

MILLER & CO
1612 SW Adams
PO Box 695
Peoria, IL 61652

309-674-1101
SIC 3312 - Srap metal processing
25 Employees

MONTEFUSCO HEATING & SHEET METAL
2200 W Altorfer Dr
Peoria, IL 61615-1808

309-691-7400
SIC 3444 - Sheet metal fabrication
7 Employees

NATIONAL LAMINATES, INC
9011 N University
Peoria, IL 61615

309-691-7799
SIC 3089 - Plastic laminate
10 Employees

NYLE STALEY INTERSTATE READY-MIX
600 Van Buren St
Peoria, IL 61603-2900

309-682-6045
SIC 3273 - Ready mix concrete
15 Employees

O'BRIEN SHEET METAL
2728 NE Adams St
Peoria, IL 61603-2804

309-685-6103
SIC 3444 - Sheet metal products & duct work
6 Employees

PARTS PLUS OF PEORIA
401 NE Rock Island
Peoria, IL 61602-1637

309-685-5912
SIC 3492 - Hydraulic hose assemblies
18 Employees

PEORIA CONCRETE CONSTRUCTION CO
1515 N Broadway
Peoria, IL 61606-1330

309-685-7623
SIC 3271 - Concrete blocks, sand, gravel & stone
5 Employees

PEORIA CULTURED MARBLE
1223 S Laramie St
Peoria, IL 61605-1301

309-637-7013
SIC 3281 - Marble products
1 Employees

PEORIA STONE & MARBLE WORKS
333 E Lake Ave
Peoria, IL 61614-6125

309-685-9122
SIC 3281 - Marble & ceramic stone
3 Employees

PERFORMANCE PATTERN & MOLD INC
2421 SW Adams
Peoria, IL 61602-1852

309-676-0907 (800-500-0907)
SIC 3544 - Wooden, metal & plastic patterns, molds, dies, models & general machining
25 Employees

PLATTNER ORTHOPEDIC CO INC
1100 Main St
Peoria, IL 61606-1927

309-682-1382 (800-551-4276)
SIC 3842 - Orthopedic & prosthetic appliances
10 Employees

PROSTHETIC & ORTHOTIC SPECIALISTS
728 E Frye
Peoria, IL 61603-2608

309-688-9549 (800-932-0267)
SIC 3842 - Orthopedic braces
10 Employees

QUALITY METAL PRODUCTS INC
7006 N Galena Rd
Peoria, IL 61614-2206

309-692-8014
SIC 3544 - Tool & die & general machine job shop
75 Employees

R&T SPECIALITIES INC
204 Morton Ave
Peoria, IL 61603-4025

309-674-9166 (800-747-3273)
SIC 3993 - Advertising specialities
30 Employees

RAMOLEY CORP
3000 W Farmington Rd
Peoria, IL 61603-4025

309-676-7909
SIC 3993 - Interior & exterior signs
6 Employees

RIVER CITY ENTERPRISES
3806 Northwood Ave
PO Box 9365
Peoria, IL 61612-9365

309-688-3223
SIC 3089 - Industrial plastic products
4 Employees

RIVERSIDE TOOL & DIE CO
1616-A W Chanute Rd
Peoria, IL 61615-1605

309-689-0104
SIC 3544 - Tool & die job shop
17 Employees

ROME INDUSTRIES
1703 W Detweiller Dr
Peoria, IL 61615-1611

309-691-7120
SIC 3949 - Camping & patio accessories
15 Employees

ROTHAN CO.
1200 W. Johnson St.
Peoria, IL 61605-2080

309-674-5189
SIC 3429 - Architectural millwork, doors, frames,& finish hardware
18 Employees

SEDCO, INC.
415 N. Jefferson
P.O. Box 58
Peoria, IL 61650-0058

309-674-2020
SIC 3851 - Optical Goods
8 Employees

SHAMROCK PLASTICS, INC.
2615 Alta Ln.
P.O. Box 3530
Peoria, IL 61612-3530

309-243-7723
SIC 3089 - Thermoformed plastic components
30 Employees

THE SIGNERY
508 E. War Memorial
Peoria, IL 61614-7544

309-685-9292
SIC 3993 - Vinyl, wooden & metal commercial & residential signs
9 Employees

SIPCO PRODUCTS INC.
800 S.W. Adams St.
P.O.Box 5655
Peoria, IL 61601-5655

309-637-5100
SIC 3499 - Smoking urn receptacles, safety latch gates & hat racks
8 Employees

SMITH & CO.,E.M.
826 W. Detweiller Dr.
Peoria, IL 61615 - 2125

309-691-6812
SIC 3544 - General machining & metal spraying & plating job shop
30 Employees

SMITH PRINTERS, INC. EDWARD J.
207 Voris St.
Peoria, IL 61603-4029

309-676-0869
SIC 3469 - Commercial printing, foil stamping & embossing
10 Employees

STAINED GLASS OF PEORIA
512 Spring St.
Peoria, IL 61603-4121

309-674-7929
SIC 3231 - Leaded art stained & beveled glass
7 Employees

STALEY & STALEY READY-MIX CONCRETE, INC.
1320 N. Raber Rd.
Peoria, IL 61604-4708

309-637-1200
SIC 3273 Ready-mix concrete
9 Employees

STANDARD SHEET METAL WORKS, INC.
100 Persimmon St.
Peoria, IL 61655-1625

309-671-5400
SIC 3444 Sheet metal fabrication
75 Employees

STERIER SAND & GRAVEL
2423 W. Farmington Rd.
Peoria, IL 61604

309-673-8894
SIC 3281 - Sand & gravel
4 Employees

TONEMASTER ELECTRONIC CONTROLS CO.
8206 N. University St.
Peoria, IL 61615

309-691-0810 (800- 691-0810)
SIC 3679 - Solid state circuits, electronics assemblies, weatherproof coatings, battery chargers & strobe lights
9 Employees

TRI-CITY MACHINE PRODUCTS, INC.
1506 S.W. Washington
Peoria, IL 61602-1748

309-673-5589
SIC 3599, 3561 - Precision general & CNC machining job shop & pump parts
30 Employees

U S A TECHNOLOGY
801 S.W. Jefferson St.
Peoria, IL 61605

309-674-0600
SIC 3714, 3469 - Automobile filters & metal stampings
72 Employees

U S RIBBON, INC
1229 W. McClur
Peoria, IL 61604

309-688-4563
SIC 3955 - Ribbon Causey
2 Employees

UNITED READY MIX, INC.
1 Leland St.
Peoria, IL 61602-4633

309-676-4633
SIC 3273 Ready mix concrete
25 Employees

WALDEN PRINTING INC.
4924 N. Renwood
Peoria, IL 61614-4514

309-691-2246
SIC 3953 - Rubber stamps & commercial printing
5 Employees

WELARCO FABRICATIONS, INC.
7400 W. Plank Rd
Peoria, IL 61614-5302

309-697-9400
SIC 3713 - Off highway truck bodies
23 Employees

PEORIA HEIGHTS

DESIGN PLUS INDUSTRIES
737 E. Marietta Ave
Peoria Heights, IL 61614

309-682-9359
SIC 3999 - Coin operated games
12 Employees

PEORIA PRODUCTION SHOP INC
920 E Glen
Peoria Heights, IL 61614-5302

309-688-8643
SIC 3089 - Contract sewing
75 Employees

RONCO TEXTILE PRODUCTS, INC.
1405 E. Lake Ave
Peoria Heights, IL 61614-7801

309-685-7266
SIC 3842 - Industrial protective clothing
40 Employees

PRINCEVILLLE

COKEL WELDING & STEEL FABRICATORS, D.J.
224 E. Evans St.
Princeville, IL 61559

309-385-4567
SIC 3312 Steel fabrication
2 Employees

GIVENS MACHINE CO., INC.
321 E. Main
Box 296
Princeville, IL 61559

309-385-4580
SIC 3599 - Internal engine & industrial automotive machining
5 Employees

HARMS ENCLOSURE CO.,INC.
1017 N. Santa Fe ST.
Princeville, IL 61559-9716

309-385-4384
SIC 3441 - Steel housings, fuel tank bases, trailers & fabrication
25 Employees

LONG ROCK CORP.
Hwy. 51
P.O.Box 188
Princeville, IL 61559-0188

309-385-4516
SIC 3281 - Crushed limestone
23 Employees

ROME

CHILLICOTHE METAL CO.,INC.
Rome West Rd.
P.O. Box 31
Chilicothe, IL 61523-0031

309-274-5421
SIC 3441 - Steel Fabrication, machining, welding & assembly job shop
80 Employees

YATES CITY

GENERAL MACHINE SERVICE
P.O. Box 344
Yates City, IL 61572

309-358-1544
SIC 3599 - General Machining shop
1 Employee

Firms No longer in Business

J&J MFG. CO INC
SIC 3469- Metal stamping, 3544- Tools, 3599- Welding
10 Employees

MEISTER & SHANE LTD (Not used as related to author)
SIC 3599- Welding, 3715- Truck repair
9 Employees

ILLINOIS WELD & MACHINE INC
SIC 3599- General machine job shop
10 Employees

ADVANCED RADIOGRAPHIC TECH
SIC 3842 - Medical Control Kits
2 Employees

CUSTOM SIGNS
SIC 3993 - Interior & exterior signs
3 Employees

O'BRIEN SHEET METAL
SIC 3444 - Sheet metal products & duct work
6 Employees

SEDCO, INC.
SIC 3851 - Optical Goods
8 Employees

TONEMASTER ELECTRONIC CONTROLS CO.
SIC 3679 - Solid state circuits, electronics assemblies, weatherproof coatings, battery chargers & strobe lights
9 Employees

U S RIBBON, INC
SIC 3955 - Ribbon Causey
2 Employees

HARMS ENCLOSURE CO.,INC.
SIC 3441 - Steel housings, fuel tank bases, trailers & fabrication
25 Employees

New Plants Added To List

Peoria Plastic
SIC 3079
100 Employees

Midwest Truck Parts
SIC 3736
12 Employees

Chillicothe Metal
SIC 3399
80 Employees

Eagle Containers
SIC 3089
11 Employees

Miller Brothers
SIC 3842
5 Employees

Acme Welding
SIC 3599
2 Employees

TOTAL POPULATION

ORIGINAL LIST	118
PLANTS OUT OF BUSINESS	(10)
NEW PLANTS	+ 6
TOTAL POPULATION	114

APPENDIX B

INDUSTRIAL ENVIRONMENTAL MANAGER

TASK VALIDATION STUDY

APPENDIX B

TABLE OF CONTENTS

Environmental Management Task Validation Study

Introduction

No comprehensive single list of environmental management tasks was located in the literature review. Rather, specific tasks performed by various members of the environmental workforce including the manager, were described and discussed.

A goal of this research was to identify the tasks and competencies of environmental managers employed in small industrial plants. Thus, a comprehensive list of pertinent competencies had to be developed and validated.

While this list has had several other uses, its primary role in this research study was to serve as the foundation for a valid survey instrument on environmental management practices. Managers from small industrial plants were asked several questions about their responsibilities and competencies. It was therefore important to insure that the task list used was a current, valid list of competencies actually performed in the workplace. The development of that list is described in this appendix.

Summary of Related Research

The reader is referred to Chapter 2 for a detailed literature review of related research on developing task lists in comparable professions.

No environmental management competency task listing was located. However, competency task listings from other professions were found. These were studied to learn how to prepare and validate a list of industrial environmental compliance competencies.

Employed professionals were often used to provide input on competencies. The number of these experts used in a particular study ranged from 3 to 30. Both interviews and actual job observation were employed to gain insights into workplace activities.

The literature review was an important tool in the development of job task listings. Literature reviews provided both initial job task listings as well as validation of tasks observed in the workplace. Vocational and trade literature was as important as research literature in identifying professional tasks. The literature often times provided a broader more comprehensive listing than interviews or observations.

There was a wide range of observed competencies between various professions. These ranged from less than 10 to almost 300. The longer, more detailed lists were self-defeating as they reduced participant response rates to unacceptable levels. An evaluation of groups or clusters of tasks was utilized in several studies to remove this problem.

In summary, task competency listings have been developed for a wide range of vocations and professions. The principals which were utilized in these other studies were reviewed and have been incorporated into this research.

Task List Development

The industrial environmental manager task list used in this study was derived from earlier ongoing work by the author and MCT Consulting, an environmental consulting and training firm. An original task list was prepared as part of, and contained in, an Industrial Environmental Manager Continuing Education Program developed by MCT Consultants for training environmental workforce staff members. This list has been used by various industries and several universities for developing continuing education programs for environmental compliance.

A review of its development is pertinent in the discussion of its use as a valid list of environmental manager tasks. Ultimately, this task list went through three stages of development. Two stages, Phase I and II proceeded this validation study. They provided the foundation for this final stage of certification. The passage through these steps of development insured that it was an accurate and valid description of the industrial environmental manager's tasks and responsibilities.

Phase I

The original task listing was obtained through an intensive workplace analysis of numerous environmental managers. Based upon over 20 years experience in the industrial environmental management arena, the author prepared a list of 92 tasks. This initial list was then presented to 25 environmental managers in a manner similar to a modified Delphi Process. From an evaluation of this initial list by these environmental managers, a revised list was obtained.

The process was conducted in the following manner. During the fall of 1995, seven Illinois manufacturing firms were visited. In January and February, 1996, eighteen manufacturing plants in Alabama were also contacted and inspected. These industrial plants were of various sizes, SIC Codes and product mixes.

Information about the specific task responsibilities was obtained via extensive interviews with the environmental manager at the workplace site and by job shadowing. The managers were asked to describe their position and responsibilities and list the various tasks that they routinely performed. They were then observed for a period of time to confirm the occurrence of these tasks. They were also asked to list and comment on tasks which were not performed routinely, but were still important in the accomplishment of environmental compliance. In addition to listing specific tasks, they were asked to place similar tasks together within common functional groups or categories of tasks.

These interviews and site visits served as the first round of the task list development. The list of firms interviewed was arbitrarily selected to provide a cross section of Standard Industrial Classification (SIC) manufacturing codes and size of operation. The individuals which were interviewed and job shadowed were all employed as environmental managers and thus constituted an expert panel on the duties and responsibilities of the position. The use of such an expert panel was similar to that utilized in a Delphi inquiry.

Those tasks, specified by least 75% of the individuals, as performed on a routine basis or as important, were listed. The result was a list of seven functional areas and 50 tasks.

When asked, most of the managers declined to rank the tasks, stating that the importance was derived from the urgency and timeliness of the task. A common comment was that while there was commonality of tasks within the functional areas, the specific application depended on the individual environmental wastestream or media. These managers felt that future task competencies would be determined more by environmental regulations rather than other factors such as technology. In other words, if the regulations changed, then the specific competencies might change, however the functional groups should remain constant.

Phase II

The second phase of preparing this task listing was to conduct a literature review on the topic of environmental management. According to a review of related literature on task analysis and identification, a literature review was a valid methodology to scan the broad spectrum of the numerous and various technological processes which are utilized throughout the environmental compliance profession. Thus, descriptive literature with a focus on the environmental manager's position and responsibilities, written by those involved in the profession was studied. That literature review has been included in Chapter 2.

In addition to professional and trade literature, other sources such as the inter-net were also reviewed. Several Dacum and task competency sheets for specific environmental occupational positions were obtained, reviewed and analyzed. No single task competency sheet for the industrial environmental manager position was found. However, several existed for various other specific environmental occupations, primarily hazardous waste operations and Occupational Health and Safety (OHSA) specialties. The literature review was conducted to include all potential responsibilities in all environmental disciplines- air water and soil.

One goal was to obtain an understanding of the varied and demanding responsibilities and tasks performed by industrial environmental managers. From this, a list of specific tasks could be developed. Another goal was to discern the common functional groups or categories of tasks. This was because many of the industrial environmental manager's tasks, as noted in the literature, were dependent on the nature and type of industrial process and materials utilized.

The tasks identified in the initial workplace analysis were all verified as valid and current based upon the literature review and existing task competency sheets. No additional functional areas of responsibilities were noted. As noted above, specific tasks and duties were dependent upon the nature of the industrial plant. For example, preparing a monthly self-monitoring report required the same skills, whether it is related to wastewater discharge or to hazardous waste generation.

As a result of the literature review, several minor changes were made. These included changes in the wording of the task descriptions. In addition, several specific tasks were added. In summary, there was a very high concurrence of agreement between the initial list and the tasks identified in the literature.

An increased emphasis on some tasks over others was noted in the literature, which is reflected in Chapter 2. However, there was no indication of any ranking of importance, as the tasks were all considered important at one time or the other. This importance was based upon the fact that the tasks were undertaken in response to regulatory mandates.

Validation Study

Introduction

The third phase of developing this list consisted of a reconfirmation of the job tasks by another expert panel of employed environmental managers. The process was similar to a round 3 of a modified Delphi panel evaluation.

Methodology

Environmental managers from 15 Illinois manufacturing plants were asked to confirm the modified task listing resulting from the literature review. The manufacturing plants were selected from the 1995-1996 Downstate Illinois Business Directory and had over 100 employees as well as an active environmental compliance program. Only manufacturing plants located in downstate Illinois, outside of the Chicago metropolitan area, with a Standard Industrial (SIC) Code between 30 and 39 were utilized.

These criteria were deliberately selected, even though they were not similar to the population of the main research. The exceptions centered around the number of employees and the location of the subjects. Thus, while the primary research dealt with plants with less than 100 employees, larger plants, that is ones with more than 100 employees were used as they were more likely to actually have an environmental manager with the education, training and experience to review and validate the tasks. Likewise, the sample population was taken from all manufacturing plants in Illinois. Since, the main research would occur among plants located in Peoria County, Illinois, it would be wise to focus this study on plants outside of Peoria County. However, it decided to include one randomly selected large plant from Peoria County to insure some continuity with the main research.

The sample size of 15 plants was too small to accomplish a stratified selection based upon SIC Code or geographic location. The fact that the selected plants had an active compliance program and a presently employed environmental staff documented their involvement in environmental matters, regardless of type of process or location. A sample size of 15 was considered adequate, based upon the literature and considering that the purpose was only to confirm the validity of the task list.

The methodology was as follows. Fifteen SIC codes were selected on a random basis. From the Illinois Directory, one plant was then selected on a random basis from each of these SIC codes. A random number table (Robbins & Ryzun, 1975) and a random number generator were used to make these selections. One plant from Peoria County, again randomly selected was included to insure area representation.

These plants were then contacted by telephone. After the situation and purpose is explained to them, the environmental manager was asked to participate. This process continued until 15 individuals had agreed to complete the survey. The task list was then sent to each of them for their review and comments. They were asked to check mark each task which was valid, to cross out any which were not, and add any which are not present (See attached document). It was decided that only those tasks which received a positive check from at least 10 (75%) of the experts would be considered as valid tasks. In summary the respondents were asked if they concurred that the list was a valid listing of environmental manager tasks and responsibilities.

Accompanying the task listing was a cover letter reminding them of their willingness to participate and explaining the purpose of the exercise. A stamped envelope for expediting the return was also included.

The initial mailing was sent out via first class mail from Carbondale, IL, on December 4, 1996. All non-respondents were contacted by telephone on December 18, 1996. Because of non-response, three new industries were randomly selected on January 2, 1997. These were contacted and mailed a survey form. The desired number of fifteen responses was received by January 13, 1997.

APPENDIX B

VALIDATION STUDY

COVER LETTER & SURVEY

(SURVEY BASED UPON INITIAL COMPETENCY LIST)

JOHN MEISTER
305 Robinson Circle A-C
Carbondale, IL. 62901
618-529-7257

December 3, 1996

Mr XXX XXXXXXX
Environmental Manager
ABCD Industries
984 Ipsen Rd.,
somewhere, IL 61016

RE: Environmental Manager Task
Competency Validation

Dear Mr XXXXXXXX

I recently spoke to you on the telephone regarding this research project. Thank you for your willingness to assist in this project.

The information from this project will be ultimately used in the development of a competency based environmental management education and training programs. Your input is greatly desired to insure that these programs provide training for tasks performed in the real world.

THIS REVIEW SHOULD TAKE LESS THAN 10 MINUTES.

A stamped envelope is attached for your convenience. All information regarding source identification will be kept confidential. A copy of the summary will be provided to you, if desired.

Thank you for your cooperation and your quick response in completing this survey and placing it back into the mail.

If you have any questions, please feel free to contact me at 618-529-7257

Sincerely,

John F. Meister

INDUSTRIAL ENVIRONMENTAL MANAGER

TASK COMPETENCY

BIOGRAPHIC INFORMATION

(All source information will be kept confidential)

Name ______________________________

Plant ____________________________________
Name & ____________________________________
Address ____________________________________
____

SIC Code & ______________________________
Primary Product ______________________________

Years of experience as environmental manager:
1-2 ___ 3-5 ___ 5-10 ___ 10-20 ___

Environmental Education & Training:
(mark all appropriate) University ___
Short Courses ___
On-the-job ___

Which type of education most helped prepare you for this job
____

DIRECTIONS:

PLEASE READ THROUGH THE ENTIRE LIST BEFORE MARKING ANY ITEMS.

IF YOU AGREE THAT THE TASK IS ONE WHICH YOU OR ANOTHER ENVIRONMENTAL MANAGER PERFORMS OR WILL PERFORM IN THE COURSE OF THEIR RESPONSIBILITY, THEN MARK THE ITEM **YES**.

IF THIS IS NOT A REQUIRED TASK OF THE POSITION, THEN MARK THE ITEM **NO**. SPACE HAS BEEN PROVIDED FOR YOU TO WRITE ANY ADDITIONAL TASKS WHICH YOU FEEL SHOULD BE INCLUDED.

A KEY POINT TO REMEMBER IS THAT THE TASK MAY NOT NECESSARILY BE PERFORMED AT YOUR PLANT DUE TO SITE-SPECIFIC FACTORS SUCH AS RAW MATERIALS OR INDUSTRIAL PROCESS UTILIZED. HOWEVER, IF THAT THE TASK, IN YOUR OPINION, IS ONE WHICH MAY BE PERFORMED AT ANOTHER INDUSTRIAL PLANT THEN MARK IT YES.

TASK LISTING SHEET
ENVIRONMENTAL MANAGER

FUNCTIONAL AREAS*	VALID JOB RESPONSIBILITY	
	YES	NO
A. Monitoring and Data Acquisition	___	___
B. Industrial Environmental Compliance	___	___
C. Professional Development	___	___
D. Reports & Communication	___	___
E. Audits & Assessments	___	___
F. Policy	___	___
G. Consultant & Contractor Selection	___	___
H. Project Management	___	___
OTHER (optional):		

Not listed in any order of priority

TASK LISTING SHEET

ENVIRONMENTAL MANAGER

Functional Area: **MONITORING AND DATA ACQUISITION**

TASKS:	VALID TASK YES	VALID TASK NO
1. Determine Emission Monitoring Needs	___	___
2. Determine Ambient Background Monitoring Needs	___	___
3. Establish Solid Waste-Waste Characteristics Testing Program	___	___
4. Implement Emission Monitoring Program	___	___
5. Implement Ambient Background Monitoring Program	___	___
6. Analyze Samples (in-house or consultant)	___	___
7. Review Monitoring Data	___	___
8. Utilize Emission Data in required reports	___	___
9. Utilize Emission Data in planning	___	___
10. Utilize Ambient Background Data in required reports and for planning	___	___

OTHER (optional):

TASK LISTING SHEET

ENVIRONMENTAL MANAGER

Functional Area: **INDUSTRIAL ENVIRONMENTAL COMPLIANCE**

TASKS:	VALID TASK YES	VALID TASK NO
1. Comply with Air Pollution Control Regulations	___	___
2. Comply with Wastewater Pollution Control Regulations	___	___
3. Comply with Potable Water Pollution Control Regulations	___	___
4. Comply with Solid Waste Pollution Control Regulations	___	___
5. Comply with Industrial Waste Pollution Control Regulations	___	___
6. Comply with Hazardous Waste Pollution Control Regulations	___	___
7. Comply with OHSA Regulations	___	___
8. Comply with Right-To-Know Regulations	___	___
9. Comply with Other Regulations as Necessary (TSCA, FIRMA)	___	___
10. Comply with Remediation & Clean-Up Regulations	___	___

OTHER (optional):

TASK LISTING SHEET

ENVIRONMENTAL MANAGER

Functional Area: **PROFESSIONAL DEVELOPMENT**

TASKS:	VALID TASK YES	NO
1. Stay Current with Environmental Regulations	___	___
2. Stay Current with Environmental Technology	___	___
3. Acquire and maintain certifications	___	___

OTHER (optional):

Functional Area: **REPORTS & COMMUNICATION**

TASKS:	VALID TASK YES	NO
1. Prepare In-House Reports	___	___
2. Prepare Off-Site Reports	___	___
3. Recommend Policy	___	___
4. Articulate Policy to Public	___	___
5. Communicate with EPA	___	___

OTHER (optional):

TASK LISTING SHEET

ENVIRONMENTAL MANAGER

Functional Area: **AUDITS & ASSESSMENTS**

TASKS:	VALID TASK YES	NO
1. Prepare Compliance Audits- (Air)	___	___
2. Prepare Compliance Audits- (Wastewater)	___	___
3. Prepare Compliance Audits- (Solid Waste)	___	___
4. Prepare Compliance Audits- (Industrial Solid Waste)	___	___
5. Prepare Compliance Audits- (Hazardous Waste)	___	___
6. Prepare Other Compliance Audits as Needed (OHSA, TSCA)	___	___
7. Conduct Property (Site) Assessment- Phase I	___	___
8. Conduct Property (Site) Assessment- Phase II & Phase III	___	___

OTHER (optional):

TASK LISTING SHEET

ENVIRONMENTAL MANAGER

Functional Area: **POLICY**

TASKS:	VALID TASK YES	VALID TASK NO
1. Comprehend Present & Projected Regulations	___	___
2. Review Compliance	___	___
3. Prepare Recommendation	___	___
4. Articulate Policy (Within-plant)	___	___

OTHER (optional):

Functional Area: **CONSULTANT & CONTRACTOR WORK**

TASKS:	VALID TASK YES	VALID TASK NO
1. Determine Need	___	___
2. Retain Consultant	___	___
3. Retain Contractor	___	___

OTHER (optional):

TASK LISTING SHEET

ENVIRONMENTAL MANAGER

Functional Area: **PROJECT MANAGEMENT**

TASKS:	VALID TASK YES	VALID TASK NO
1. Supervise Consultant Work	___	___
2. Supervise Contractor Work	___	___
3. Employ In-House Staff	___	___
4. Train Staff	___	___
5. Prepare budgets & Operating Plans	___	___
6. Operate Pollution Control Facilities	___	___
7. Review Operational Reports	___	___
8. Maintain Compliance	___	___
9. Inform Plant Management	___	___
10. Communicate Plans & Progress to EPA	___	___
11. Guide EPA during inspections	___	___
12. Represent management	___	___

OTHER (optional):

TASK LISTING SHEET

ENVIRONMENTAL MANAGER

OTHER COMMENTS:

PLEASE RETURN THIS INSTRUMENT IN THE ATTACHED STAMPED, SELF-ADDRESSED ENVELOPE.

THANK YOU FOR YOUR COOPERATION

APPENDIX B

INDUSTRIAL ENVIRONMENTAL MANAGER TASK COMPETENCY LIST

SURVEY RESULTS

RESPONDENTS BIOGRAPHIC INFORMATION

Years of experience as environmental manager:

1-2 yrs.	4
3-5 yrs.	6
5-10 yrs.	2
10-20 yrs.	3

Gender: Male - 12 Female - 3

Environmental Education & Training:
(mark all appropriate)

University - 5
Short Courses - 9
On-the-job - 12

Which type of education most helped prepare you for this job?

University - 0
Short Courses - 2
On-the-job - 7

TASK LISTING SHEET
ENVIRONMENTAL MANAGER

FUNCTIONAL AREAS*	VALID JOB RESPONSIBILITY	
	YES	NO
A. Monitoring and Data Acquisition	14	1
B. Industrial Environmental Compliance	15	0
C. Professional Development	13	2
D. Reports & Communication	15	0
E. Audits & Assessments	14	1
F. Policy	15	0
G. Consultant & Contractor Selection	14	1
H. Project Management	15	0

*Not listed in any order of priority

OTHER (optional):

Permits needs to be listed as a major category.

TASK LISTING SHEET

ENVIRONMENTAL MANAGER

Functional Area: **MONITORING AND DATA ACQUISITION**

TASKS:	VALID TASK YES	NO
1. Determine Emission Monitoring Needs	15	0
2. Determine Ambient Background Monitoring Needs	9	3(3?)
3. Establish Solid Waste-Waste Characteristics Testing Program	15	0
4. Implement Emission Monitoring Program	14	1
5. Implement Ambient Background Monitoring Program	9	4(2?)
6. Analyze Samples (in-house or consultant)	14	1
7. Review Monitoring Data	14	1
8. Utilize Emission Data in required reports	15	0
9. Utilize Emission Data in planning	15	0
10. Utilize Ambient Background Data in required reports and for planning	9	4(2?)

OTHER (optional):

COMMENTS

? = Subject placed question mark on form indicating uncertainty about the topic.

#4 - Yes important even though we contract it out.

#2, #5 - No do, but could be important

TASK LISTING SHEET

ENVIRONMENTAL MANAGER

Functional Area: **INDUSTRIAL ENVIRONMENTAL COMPLIANCE**

TASKS:	VALID TASK YES	VALID TASK NO
1. Comply with Air Pollution Control Regulations	15	0
2. Comply with Wastewater Pollution Control Regulations	15	0
3. Comply with Potable Water Pollution Control Regulations	14	1
4. Comply with Solid Waste Pollution Control Regulations	15	0
5. Comply with Industrial Waste Pollution Control Regulations	15	0
6. Comply with Hazardous Waste Pollution Control Regulations	15	0
7. Comply with OHSA Regulations	15	0
8. Comply with Right-To-Know Regulations	15	0
9. Comply with Other Regulations as Necessary (TSCA, FIRMA)	14	1
10. Comply with Remediation & Clean-Up Regulations	15	0

OTHER (optional):

COMMENTS

- Department of Transportation
- Local codes and inspectors

- The state is the worst

TASK LISTING SHEET

ENVIRONMENTAL MANAGER

Functional Area: **PROFESSIONAL DEVELOPMENT**

TASKS:	VALID TASK YES	NO
1. Stay Current with Environmental Regulations	15	0
2. Stay Current with Environmental Technology	13	2
3. Acquire and maintain certifications	13	2

OTHER (optional): COMMENTS

- #3 Only if required by employer

Functional Area: **REPORTS & COMMUNICATION**

TASKS:	VALID TASK YES	NO
1. Prepare In-House Reports	15	0
2. Prepare Off-Site Reports	13	2
3. Recommend Policy	15	0
4. Articulate Policy to Public	10	4
5. Communicate with EPA	15	0

OTHER (optional): COMMENTS

- Vitally important responsibility
- #4 Handled by another department

TASK LISTING SHEET

ENVIRONMENTAL MANAGER

Functional Area: **AUDITS & ASSESSMENTS**

TASKS:	VALID TASK YES	NO
1. Prepare Compliance Audits- (Air)	15	0
2. Prepare Compliance Audits- (Wastewater)	15	0
3. Prepare Compliance Audits- (Solid Waste)	15	0
4. Prepare Compliance Audits- (Industrial Solid Waste)	15	0
5. Prepare Compliance Audits- (Hazardous Waste)	14	1
6. Prepare Other Compliance Audits as Needed (OHSA, TSCA)	14	1
7. Conduct Property (Site) Assessment- Phase I	10	4(1?)
8. Conduct Property (Site) Assessment- Phase II & Phase III	7	6(2?)

OTHER (optional):

COMMENTS

? = Subject placed question mark as answer on topic

- Scary thing but important, but info can be used against you

#7, #8 - Important, but we use outside consultant for objective results. However, I review their reports.

TASK LISTING SHEET

ENVIRONMENTAL MANAGER

Functional Area: **POLICY**

TASKS:	VALID TASK YES	NO
1. Comprehend Present & Projected Regulations	14	1
2. Review Compliance	15	0
3. Prepare Recommendation	14	1
4. Articulate Policy (Within Plant)	13	2

OTHER (optional): COMMENTS

NONE

Functional Area: **CONSULTANT & CONTRACTOR WORK**

TASKS:	VALID TASK YES	NO
1. Determine Need	14	1
2. Retain Consultant	12	3
3. Retain Contractor	12	3

OTHER (optional):

COMMENTS

- Formal contract prepared by purchasing

#2, #3 - Done by another department in the plant

- I put together bidder's list and review bids but purchasing responsible

TASK LISTING SHEET

ENVIRONMENTAL MANAGER

Functional Area: **PROJECT MANAGEMENT**

TASKS:	VALID TASK YES	NO
1. Supervise Consultant Work	13	2
2. Supervise Contractor Work	12	3
3. Employ In-House Staff	12	3
4. Train Staff	13	2
5. Prepare budgets & Operating Plans	13	2
6. Operate Pollution Control Facilities	13	2
7. Review Operational Reports	15	0
8. Maintain Compliance	15	0
9. Inform Plant Management	14	1
10. Communicate Plans & Progress to EPA	15	0
11. Guide EPA during inspections	15	0
12. Represent management	14	1

OTHER (optional):

COMMENTS

#1, #2 (3 responses) - Do not hire, but responsible for reviewing and approving payment

#3, #4 (3 responses) - if necessary, we do not but if have own equipment then important

TASK LISTING SHEET

ENVIRONMENTAL MANAGER

OTHER COMMENTS:

- Good summary of duties (5 responses)

- Need to state these in sentence format to avoid confusion

- Environmental duties are only about 20% of my responsibilities

- In my opinion getting the permits should be considered as a major task, even though it is done in each of the other areas.

Information collected from a mail survey sent to 15 randomly selected Illinois manufactures December, 1996 - January, 1997.

APPENDIX B

Summary

A survey was undertaken in December, 1996 to validate a list of environmental managerial tasks. Fifteen environmental managers employed at industrial plants in Illinois were randomly selected and mailed a questionnaire listing numerous tasks. The tasks listed on the instrument were culled from previous interviews with environmental managers and a review of the environmental compliance professional and trade literature. The subjects were asked to respond with a yes or no whether or not the listed tasks were performed at industrial plants as part of their environmental managerial responsibilities.

Responses were obtained from 15 environmental managers. Since all of them were employed in the position, they served as an expert panel relating to the topic. The procedure utilized in this validation process was similar to a modified Delphi process which has been used successfully in a number of other task identification studies. An analysis of the responses indicated that the instrument was valid and reliable.

Only four tasks were identified as not currently important or performed by these managers. Three of the tasks related to ambient testing. The fourth dealt with property or site investigations. The area of permits was upgraded from just specific tasks to a functional group.

From this information, a revised environmental manager task listing has been developed. As a result of this review process, this revised list can be considered valid.

An analysis of the survey comments and number of affirmative marks for each task, interesting observations as to the relative importance of the tasks can be made. These are discussed in detail above. In summary, this summary has confirmed the increasing importance of the managerial aspects of industrial environmental compliance.

INDUSTRIAL ENVIRONMENTAL MANAGER

FINAL
TASK LISTING

Functional Areas:

A. Monitoring and Data Acquisition

B. Industrial Environmental Compliance

C. Professional Development

D. Reports & Communication

E. Permits

F. Audits & Assessments

G. Policy

H. Consultant & Contractor Selection

I. Project Management

* Not listed in any order of priority

FINAL TASK LISTING SHEET

ENVIRONMENTAL MANAGER

Functional Area: **MONITORING AND DATA ACQUISITION**

TASKS:

1. Determine Emission Monitoring Needs
2. Establish Solid Waste- Waste Characteristics Testing Program
3. Implement Emission Monitoring Program
4. Analyze Samples
5. Review Monitoring Data
6. Utilize Emission Data in required reports
7. Utilize Emission Data in planning

FINAL TASK LISTING SHEET

ENVIRONMENTAL MANAGER

Functional Area: **INDUSTRIAL ENVIRONMENTAL COMPLIANCE**

TASKS:

1. Comply with Air Pollution Control Regulations
2. Comply with Wastewater Pollution Control Regulations
3. Comply with Potable Water Pollution Control Regulations
4. Comply with Solid Waste Pollution Control Regulations
5. Comply with Industrial Waste Pollution Control Regulations
6. Comply with Hazardous Waste Pollution Control Regulations
7. Comply with OHSA Regulations
8. Comply with Right-To-Know Regulations
9. Comply with Other Regulations as Necessary (TSCA, FIRMA)
10. Comply with Remediation & Clean-Up Regulations

FINAL TASK LISTING SHEET

ENVIRONMENTAL MANAGER

Functional Area: **PROFESSIONAL DEVELOPMENT**

TASKS:

1. Stay Current with Environmental Regulations
2. Stay Current with Environmental Technology
3. Acquire and maintain certifications

Functional Area: **REPORTS & COMMUNICATION**

TASKS:

1. Prepare In-House Reports
2. Prepare Off-Site Reports
3. Recommend Policy
4. Articulate Policy to Public
5. Communicate with EPA

FINAL TASK LISTING SHEET

ENVIRONMENTAL MANAGER

Functional Area: **PERMITS**

TASKS:

1. Discern which permits are required
2. Determine which information is required for permit application
3. Collect required information
4. Prepare application forms
5. Obtain proper signatures
6. Provide any additional information requested by Agency
7. Review permit when received
8. Prepare monitoring programs as required by permit
9. Submit all information required by permit

Functional Area: **AUDITS & ASSESSMENTS**

TASKS:

1. Prepare Compliance Audits- (Air)
2. Prepare Compliance Audits- (Wastewater)
3. Prepare Compliance Audits- (Solid Waste)
4. Prepare Compliance Audits- (Industrial Solid Waste)
5. Prepare Compliance Audits- (Hazardous Waste)
6. Prepare Other Compliance Audits as Needed (OHSA, TSCA)
7. Conduct Property (Site) Assessment- Phase I

FINAL TASK LISTING SHEET

ENVIRONMENTAL MANAGER

Functional Area: **POLICY**

TASKS:

1. Comprehend Present & Projected Regulations
2. Review Compliance
3. Prepare Recommendation
4. Articulate Policy

Functional Area: **CONSULTANT & CONTRACTOR WORK**

TASKS:

1. Determine Need
2. Retain Consultant
3. Retain Contractor

FINAL TASK LISTING SHEET

ENVIRONMENTAL MANAGER

Functional Area: **PROJECT MANAGEMENT**

TASKS:

1. Supervise Consultant Work
2. Supervise Contractor Work
3. Employ In-House Staff
4. Train Staff
7. Prepare budgets & Operating Plans
8. Operate Pollution Control Facilities
9. Review Operational Reports
10. Maintain Compliance
11. Inform Plant Management
12. Communicate Plans & Progress to EPA
13. Guide EPA during inspections
14. Represent management

INDUSTRIAL ENVIRONMENTAL MANAGER TASK LISTING

PHASE I
INITIAL TASK LISTING

PARTICIPANTS:

1. NuWay Speaker Company
   123 Railroad St. Antioch, IL

2. Parade Packaging
   29087 Millway, Mudelein, IL

3. Miller Brothers
   #56 Parkway Manor GraysLake, IL

4. AmGen Corp.
   34569 River Road Gurnee, IL

5. koppers Corporation
   PO Box 349 Carbondale, IL

6. SouthPass Products
   PO Box 237 Cobden, IL

7. Sanders Trucking
   2389 Highway 42 Montegomery, AL

8. Wiley International
   78 Airport Plaza Montegomery, AL

9. Abbotat Laboratory
   56783 Rosa Parks Dr. Montegomery, AL

10. Dortry Foundry
    45623 S. 34th St. Montegomery, AL

11. Case Manufactoring
    S. Highway 345 Dothan, AL

12. Musison Fabricators
    347 E. Robbin Ave. Enterprise, AL

13. Janson Manufacturing
    23894 N Michael Rd Enterprise, AL

14. Russell Drugs
    RR 3 Box 286 Enterprise, AL

15. James Builders
Highway 34S Birmingham, AL

16. Tyson Manufacturing
3476 N. Enterprise Rd Birmingham, AL

17. Robinson & Sons Management
#21 Robinson Rd. Birmingham, AL

18. Triple S Glass Manufactures
2598 Redial Rd Birmingham, AL

19. New Horizons
56 Industrial Park Plaza Birmingham, AL

20. Shane Brothers
23 Third Street New Brunswick, AL

21. Delivery Inc.
89991 Airport Rd Athens, AL

22. Ace Iron Works
S Highway 13 Birmingham, AL

23. Jones & Hovitt
34701 Anderson Rd Birmingham, AL

24. W. G. Porcelain
1212 Waterworks St Birmingham, AL

25. Cooper Molding & Gaskets
34571 Industrial Parkway Birmingham, AL

ENVIRONMENTAL MANAGER COMPETENCY
TASK LIST

VALIDATION STUDY

PHASE III

SUBJECTS

PROCESS: From the Illinois Downstate Business Directory, 15 SIC codes were selected on a random basis. One industrial plant was then randomly chosen from each SIC code.

1. SIC Code - 3399 Primary Metal Products

Sterling Steel Ball Division
W. Lincoln Hwy,
Sterling, IL 61081

2. SIC Code - 3297 Non-Clay Refractories

Vesuvius USA
PO Box 290,
Charleston, IL 61920

3. SIC Code - 3365 Aluminum Foundries

Brass Foundry Co.
713 SW Adams,
Peoria, IL 61602

4. SIC Code - 3143 Men's Footwear- Except Athletic

Belleville Shoe Mfg. Inc.
PO Box 508, Belleville, IL 62220
618-233-5600

5. SIC Code - 3497 Metal Foil & Leaf

Spartan Aluminum Products
510 E. McClurken Ave,
Sparta, IL 62286

6. SIC Code - 3053 Gaskets, Packing & Sealing Devices

Victor Products Corp.
S. Eaton Rd.
Robinson, IL 62454

7. SIC Code - 3545 Cutting Tools and Machine Tool Accessories

Peddinghaus Corp.
300 N. Washington Ave.
Bradley, IL. 60915

8. SIC Code - 3325 Steel Foundries NEC

Alloy Engineering & Casting Co.
1700 W. Washington St.
Champaign, IL 61821

9. SIC Code - 3567 Industrial Process Furnaces & Ovens

ABAR Ipsen Industries
984 Ipsen Rd.,
Cherry Valley, IL 61016

10. SIC Code - 3479 Coating Engraving & Allied SVCS

American Nickeloid Co.
2900 Main St.
Peru, IL 61354

11. SIC Code - 3555 Printing Trades Machinery & Equipment

Martin Automatic Inc.
1661 Northrock Ct.
Rockford, Il 61103

12. SIC Code - 3826 Laboratory Analytical Instruments

Dicky-John Corp.
5200 Dicky-John Rd.
Auborn, IL 62615

13. SIC Code - 3566 Speed Changers & Industrial High Speed Drives

Rockford Powertrain Inc.
1200 Windsor Rd.
Rockford, IL 61132

14. SIC Code - 3699 Electrical Machinery Equipment & Supplies

LittleFuse
E. Rt. 133
Arcola, IL 61910

15. SIC Code - 3433 Heating Equipment

Empire Comfort Systems
918 Freeburg Ave.
Belleville, IL 62220

APPENDIX C

TASK IDENTIFICATION MATRIX

AND
INSTRUCTIONS

LISTED ON THE NEXT FEW PAGES ARE A NUMBER OF ENVIRONMENTAL MANAGEMENT COMPETENCIES OR TASKS THAT ARE PERFORMED IN LARGE INDUSTRIAL PLANTS. YOU MAY OR MAY NOT PERFORM ANY OF THESE TASKS, BUT YOUR PERSPECTIVE AS TO WHETHER THEY ARE PERTINENT TO SMALL INDUSTRIAL PLANTS IS IMPORTANT TO THIS STUDY.

For each statement, please answer **ALL FOUR** questions

(1) Do you **PERFORM** this competency or task? Yes or No

(2) Is this an **IMPORTANT** task for environmental managers in small industrial plants?

(3) How **COMPETENT** or skilled are you in performing this task?

(4) Do you **DESIRE** more knowledge, skill or competency in this task; ie. be willing to obtain more education and training to become competent in this task?

Answer questions 2, 3, 4 by circling the number 1 - 5, which most closely expresses your thoughts, 1= no, not important, 5= important, competent, high

EXAMPLE:

Laboratory testing of plant waste streams for pollutant strength.

Perform	Yes ___	No _X__			
Important	1	2	3	4	5
Competent	1	2	3	4	5
Desire	1	2	3	4	5

Subjects do not actually **PERFORM** the task listed above. However, they believe that it is above average in **IMPORTANCE**. Yet, they do not have the any **COMPETENCE** or skill in the task, but do have a high **DESIRE** to learn how to perform it.

ENVIRONMENTAL MANAGER
TASK LISTING

1. Monitoring the emissions - air, wastewater and solid waste produced by the industrial plant and collecting data on these emissions for use in making decisions and preparing reports.

Perform	Yes ___	No ___			
Important	1	2	3	4	5
Competent	1	2	3	4	5
Desire	1	2	3	4	5

2. Complying with all federal, state or local environmental regulations which apply to the plant.

Perform	Yes ___	No ___			
Important	1	2	3	4	5
Competent	1	2	3	4	5
Desire	1	2	3	4	5

3 Reading and studying environmental regulations and pollution control technologies that might be applicable to your industrial plant.

Perform	Yes ___	No ___			
Important	1	2	3	4	5
Competent	1	2	3	4	5
Desire	1	2	3	4	5

4. Preparing and submitting reports on environmental matters. These reports might go either to in-house staff or off-site to the EPA or other regulatory agency. A part of these reports would be to recommend and communicate company environmental policy and plans.

Perform	Yes ___	No ___			
Important	1	2	3	4	5
Competent	1	2	3	4	5
Desire	1	2	3	4	5

5. Conducting environmental compliance audits or assessments on all of the plant's waste streams to determine environmental compliance.

Perform	Yes ___	No ___			
Important	1	2	3	4	5
Competent	1	2	3	4	5
Desire	1	2	3	4	5

6. Preparing, submitting and obtaining all necessary EPA and local agency permits, such as discharge permits, pretreatment permits, waste generator permits.

Perform	Yes ___	No ___			
Important	1	2	3	4	5
Competent	1	2	3	4	5
Desire	1	2	3	4	5

7. Establish environmental policy for the plant in light of regulations and present compliance status and be able to communicate and defend that policy.

Perform	Yes ___	No ___			
Important	1	2	3	4	5
Competent	1	2	3	4	5
Desire	1	2	3	4	5

8. Determine the need and scope for environmental consultants and service contractors, such as laboratories and waste haulers and prepare the documents to retain their services.

Perform	Yes ___	No ___			
Important	1	2	3	4	5
Competent	1	2	3	4	5
Desire	1	2	3	4	5

9. Manage and supervise all environmental projects. May include supervising personnel who operate pollution control equipment. Also serve as the plant's official representative to the EPA and other agencies in meetings and inspections.

Perform	Yes ___	No ___			
Important	1	2	3	4	5
Competent	1	2	3	4	5
Desire	1	2	3	4	5

APPENDIX D

MASTER TOPICAL SUBJECT LIST

ENVIRONMENTAL MANAGEMENT ACTIVITIES

ENVIRONMENTAL MANAGEMENT ATTITUDES

ENVIRONMENTAL MANAGEMENT
TOPICAL CATEGORIES

<u>BACKGROUND</u>

<u>ACTIVITY AREAS</u>

1. REPORTS
2. READING STUDYING REGULATIONS
3. PERMITS
4. MONITORING & TESTING
5. TYPES OF WASTE
6. CONSULTANTS

    Experience with

    Attitude towards

    Why Use?

7. SPECIFIC TASKS - WORKLOAD
8. LEVEL OF INTERACTION WITH EPA

<u>ATTITUDE</u>

9. ATTITUDE IN GENERAL TOWARDS EPA
10. LEVEL OF ASSISTANCE EPA PROVIDES TO INDUSTRIAL PLANTS
11. HOW IMPORTANT ARE EPA & ENVIRONMENTAL CONCERNS
12. ATTITUDE TOWARD PLANT ENVIRONMENTAL TASKS
13. PERCEIVED FUTURE DIRECTION
    EPA & Small Plants in general
    EPA & Your Plant

<u>GENERAL</u>

14. LEVEL OF COMPETENCE
15. EDUCATION
    Present Level
    Desire
    Willingness

ENVIRONMENTAL ACTIVITIES

QUESTION LIST

BACKGROUND

Generate wastes	yes no
treated in-house	yes no
EPA notices	yes no
EPA inspection	yes no
EPA permits	yes no
Level of interaction	1 2 3 4 5

1. REPORTS

Do you prepare	yes no
Do you file	yes no
Do you prepare (in-house)	yes no
Do you prepare (EPA)	yes no
Consider important	1 2 3 4 5

Task #4

2. READING AND STUDYING ENVIRONMENTAL REGULATIONS

Should a manager spend time	yes no
Do you read study	yes no
Is it important	1 2 3 4 5

Task #3

3. PERMITS

Do you have any	yes no
Do you prepare	yes no

Task #6

4. MONITORING AND TESTING

Do you have active program	yes	no
Believe important at your plant	yes	no
Important to do periodically	yes	no
Take samples	yes	no
Lab data	yes	no
Collect data prepare reports	yes	no

Task #1, Task #5

5. TYPES OF WASTE

Generate any non-domestic	yes no
ID type of waste	a b c d e f

6. CONSULTANTS

EXPERIENCE

Would you use	yes no
Have you used in past	yes no
Are you familiar in your area	yes no

ATTITUDE

Satisfied with work	yes no
Prefer self or consultant	self consultant
Overall impression	1 2 3 4 5

WHY HIRE

No time to learn	1 2 3 4 5
EPA recommended to get one	1 2 3 4 5
I don't know what to do	1 2 3 4 5
Cost insignificant to hassle	1 2 3 4 5

Task #8

7. WORKLOAD

Waste treated in house	yes no
Percent of time	a b c d e f
What other jobs	a b c d e f
Foresee an increase in duties	1 2 3 4 5
Preference to who does job	self consultant

7. WORKLOAD CON'T

Prepare permits	yes	no
Attend meetings	yes	no
Write letters, reports, calls	yes	no
Take samples	yes	no
Prepare reports, recommendations	yes	no
Read Lab data sheets	yes	no
Prepare written responses to EPA	yes	no
Operate PC equipment	yes	no
Read study regs	yes	no
Collect data prepare discharge reports	yes	no
Supervise other envir. staff	yes	no
Contact haulers and disposal sites	yes	no
Prepare reports to EPA	yes	no
Prepare reports to EPA	yes	no

Task 1 - 9

8. LEVEL OF EPA INTERACTION

Any EPA notices	yes	no
Any EPA inspections	yes	no
Any permits	yes	no
Any wastes treated in-house	yes	no
Meetings with EPA	yes	no
Write letters	yes	no
Operate PC equipment	yes	no
What is level of EPA interaction	1 2 3 4 5	

ENVIRONMENTAL ATTITUDES

QUESTION LIST

9. ATTITUDE IN GENERAL TOWARDS EPA

Overall opinion of EPA	1 2 3 4 5
Do regs hinder economic growth	1 2 x 4 5
Should small plants comply	1 2 3 4 5

10. LEVEL OF ASSISTANCE EPA PROVIDES TO INDUSTRIAL PLANTS

Does EPA help	yes no
Does the EPA help assist	1 2 X 4 5

11. HOW IMPORTANT ARE EPA AND ENVIRONMENTAL CONCERNS

What level of importance compared	1 2 3 4 5
Fearful of non-compliance	1 2 3 4 5
Frustrated and mad	1 2 3 4 5
Environmental tasks a hinderance	1 2 3 4 5
How concerned are you about EPA	1 2 3 4 5

12. ATTITUDE TOWARDS PLANT ENVIRONMENTAL TASKS

Who handle problems	self consultant
Preference as to who take care	self consultant
No time to learn so hire consultant	1 2 3 4 5
Other jobs more important	1 2 3 4 5
Cost for consultant less than hassle	1 2 3 4 5
Env. tasks hindrance to other jobs	1 2 X 4 5

13. PERCEIVED FUTURE DIRECTION

EPA-SMALL PLANTS

Foresee closer EPA looking	1 2 3 4 5
Install PC equipment	1 2 X 4 5
Expect more regulations	1 2 X 4 5
Foresee more enforcement	1 2 X 4 5

14. PERCEIVED FUTURE DIRECTION

EPA- YOUR PLANT

EPA look closer at your plant	1 2 3 4 5
See need to install PC equipment	1 2 3 4 5
More time required in future	1 2 3 4 5

QUESTION LIST

GENERAL

15. LEVEL OF COMPETENCE

Do you feel competent	yes no
Don't know what to do	1 2 3 4 5
How competent rate yourself	1 2 3 4 5
Don't know what to do	1 2 3 4 5

ALL TASKS

16. EDUCATION

PRESENT

Have you had any	yes no
What type	a b c d e f

DESIRE FOR

Feel need	yes no
Rate level of need	1 2 3 4 5

WILLINGNESS

Be willing to spend time	yes no
If had time, would you	1 2 3 4 5
How willing to take time	1 2 3 4 5

APPENDIX E

RELIABILITY

TOPICS & WORKSHEET

APPENDIX E
RELIABILITY TOPICS

TOPIC: REPORTS

QUESTIONS:

#32 Do you yourself, prepare reports to the EPA?

34 Have you, in the past, or now presently prepare and submit reports to the EPA describing your plant's environmental problems, status, or progress?

Task 4 -- Perform Yes ___ No ___

TOPIC: PERMITS

QUESTIONS:

20 Do you yourself, prepare EPA permit applications?

Task 6 -- Perform Yes ___ No ___

TOPIC: READ & STUDY ENVIRONMENTAL REGULATIONS

QUESTIONS:

28 Do you yourself read and study environmental regulations?

Task 3 -- Perform Yes ___ No ___

RELIABILITY - WORKSHEET

SUBJECT	QUESTION	RESPONSE
#1 --	#32 DO YOU PREPARE REPORTS	YES ___ NO ___
	#34 DO YOU PREPARE	YES ___ NO ___
	TASK 4	YES ___ NO ___
	#20 DO YOU PREPARE PERMITS	YES ___ NO ___
	TASK 6	YES ___ NO ___
	#28 DO YOU READ STUDY REGS	YES ___ NO ___
	TASK 3	YES ___ NO ___
#2 --	#32 DO YOU PREPARE REPORTS	YES ___ NO ___
	#34 DO YOU PREPARE	YES ___ NO ___
	TASK 4	YES ___ NO ___
	#20 DO YOU PREPARE PERMITS	YES ___ NO ___
	TASK 6	YES ___ NO ___
	#28 DO YOU READ STUDY REGS	YES ___ NO ___
	TASK 3	YES ___ NO ___
#3 --	#32 DO YOU PREPARE REPORTS	YES ___ NO ___
	#34 DO YOU PREPARE	YES ___ NO ___
	TASK 4	YES ___ NO ___
	#20 DO YOU PREPARE PERMITS	YES ___ NO ___
	TASK 6	YES ___ NO ___
	#28 DO YOU READ STUDY REGS	YES ___ NO ___
	TASK 3	YES ___ NO ___
#4 --	#32 DO YOU PREPARE REPORTS	YES ___ NO ___
	#34 DO YOU PREPARE	YES ___ NO ___
	TASK 4	YES ___ NO ___
	#20 DO YOU PREPARE PERMITS	YES ___ NO ___
	TASK 6	YES ___ NO ___
	#28 DO YOU READ STUDY REGS	YES ___ NO ___
	TASK 3	YES ___ NO ___
#5 --	#32 DO YOU PREPARE REPORTS	YES ___ NO ___
	#34 DO YOU PREPARE	YES ___ NO ___
	TASK 4	YES ___ NO ___
	#20 DO YOU PREPARE PERMITS	YES ___ NO ___
	TASK 6	YES ___ NO ___
	#28 DO YOU READ STUDY REGS	YES ___ NO ___
	TASK 3	YES ___ NO ___
#6 --	#32 DO YOU PREPARE REPORTS	YES ___ NO ___
	#34 DO YOU PREPARE	YES ___ NO ___
	TASK 4	YES ___ NO ___
	#20 DO YOU PREPARE PERMITS	YES ___ NO ___
	TASK 6	YES ___ NO ___
	#28 DO YOU READ STUDY REGS	YES ___ NO ___
	TASK 3	YES ___ NO ___

APPENDIX F

FINAL COVER LETTER

AND

TELEPHONE SCRIPT

SOUTHERN ILLINOIS UNIVERSITY

WORKFORCE EDUCATION & DEVELOPMENT LETTERHEAD

Dear Industrial Manager,

This survey is part of a doctoral dissertation research project on environmental management task competency conducted by John Meister, a Ph.D candidate in the Workforce Education & Development Department. Mr Meister has worked in the environmental field as a wastewater operator, solid & hazardous waste disposal expert and a consultant on industrial waste disposal problems.

Information from this research will be used only for professional research and the development of education and training programs. **No information from this survey will be given to the EPA.**

Your participation in entirely voluntary. Their will be no attempt to identify you or your company in the results. All results will be reported in terms of group scores. The form is coded only for internal tracking.

This research is being done under the direction of Dr. Richard Bortz in the SIU-C Department of Workforce Education and Development. Dr Bortz can be reached at the above address and phone number.

This project has been reviewed and approved by the Carbondale Committee For Research Involving Human Subjects. Questions concerning your rights as a participant in this research may be addressed to the Committee Chairperson, Office of Research Development and Administration, Southern Illinois University, Carbondale, IL 62901-4709, phone 618-453-4533.

Please return the questionnaire in the self-addressed envelope by May 10, 1997. If you have any questions, please feel free to contact Mr Meister at (618) 529-7257.

TIME REQUIRED TO COMPLETE 10-15 MINUTES

Sincerely,

John F. Meister
Ph.D Candidate

Dr. Richard Bortz, Committee Chair
Workforce Education and Development
SIU-C Carbondale, IL. 62901

WE NEED YOUR HELP!!

We are concerned about the education and training needs of industrial managers who are responsible for environmental compliance at plants such as yours.

Environmental rules and regulations are a growing area of responsibility. The EPA states that they will be increasingly looking at the environmental compliance status of small industrial plants.

By completing this questionnaire, you will be helping planners better identify educational and training needs of individuals such as yourself regarding environmental compliance and management.

ENVIRONMENTAL COMPLIANCE PRACTICES
AND TASK COMPETENCY OF MANAGERS
IN SMALL INDUSTRIAL PLANTS

JOHN F MEISTER

TELEPHONE SCRIPT FOR CONTACTING SUBJECTS

1) MY NAME IS JOHN MEISTER. I AM A PHD CANDIDATE IN THE WORKFORCE EDUCATION AND DEVELOPMENT DEPARTMENT AT SOUTHERN ILLINOIS UNIVERSITY.

2) I AM CONDUCTING RESEARCH ON THE ENVIRONMENTAL COMPLIANCE PRACTICES AND COMPETENCY OF INDUSTRIAL MANAGERS IN SMALL INDUSTRIAL PLANTS.

3) THIS RESEARCH IS BEING CONDUCTED UNDER THE DIRECTION OF DR. RICHARD BORTZ OF THE WORKFORCE EDUCATION AND DEVELOPMENT DEPARTMENT. THIS RESEARCH PROJECT AND THE PILOT STUDY HAVE BEEN REVIEWED AND APPROVED BY THE HUMAN SUBJECTS REVIEW COMMITTEE.

4) YOUR PLANT WAS SELECTED FROM A STATE WIDE DIRECTORY OF ALL ILLINOIS MANUFACTURING BUSINESSES

5) YOU WILL SHORTLY BE RECEIVING A SURVEY QUESTIONNAIRE IN THE MAIL

6) THE SURVEY ASKS 49 QUESTIONS ABOUT ENVIRONMENTAL PRACTICES AT YOUR PLANT AND ASKS YOU TO IDENTIFY 9 ENVIRONMENTAL MANAGEMENT TASKS. THE WHOLE SURVEY WILL TAKE ABOUT 10-15 MINUTES. AN ENCLOSED STAMPED ENVELOPE WILL BE INCLUDED FOR ITS RETURN.

7) THE INFORMATION FROM THIS SURVEY WILL BE USED FOR MY DISSERTATION RESEARCH ON EDUCATIONAL NEEDS IN INDUSTRY. NO INFORMATION FROM THIS SURVEY WILL BE GIVEN TO THE EPA. ALL INFORMATION WILL BE CONFIDENTIAL.

8) YOUR PARTICIPATION IS ENTIRELY VOLUNTARY. HOWEVER YOUR PARTICIPATION WOULD BE GREATLY APPRECIATED.

9) THANK YOU FOR YOUR TIME.

APPENDIX G

PILOT STUDY INSTRUMENT

SIU - C DEPARTMENT OF WORKFORCE EDUCATION & DEVELOPMENT

LETTERHEAD

March 17, 1997

Dear Pilot Study Participant:

Thank you for your participation in this research project.
Your assistance in the examination and evaluation of the attached survey questionnaire is greatly appreciated.

I am conducting a study on the environmental management practices and competency at small (less than 100 employees) industrial plants. The survey instrument resulting from this pilot study will be utilized in my research for a doctoral dissertation.

This research and instruments have been reviewed and approved by the Carbondale Committee For Research Involving Human Subjects. Questions concerning your rights as a participant in this research may be addressed to the Committee Chairperson, Office of Research Development and Administration, Southern Illinois University, Carbondale, IL 62901-4709, phone 618-453-4533. Your participation in entirely voluntary. You do not need to sign your name and their will be no attempt to identify you or your company in the results.

This work is being done under the direction of Dr. Richard Bortz in the Department of Workforce Education and Development at Southern Illinois University. Dr Bortz can be contacted at the above address and telephone.

DIRECTIONS

1) Complete the survey following the directions which accompany it.

2) Keep track of the time which it took you to complete the survey.

3) Answer the Validation Review Form attached to the the survey. Be sure to answer questions 4 & 5.

NOTE: Please feel free to make any comments on the survey questionnaire itself about the appropriateness of the questions or the directions, questions or answer choices.

4) Return the Survey and Validation Review Form in the attached envelope by March 25, 1997.

If you have any questions, please feel free to contact John Meister at (618) 529-7257.

If you would like to receive a copy of the final results of this survey, please attach a note to that affect with your name and address.

Your assistance in field testing the enclosed questionnaire and making subsequent recommendations is essential in developing a valid, reliable survey instrument.

Sincerely,

John F. Meister
Ph. D. Candidate

Dr. Richard Bortz
Committee Chair
Workforce Education & Development
SIU-C,
Carbondale, IL. 62901

SURVEY
VALIDATION REVIEW FORM

PLEASE ANSWER THE FOLLOWING QUESTIONS

Feel free to write on either the questionnaire itself as you proceed through the survey, or on this form.
Please be sure that you answer questions 4 and 5 on the next page.

1) WHAT QUESTION(S) DO YOU FEEL SHOULD BE DELATED?

2) WHAT QUESTION(S) SHOULD BE MODIFIED AND IN WHAT MANNER?

3) WHAT ADDITIONAL QUESTION(S) SHOULD BE ADDED?

4) HOW LONG DID IT TAKE YOU TO COMPLETE THE SURVEY (Excluding this Validation Review Form)?

5) DID YOU FEEL THAT THIS SURVEY COVERED THE TASKS AND RESPONSIBILITIES OF AN INDUSTRIAL PLANT ENVIRONMENTAL MANAGER?

YES ____ NO ____ COMMENT:

6) OTHER COMMENTS OR RECOMMENDATIONS:

THANK YOU FOR YOUR COOPERATION

Please return the completed survey and validation form in the attached envelope to John Meister before March 25, 1997.

SMALL INDUSTRIAL PLANT
ENVIRONMENTAL COMPLIANCE MANAGEMENT PRACTICES & COMPETENCIES

WE NEED YOUR HELP!!

Environmental rules and regulations are a growing area of responsibility. The EPA states that they will be increasingly looking at the environmental compliance status of small industrial plants.

By completing this survey you will be helping planners better identify educational and training needs of individuals such as yourself regarding environmental compliance and management.

THIS SURVEY WILL TAKE ONLY 10-15 MINUTES

SURVEY DIRECTIONS

TO BE COMPLETED BY THE INDIVIDUAL RESPONSIBLE FOR ENVIRONMENTAL COMPLIANCE

Please answer all questions. Answer them based upon the experience, perspective, skills that you have as the environmental manager for your plant. When you are finished, return the survey in the enclosed envelope.

QUESTIONS??? -- CALL JOHN MEISTER (618) 529-7257

Fill in the blank with the information requested.
Example: # of employees ___33__

What is the:

1. Name of Firm____________________

2. Primary product produced?
____

3. SIC Code? ____________

4. # of employees at the plant? ____________

5. # of years the company has been in business?
____

6. # of years you have worked for this firm? ____________

7. # of years you have been responsible for environmental compliance? ____________

In this section, please **check** the answer of your choice.

A blank space will also be provided for you to provide further information or a comment. If additional room is needed continue your comments onto the back of the page.

Example: Do you prepare permit applications?
Yes _x_ No ___ Comment: ____ I love permits_____

8. Have you had any environmental compliance education/training?

Yes ___ No __

9. Does your plant generate any significant non-domestic strength environmental wastestreams or pollutants?

Yes _____ No _____

11. Is any waste treated in-plant?

Yes ____ No ____ Describe:

12. Do you have an active environmental monitoring and testing program?

Yes ____ No____

13. Do you prepare reports that are sent to the EPA?

Yes ___ No ___

14. Within the past year, have you received any notices from the EPA or local agency (Sanitary District, landfill) about your waste streams or problems they may be causing?

    Yes ___ No ___ Subject:

15. Within the past year has the EPA or any local environmental agency inspected your plant?

    Yes ____ No ____ Reason:

16. Do you have any EPA or other environmental agency permits?

    Yes ___ No ___ What kind?

17. Should a manager spend time to stay informed of current and proposed environmental regulations which could affect industrial plants?

    Yes ___ No ___

18. If an environmental problems arose, would you handle it in-house or call an environmental consultant- engineer, lawyer?

    In-House ___ Consultant ___

19. Have you used environmental consultants in the past?

    Yes ___ No ___

20. Do you file any reports to the EPA or other environmental agencies?

    Yes ___ No ___ What kind?

21. Are you familiar with environmental consultants or engineers who practice in the local area?

    Yes ___ No ___

22. Does the EPA try to help small industries with their environmental compliance problems?

    Yes ___ No ___

23. Have you been satisfied with the work of environmental consultants who have done work for you in the past, or for other firms that you are familiar with?

    Yes ___ No___

24. Do you believe that it is important to monitor and test the strength of the wastes that are generated by <u>your</u> plant?

    Yes ___ No ___ Why?

25. What type of wastestreams are produced in your plant?

    a) Domestic Wastewater Yes ___ No ___

    b) Normal Garbage Yes ___ No ___
    c) Industrial WastewaterYes ___ No ___
    d) Industrial Special Waste Yes ___ No ___
    e) Air Pollution Yes ___ No ___
    f) Hazardous Waste Yes ___ No ___

26. Do you feel competent in taking care of any environmental problems or complying with EPA regulations?

    Yes ___ No ___ Comment:

27. Is it important to periodically test the plant's wastestreams and conduct a review of the plant's environmental compliance status?

    Yes ___ No ___ Comment:

28. Do you feel a need for environmental compliance education or training?

    Yes ___ No ___ Comment:

29. On general principals, would you prefer to perform environmental tasks in-house or hire an environmental consultant?

    Self ___ Consultant ___

30. What % of your time is spent on environmental matters?

    1-10% __ 11-25% __ 26-50% __ 51-75% __ 76-100% __

31. Mark the other jobs and responsibilities that you have in addition to environmental management within the company.

    a) None ___
    b) Operations ___
    c) General Management ___
    d) Supervisory ___
    e) OSHA Compliance ___
    f) Worker Safety ___
    g) Training ___
    h) Other

____

In the normal course of your responsibilities and activities, <u>DO YOU, YOURSELF</u>:

32. Prepare EPA permit applications?
    Yes ___ No ___

33. Attend meetings with EPA officials or other environmental agencies to discuss your plant's environmental compliance?
    Yes ___ No ___

34. Write letters, reports, or make phone calls to EPA personnel to discuss your plant's environmental status?
    Yes ___ No ___

35. Take samples of your plant's wastestreams, or have samples taken for analysis of how strong or what is in the wastestream?
    Yes ___ No ___

36. Prepare reports and recommendations to others in your plant on environmental problems and solutions?
    Yes ___ No ___

37. Read laboratory data wastestream analysis sheets?
    Yes ___ No ___

38. Prepare written responses to letters from the EPA?
    Yes ___ No ___

39. Operate pollution control equipment?
    Yes ___ No ___

40. Read and study environmental regulations?
    Yes ___ No ___

41. Collect data and prepare the discharge monitoring reports required by the EPA?
    Yes ___ No ___

42. Supervise other employees performing environmental tasks?
    Yes ___ No ___

43. Contact haulers and disposal firms for the off-site disposal of waste generated at your plant?
    Yes ___ No ___

44. Prepare reports to the EPA?
    Yes ___ No ___

45. Would you be willing to spend time in the evenings or weekends learning how to handle environmental compliance responsibilities?

    Yes ___ No ___ Comment:

For the following questions, write or circle the number - 1, 2, 3, 4, 5 that most closely **expresses your opinion** regarding the subject of the question.

The number 1 is always No, the most negative perspective, disagreement or low; in contrast, 5 is the highest, the most positive agreement or simply Yes.

Since the number 3 represents the middle, it has been purposely deleted in some questions, so that you will have to take an affirmative or negative position.

Example: Do you believe that the environment is cleaner now than 20 years ago?

1 2 3 4 5 Comment:
No Yes

---

46. What is the level of interaction and involvement between your plant and the EPA and their regulations?

1 2 3 4 5
None High

47. At what level would you rank your environmental concerns and problems <u>in comparison to other plant problems</u> such as labor, finances, markets and supplies.

1 2 3 4 5 Comment:
Low High

48. Is reading and studying industrial environmental regulations an important task for the environmental manager?

1 2 4 5
No Yes

49. Do you foresee the EPA "looking more closely" at <u>your</u> plant, that is requesting more meetings, more testing of your wastestreams and, in general, more enforcement of environmental regulations in the future?

1 2 3 4 5 Comment:
No Yes

50. How do you rate your need for additional education or training for environmental compliance activities?

1 2 3 4 5 Comment:
Low High

51. Do you foresee the need to install pollution control equipment in the next several years?

1 2 3 4 5
No Yes

52. The overall impression that you have about environmental consultants- engineers, lawyers, testing firms is:

1 2 3 4 5 Comment:
Poor Good

53. Do you foresee an increase in your environmental duties and responsibilities, either in terms of time required, or them being more essential to the plant in the next several years?

1 2 3 4 5
No Yes

54. What is your overall opinion of the EPA and their regulations?

1 2 3 4 5 Comment:
Low High

Assume, an environmental problem arose. Rate each of the following reasons as to why you would hire an environmental consultant (engineer, lawyer, testing firm).

(Answer each phrase with a 1 to 5. 1=low 5=high)

55. Don't know what or how to do the task ___

56. Fearful of the EPA and being in non-compliance ___

57. Don't have time to learn how to do these things ___

58. My time is more important doing other plant tasks ___

59. Cost of the consultant is insignificant to the hassle ___

60. I don't want to be bothered by environmental regulations or problems ___

61. The EPA recommended me to get one ___

62. In the future, do you foresee the EPA "looking closely" at <u>small</u> businesses and industrial plants, demanding more compliance with all environmental regulations and requiring permits and reports and testing?

1 2 3 4 5 Comment:
No Yes

63. If you had the opportunity to learn how to perform these environmental tasks, would you be willing to, so that you would not have to hire an outside environmental consultant?
(assume that it would require 8 sessions, 1 night a week of 3 hours each)

1 2 3 4 5 Comment:
No Yes

64. Do you view your environmental responsibilities and tasks as a hindrance to your other plant responsibilities?

1 2 - 4 5 Comment:
No Yes

65. Do you feel that the present level or number of environmental regulations on industries is excessive or fair?

1 2 - 4 5 Comment:
Excessive Fair

66. Do environmental regulations hinder economic growth?

1 2 - 4 5 Comment:
No Yes

67. How concerned are you about EPA rules and regulations affecting your plant?

1 2 3 4 5 Comment:
Low High

68. How competent would you rate yourself in performing environmental compliance activities or tasks?

1 2 3 4 5 Comment:
Low High

69. Should small industrial plants have to comply with all environmental regulations?

1 2 3 4 5 Comment:
No Yes

70. What type of training / education have you had for your environmental responsibilities?

(Mark all that apply)
(Rank each one you marked as to how helpful it was in preparing you for your environmental compliance and management job. 1=low to 5=high)
(Example- Conference _x_ _4_)

a) No formal education ___

b) University Degree Program ___ __
c) Community College Degree ___ __
d) University or Comm. College Courses ___ __
e) Adult or Continuing Education Courses ___ __
f) Conferences & Workshops ___ __
g) Short Professional Courses ___ __

h) On the Job Experience ___ __

71. In your opinion does the EPA try to work with and help with small industries on environmental problems?

1 2 - 4 5 Comment:
No Yes

72. Do you consider preparing reports on environmental problems an essential, important part of an environmental manager's duties.

1 2 - 4 5 Comment:
No Yes

73. In your opinion, will an increasing number of small industries in the future have to install pollution control equipment and become involved in environmental compliance programs.

1 2 - 4 5 Comment:
No Yes

74. in the future, do you expect more environmental regulations for small industrial plants?

1 2 - 4 5 Comment:
No Yes

75. Do you foresee more EPA enforcement of environmental regulations on small businesses and industries in the future?

1 2 - 4 5 Comment:
No Yes

76. How willing are you to take time to attend classes to become more competent in understanding and performing environmental compliance tasks?

1 2 3 4 5 Comment:
Low High

LISTED ON THE NEXT FEW PAGES ARE A NUMBER OF ENVIRONMENTAL MANAGEMENT COMPETENCIES OR TASKS WHICH ARE PERFORMED IN LARGE INDUSTRIAL PLANTS. YOU MAY OR MAY NOT PERFORM ANY OF THESE TASKS, BUT YOUR PERSPECTIVE AS TO WHETHER THEY ARE PERTINENT TO SMALL INDUSTRIAL PLANTS IS IMPORTANT TO THIS STUDY.

For each statement, please answer four questions

(1) Do you PERFORM this competency or task? Yes or No

(2) You may or may not actually perform this task, but in the right circumstances such as type of waste produced, is this an IMPORTANT task for environmental managers in small industrial plants?

Answer by circling the number 1 - 5 which most closely expresses your thoughts, 1= not important, 5 = important

(3) How COMPETENT or skilled are you in performing this task?

Answer by circling the number 1 - 5 which most closely expresses your thoughts, 1= not at all, 5 = competent

(4) Would you DESIRE more knowledge, skill or competency in this task; ie. be willing to obtain more education and training to become competent in this task?

Answer by circling the number 1 - 5 which most closely expresses your thoughts, 1= no, 5 = high

---

EXAMPLE:

Laboratory testing of plant wastestreams for pollutant strength.

Perform	Yes ___	No ___			
Important	1	2	3	4	5
Competent	1	2	3	4	5
Desire	1	2	3	4	5

This individual does not actually perform the task listed above. However, they believe that it is above average in importance. Yet, they do not have the any skill in the task, but do have a high desire to learn how to perform it.

TASK LISTING SHEET
ENVIRONMENTAL MANAGER

1. Monitoring the emissions - air, wastewater and solid waste which are produced by the industrial plant and collecting data on these emissions for use in making decisions and preparing reports.

Perform Yes ___ No ___					
Important	1	2	3	4	5
Competent	1	2	3	4	5
Desire	1	2	3	4	5

2. Complying with all federal, state or local environmental regulations which apply to the plant.

Perform Yes ___ No ___					
Important	1	2	3	4	5
Competent	1	2	3	4	5
Desire	1	2	3	4	5

3. Reading and studying environmental regulations and pollution control technologies which might be applicable to your industrial plant.

Perform Yes ___ No ___					
Important	1	2	3	4	5
Competent	1	2	3	4	5
Desire	1	2	3	4	5

4. Preparing and submitting reports on environmental matters. These reports might go either to in-house staff or off-site to the EPA or other regulatory agency. A part of these reports would be to recommend and communicate company environmental policy and plans.

Perform Yes ___ No ___					
Important	1	2	3	4	5
Competent	1	2	3	4	5
Desire	1	2	3	4	5

5. Conducting environmental compliance audits or assessments on all of the plant's wastestreams to determine environmental compliance.

Perform Yes ___ No ___					
Important	1	2	3	4	5
Competent	1	2	3	4	5
Desire	1	2	3	4	5

6. Preparing, submitting and obtaining all necessary EPA and local agency permits such as discharge permits, pretreatment permits, waste generator permits.

Perform Yes ___ No ___					
Important	1	2	3	4	5
Competent	1	2	3	4	5
Desire	1	2	3	4	5

7. Establish environmental policy for the plant in light of regulations and present compliance status and be able to communicate and defend that policy.

Perform Yes ___ No ___					
Important	1	2	3	4	5
Competent	1	2	3	4	5
Desire	1	2	3	4	5

8. Determine the need and scope for environmental consultants and service contractors such as laboratories and waste haulers and prepare the documents to retain their services.

Perform Yes ___ No ___					
Important	1	2	3	4	5
Competent	1	2	3	4	5
Desire	1	2	3	4	5

9. Manage and supervise all environmental projects.May include supervising personnel which operate pollution control equipment. Also serve as the plant's official representative to the EPA and other agencies in meetings and inspections.

Perform Yes ___ No ___					
Important	1	2	3	4	5
Competent	1	2	3	4	5
Desire	1	2	3	4	5

OTHER (optional):

APPENDIX H

FINAL SURVEY INSTRUMENT

SMALL INDUSTRIAL PLANT
ENVIRONMENTAL COMPLIANCE MANAGEMENT PRACTICES & COMPETENCIES

SURVEY DIRECTIONS

TO BE COMPLETED BY THE INDIVIDUAL RESPONSIBLE FOR ENVIRONMENTAL COMPLIANCE

Please answer all questions. Answer them based upon the experience, perspective, skills that you have as the environmental manager for your plant. When you are finished, return the survey in the enclosed envelope.

THIS SURVEY WILL TAKE APPROXIMATELY 15 MINUTES

QUESTIONS??? -- CALL JOHN MEISTER (618) 529-7257

Fill in the blank with the information requested.
Example: # of employees ___33__

What is the:

1. Name of Firm____________________________________
2. Primary product produced?__________________________
3. SIC Code? ____________
4. # of employees at the plant? ____________
5. # of years the company has been in business? _________
6. # of years you have worked for this firm? ____________
7. # of years you have been responsible for environmental compliance? _________________

In this section, please **check** the answer of your choice.

A blank space will also be provided for you to provide further information or a comment. If additional room is needed continue your comments on to the back of the page.

Example: Do you prepare permit applications?
Yes _x_ No ___ Comment: ____ I love permits_____

8. Have you had any environmental compliance education/training? .... Y __ N __

9. Does your plant generate any significant non-domestic strength environmental wastestreams or pollutants? .... Y __ N __

   Type:

10. Is any waste treated in-plant? .... Y __ N __
    Describe:

11. Within the past year, have you received any notices from the EPA or local agency (Sanitary District, landfill) about your waste streams or problems? .... Y __ N __
    Subject:

12. Within the past year has the EPA or any local environmental agency inspected your plant? .... Y __ N__
    Reason:

13. Do you have any EPA or other environmental agency permits? .... Y __ N __
    What kind?

14. Have you used environmental consultants in the past? .... Y __ N __

15. Do you feel competent in taking care of environmental problems or complying with EPA regulations? .... Y __ N__

16. Do you feel a personal need for any environmental compliance education or training? .... Y __ N __

17. If an environmental problems arose, would you handle it in- house or call an environmental consultant (engineer, lawyer)?

    In-House ___ Consultant ___

18. On general principals, would you prefer to perform environmental tasks in-house or hire an environmental consultant?

    Self ___ Consultant ___

19. What % of your time is spent on environmental matters?

1-10% __ 11-25% __ 26-50% __ 51-75% __ 76-100% __

In the normal course of your responsibilities and activities, DO YOU, YOURSELF:

20. Prepare EPA permit applications?
.... Yes ___ No ___

21. Attend meetings with EPA officials or other environmental agencies to discuss your plant's environmental compliance?
.... Yes ___ No ___

22. Write letters, reports, or make phone calls to the EPA to discuss problems or the environmental status of your plant?
.... Yes ___ No ___

23. Take samples of the wastes leaving your plant, or have samples taken for analysis to determine how strong it is or what is in the wastestream?
.... Yes ___ No ___

24. Prepare reports and recommendations to others in your plant on environmental problems and solutions?
.... Yes ___ No ___

25. Read laboratory data wastestream analysis sheets?
.... Yes ___ No ___

26. Prepare written responses to letters from the EPA?
.... Yes ___ No ___

27. Operate pollution control equipment?
.... Yes ___ No ___

28. Read and study environmental regulations?
.... Yes ___ No ___

29. Collect data and prepare the discharge monitoring reports required by the EPA?
.... Yes ___ No ___

30. Supervise other employees performing environmental tasks?
.... Yes ___ No ___

31. Contact haulers and disposal firms for the off-site disposal of waste generated at your plant?
.... Yes ___ No ___

32. Prepare reports to the EPA?
.... Yes ___ No ___

33. Would you be willing to spend time in the evenings or weekends learning how to handle environmental compliance responsibilities?
.... Yes ___ No ___

34. Have you, in the past, or now presently prepare and submit reports to the EPA describing your plant's environmental problems, status, or progress?
.... Yes ___ No ___

For the following questions, write or circle the number that most closely **expresses your opinion** regarding the subject of the question ie. 1, 2, 3, 4, 5.

The number 1 is always No, the most negative perspective, disagreement or low; in contrast, 5 is the highest, the most positive agreement or simply Yes.

Since the number 3 represents the middle, it has been purposely deleted in some questions, so that you will have to take an affirmative or negative position.

Example: Do you believe that the environment is cleaner now than 20 years ago?
1 2 3 4 5 Comment:
No Yes

35. Describe the level of interaction between your plant and the EPA?
1 2 3 4 5
None High

36. At what level of importance would you rank your environmental concerns and problems in comparison to other plant problems such as labor, finances, markets and supplies.
1 2 3 4 5 Comment:
Low High

37. Do you foresee the EPA "looking more closely" at your plant in the future?
1 2 3 4 5 Comment:
No Yes

38. Do you foresee the need to install pollution control equipment in the next several years?

1 2 3 4 5
No Yes

39. Do you foresee an increase in your environmental duties and responsibilities in the next several years?

1 2 3 4 5 Comment:

40. Are you fearful of the EPA and being in non-compliance?

1 2 3 4 5
Low High

41. Do you view your environmental responsibilities and tasks as a hindrance to your other plant responsibilities?

1 2 - 4 5 Comment:
No Yes

42. Do you feel that the present level or number of environmental regulations on industries is excessive or fair?

1 2 - 4 5 Comment:
Excessive Fair

43. How concerned are you about EPA rules and regulations affecting your plant?

1 2 3 4 5 Comment:
Low High

44. How competent would you rate yourself in performing environmental compliance activities or tasks?

1 2 3 4 5 Comment:
Low High

45. Should small industrial plants have to comply with all environmental regulations?

1 2 - 4 5 Comment:
No Yes

46. In your opinion, will an increasing number of small industries have to install pollution control equipment and become involved in environmental compliance programs.

1 2 3 4 5 Comment:
No Yes

47. In the future, do you expect more environmental regulations for small industrial plants?

    1 2 - 4 5 Comment:
    No Yes

48. Do you foresee more EPA <u>enforcement</u> of environmental regulations on small businesses and industries in the future?

    1 2 - 4 5
    No Yes

49. How willing are you to take time to attend classes to become more competent in understanding and performing environmental compliance tasks?

    1 2 3 4 5 Comment:
    Low High

LISTED ON THE NEXT FEW PAGES ARE A NUMBER OF ENVIRONMENTAL MANAGEMENT COMPETENCIES OR TASKS WHICH ARE PERFORMED IN LARGE INDUSTRIAL PLANTS. YOU <u>MAY</u> OR <u>MAY NOT</u> PERFORM ANY OF THESE TASKS, BUT <u>YOUR</u> PERSPECTIVE AS TO <u>WHETHER THEY ARE PERTINENT</u> TO SMALL INDUSTRIAL PLANTS <u>IS IMPORTANT</u> TO THIS STUDY.

For each statement, please answer **ALL FOUR** questions

(1) Do you **<u>PERFORM</u>** this competency or task? Yes or No

(2) Is this an **<u>IMPORTANT</u>** task for environmental managers in small industrial plants?

(3) How **<u>COMPETENT</u>** or skilled are you in performing this task?

(4) Do you **<u>DESIRE</u>** more knowledge, skill or competency in this task; ie. be willing to obtain more education and training to become competent in this task?

Answer questions 2, 3, 4 by circling the number 1 - 5 which most closely expresses your thoughts, 1= no, not important / 5= important, competent, high

EXAMPLE:

Laboratory testing of plant wastestreams for pollutant strength.

Perform Yes ___ No ___					
Important	1	2	3	4	5
Competent	1	2	3	4	5
Desire	1	2	3	4	5

This individual does not actually **PERFORM** the task listed above. However, they believe that it is above average in **IMPORTANCE**. Yet, they do not have the any **COMPETENCE** or skill in the task, but do have a high **DESIRE** to learn how to perform it.

ENVIRONMENTAL MANAGER
TASK LISTING

1. Monitoring the emissions - air, wastewater and solid waste which are produced by the industrial plant and collecting data on these emissions for use in making decisions and preparing reports.

Perform Yes ___ No ___					
Important	1	2	3	4	5
Competent	1	2	3	4	5
Desire	1	2	3	4	5

2. Complying with all federal, state or local environmental regulations which apply to the plant.

Perform Yes ___ No ___					
Important	1	2	3	4	5
Competent	1	2	3	4	5
Desire	1	2	3	4	5

3 Reading and studying environmental regulations and pollution control technologies which might be applicable to your industrial plant.

Perform	Yes ___ No ___				
Important	1	2	3	4	5
Competent	1	2	3	4	5
Desire	1	2	3	4	5

4. Preparing and submitting reports on environmental matters. These reports might go either to in-house staff or off-site to the EPA or other regulatory agency. A part of these reports would be to recommend and communicate company environmental policy and plans.

Perform	Yes ___ No ___				
Important	1	2	3	4	5
Competent	1	2	3	4	5
Desire	1	2	3	4	5

5. Conducting environmental compliance audits or assessments on all of the plant's wastestreams to determine environmental compliance.

Perform	Yes ___ No ___				
Important	1	2	3	4	5
Competent	1	2	3	4	5
Desire	1	2	3	4	5

6. Preparing, submitting and obtaining all necessary EPA and local agency permits such as discharge permits, pretreatment permits, waste generator permits.

Perform	Yes ___ No ___				
Important	1	2	3	4	5
Competent	1	2	3	4	5
Desire	1	2	3	4	5

7. Establish environmental policy for the plant in light of regulations and present compliance status and be able to communicate and defend that policy.

Perform	Yes ___	No ___			
Important	1	2	3	4	5
Competent	1	2	3	4	5
Desire	1	2	3	4	5

8. Determine the need and scope for environmental consultants and service contractors such as laboratories and waste haulers and prepare the documents to retain their services.

Perform	Yes ___	No ___			
Important	1	2	3	4	5
Competent	1	2	3	4	5
Desire	1	2	3	4	5

9. Manage and supervise all environmental projects. May include supervising personnel which operate pollution control equipment. Also serve as the plant's official representative to the EPA and other agencies in meetings and inspections.

Perform	Yes ___	No ___			
Important	1	2	3	4	5
Competent	1	2	3	4	5
Desire	1	2	3	4	5

OTHER TASKS(optional):

Perform	Yes ___	No ___			
Important	1	2	3	4	5
Competent	1	2	3	4	5
Desire	1	2	3	4	5

OTHER COMMENTS:

THANK YOU FOR YOUR COOPERATION IN COMPLETING THIS QUESTIONNAIRE.

PLEASE RETURN THIS SURVEY AS SOON AS POSSIBLE TO JOHN MEISTER WITH THE ENCLOSED ENVELOPE.

APPENDIX I

SECOND MAILING

BRIEF SURVEY

SIU-C Department of Workforce Education & Development

Letterhead

Dear Industrial Manager,

You were recently sent a research survey on environmental management task competency. As of this date, we have not received your survey.

Your participation in this research is important.

We would greatly appreciate your willingness to complete the enclosed short form of the survey questionnaire. **This 3 page survey will only take about 5 minutes**. Your participation and response in critical to the success of this project.

Information from this research will be used only for professional research and the development of education and training programs. **No information from this survey will be given to the EPA.** Your participation in entirely voluntary.

This research is being done under the direction of Dr. Richard Bortz in the SIU-C Department of Workforce Education and Development. Dr Bortz can be reached at the above address and phone number.

This project has been reviewed and approved by the Carbondale Committee For Research Involving Human Subjects. Questions concerning your rights as a participant in this research may be addressed to the Committee Chairperson, Office of Research Development and Administration, Southern Illinois University, Carbondale, IL 62901-4709, phone 618-453-4533.

Please return the questionnaire in the self-addressed envelope by May 20, 1997. If you have any questions, please feel free to contact Mr Meister at (618) 529-7257.

Sincerely,

John F. Meister
Ph.D Candidate

Dr. Richard Bortz,
Committee Chair
Workforce Education and
Development
SIU-C Carbondale, IL. 62901

ENVIRONMENTAL COMPLIANCE PRACTICES
AND TASK COMPETENCY OF MANAGERS
IN SMALL INDUSTRIAL PLANTS

JOHN F MEISTER

TELEPHONE SCRIPT
FOR
CONTACTING NON-RESPONDING SUBJECTS
(2ND MAILING)

1) MY NAME IS JOHN MEISTER. I AM A PHD CANDIDATE IN THE WORKFORCE EDUCATION AND DEVELOPMENT DEPARTMENT AT SOUTHERN ILLINOIS UNIVERSITY.

2) I AM CONDUCTING RESEARCH ON THE ENVIRONMENTAL COMPLIANCE PRACTICES AND COMPETENCY OF INDUSTRIAL MANAGERS IN SMALL INDUSTRIAL PLANTS.

3) THIS RESEARCH IS BEING CONDUCTED UNDER THE DIRECTION OF DR. RICHARD BORTZ OF THE WORKFORCE EDUCATION AND DEVELOPMENT DEPARTMENT. THIS RESEARCH PROJECT AND THE PILOT STUDY HAVE BEEN REVIEWED AND APPROVED BY THE HUMAN SUBJECTS REVIEW COMMITTEE.

4) YOU WERE RECENTLY SENT A SURVEY QUESTIONNAIRE. WE HAVE NOT RECEIVED YOUR RESPONSE.

5) WE ARE THEREFORE MAILING YOU A SECOND 3 PAGE SURVEY WITH ONLY 19 QUESTIONS DEALING WITH THE SAME SUBJECT.

6) PLEASE COMPLETE IT AS SOON AS POSSIBLE AND RETURN IT IN THE ENCLOSED ENVELOPE.

7) THE INFORMATION FROM THIS SURVEY WILL BE USED FOR MY DISSERTATION RESEARCH ON EDUCATIONAL NEEDS IN INDUSTRY. NO INFORMATION FROM THIS SURVEY WILL BE GIVEN TO THE EPA. ALL INFORMATION WILL BE CONFIDENTIAL.

8) YOUR PARTICIPATION IS ENTIRELY VOLUNTARY. HOWEVER YOUR PARTICIPATION WOULD BE GREATLY APPRECIATED.

9) THANK YOU FOR YOUR TIME.

SMALL INDUSTRIAL PLANT
ENVIRONMENTAL COMPLIANCE MANAGEMENT PRACTICES & COMPETENCIES

SURVEY DIRECTIONS

TO BE COMPLETED BY THE INDIVIDUAL RESPONSIBLE FOR ENVIRONMENTAL COMPLIANCE

Please answer all questions. Answer them based upon the experience, perspective, skills that you have as the environmental manager for your plant. When you are finished, return the survey in the enclosed envelope.

THIS SURVEY WILL ONLY TAKE 5-10 MINUTES

QUESTIONS??? -- CALL JOHN MEISTER (618) 529-7257

What is the:

1. Name of Firm ________________________________

2. Primary product produced? ______________________

3. SIC Code? __________

4. # of employees at the plant? __________

---

5. Within the past year, have you received any notices from the EPA or local agency (Sanitary District, landfill) about your waste streams or problems?
   .... Yes ___ No ___ Subject:

6. Within the past year has the EPA or any local environmental agency inspected your plant?
   .... Yes ___ No ___ Reason:

7. Do you have any EPA or other environmental agency permits? .... Yes ___ No ___
   What kind?

8. Do you write letters, reports, or make phone calls to the EPA to discuss problems or the environmental status of your plant? ....Yes ___ No ___

9. Do you collect data and prepare the discharge monitoring reports required by the EPA? .... Yes ___ No ___

10. Do you contact haulers and disposal firms for the off-site disposal of waste generated at your plant? .... Yes ___ No ___

11. Do you feel a personal need for any environmental compliance education or training? .... Yes ___ No___

12. If an environmental problems arose, would you handle it in-house or call an environmental consultant (engineer, lawyer)? .... In-House ___ Consultant ___

13. What % of your time is spent on environmental matters?

1-10% __ 11-25% __ 26-50% __ 51-75% __ 76-100% __

---

14. Describe the level of interaction between your plant and the EPA?

1 2 3 4 5
None High

15. At what level of importance would you rank your environmental concerns and problems <u>in comparison to other plant problems</u> such as labor, finances, markets and supplies.

1 2 3 4 5
Low High

16. Do you foresee the EPA "looking more closely" at <u>your</u> plant in the future?

1 2 3 4 5
No Yes

17. Should small industrial plants have to comply with all environmental regulations?

1 2 - 4 5
No Yes

18. How willing are you to take time to attend classes to become more competent in understanding and performing environmental compliance tasks?

1 2 3 4 5
Low High

19. How competent would you rate yourself in performing environmental compliance activities or tasks?

1 2 3 4 5
Low High

THANK YOU FOR YOUR COOPERATION IN COMPLETING THIS FORM. YOUR OPINION IS IMPORTANT.

PLEASE RETURN THE COMPLETED SURVEY TO JOHN MEISTER WITH THE ENCLOSED ENVELOPE.

EVALUATION FORM

SUBJECT ______________________ SIC CODE ______________
PRODUCT _____________________ EMPLOYEES ______________

Question #1:

Background

# 5	EPA notices	yes no
6	EPA inspection	yes no
7	EPA permits	yes no
8	Write letters, phone calls	yes no
9	Collect data for discharge	yes no
10	Contact haulers, disposal sites	yes no
14	Level of interaction	1 2 3 4 5
13	% of time	_____

Consultants (Attitude Towards Tasks)

12 If problem how handle in-house consultant

Question #2:

Attitude-EPA Regs

#17 Should small comply with all regs 1 2 - 4 5

How Important EPA Matters:

#15 Level of importance 1 2 3 4 5

Future Direction:

#16 EPA look more closely 1 2 3 4 5

Question #3

Competent

#19 Rate self competent 1 2 3 4 5

Question #4:

Education

11 Feel need for education yes no

18 How willing 1 2 3 4 5

APPENDIX J

TELEPHONE INTERVIEW

ENVIRONMENTAL COMPLIANCE PRACTICES
AND TASK COMPETENCY OF MANAGERS
IN SMALL INDUSTRIAL PLANTS

JOHN F MEISTER

TELEPHONE SCRIPT
FOR
CONTACTING NON-RESPONDING SUBJECTS
(3RD CONTACT)

1) MY NAME IS JOHN MEISTER. I AM A PHD CANDIDATE IN THE WORKFORCE EDUCATION AND DEVELOPMENT DEPARTMENT AT SOUTHERN ILLINOIS UNIVERSITY.

2) I AM CONDUCTING RESEARCH ON THE ENVIRONMENTAL COMPLIANCE PRACTICES AND COMPETENCY OF INDUSTRIAL MANAGERS IN SMALL INDUSTRIAL PLANTS.

3) THIS RESEARCH IS BEING CONDUCTED UNDER THE DIRECTION OF DR. RICHARD BORTZ OF THE WORKFORCE EDUCATION AND DEVELOPMENT DEPARTMENT. THIS RESEARCH PROJECT AND THE PILOT STUDY HAVE BEEN REVIEWED AND APPROVED BY THE HUMAN SUBJECTS REVIEW COMMITTEE.

4) YOU WERE RECENTLY SENT 2 SURVEY QUESTIONNAIRES. WE HAVE NOT RECEIVED ANY RESPONSE.

5) MAY I TAKE YOUR TIME TO ASK YOU A FEW YES - NO QUESTIONS ABOUT YOUR PLANT AND ENVIRONMENTAL MANAGEMENT PRACTICES.

6) THE INFORMATION FROM THIS SURVEY WILL BE USED FOR MY DISSERTATION RESEARCH ON EDUCATIONAL NEEDS IN INDUSTRY. NO INFORMATION FROM THIS SURVEY WILL BE GIVEN TO THE EPA. ALL INFORMATION WILL BE CONFIDENTIAL. YOUR PARTICIPATION IS ENTIRELY VOLUNTARY. HOWEVER YOUR PARTICIPATION WOULD BE GREATLY APPRECIATED.

7) ASK FOR PERMISSION TO PROCEED WITH 5 QUESTIONS

IF ANSWER - NO. THANK THEM FOR THE TIME AND HANG UP
IF ANSWER - YES. PROCEED WITH FOLLOWING QUESTIONS

8) QUESTION 1: PRODUCT PRODUCED? ________________
NUMBER OF EMPLOYEES? ________________

9) QUESTION 2: DO YOU GENERATE OR TREAT ANY SPECIAL INDUSTRIAL WASTE AND HAVE ANY EPA PERMITS?

YES ___ NO ___

10) QUESTION 3: DO YOU PERFORM ANY ENVIRONMENTAL ACTIVITIES SUCH AS PREPARING REPORTS TO THE EPA, TESTING WASTES LEAVING YOUR PLANT, OPERATING ANY POLLUTION CONTROL EQUIPMENT?

YES___ NO___

11) QUESTION 4: IF ENVIRONMENTAL PROBLEMS AROSE DO YOU FEEL COMPETENT TO HANDLE THIS SITUATION?

YES ___ NO ___

12) QUESTION 5: DO YOU FEEL A NEED FOR EDUCATION OR TRAINING ON INDUSTRIAL ENVIRONMENTAL COMPLIANCE AND MANAGEMENT?

YES ___ NO ___

13) OPTIONAL QUESTIONS

A- IN THE FUTURE, DO YOU BELIEVE THAT THE EPA WILL EXPECT MORE COMPLIANCE FROM SMALL INDUSTRIAL PLANTS?

YES ___ NO ___
SCALE 1 2 3 4 5

B- IN THE FUTURE, DO YOU EXPECT THAT THE EPA WILL TAKE A CLOSER LOOK AT YOUR PLANT, CONDUCT MORE INSPECTIONS, REQUIRE MORE PC EQUIPMENT?

YES ___ NO ___
SCALE 1 2 3 4 5

C- DO YOU FEEL COMPETENT TO HANDLE ENVIRONMENTAL PROBLEMS?

YES ___ NO ___
SCALE 1 2 3 4 5

D- DO YOU FEEL A NEED FOR EDUCATION?

YES ___ NO ___
SCALE 1 2 3 4 5

APPENDIX K

HUMAN SUBJECTS APPROVAL

SIU

Southern Illinois University at Carbondale
Carbondale, Illinois 62901-4709

Human Subjects Committee
Institutional Review Board
618-453-4533
FAX 618-453-8038

April 21, 1997

John Meister
305 Robinson Circle A-C
Carbondale, IL 62901

RE: "Environmental Compliance Practices and Task Competency of Managers in Small Industrial Plants"

Dear Mr. Meister:

Your above-named project has been reviewed and approved by the SIUC Human Subjects Committee. This approval is valid for one (1) year from the approval date, and you must requst a renewal to continue the research after that date.

Your Form A approval has been executed by Dr. Radtke and is enclosed. If you have any questions concerning this review, please call me at (618) 453-4533.

Sincerely,

Frances Stanley

Frances Stanley, Secretary
Human Subjects Committee

Enclosure

c: Dr. Richard Bortz, Workforce Education & Development

APPENDIX L

PROGRAM / NO-PROGRAM STATUS

APPENDIX L

PROGRAM VERSUS NO PROGRAM

TOTAL RESPONSES	PROGRAM	NO PROGRAM
97	35 (36%)	62 (64%)

PROGRAM VS NON PROGRAM SUBJECTS BY SIC CODE

SIC CODE	PROGRAM NO.	(%)	NO PROGRAM NO.	(%)	TOTAL
3000	4	(50)	4	(50)	8
3200	5	(38)	8	(62)	13
3300	6	(60)	4	(40)	10
3400	5	(26)	14	(74)	19
3500	7	(28)	18	(72)	25
3600	2	(50)	2	(50)	4
3700	4	(80)	1	(20)	5
3800	0	(0)	4	(100)	4
3900	2	(22)	7	(78)	9
Total	35	(36)	62	(64)	97

The average number of program subjects in each SIC class was four and seven were found in each size classification. In comparison, the average number of no-program subjects was seven and twelve respectively. These facts illustrated a major concern. While the total number of responses was large (97), once the subjects were broken down into their respective classes (program and no-program) and then divided into subdivisions between 9 SIC or 5 size groups, the number in any one final classification was too small for any valid statistical evaluations. Thus, results were presented in terms of absolute numbers, total and averages.

PROGRAM VS NO PROGRAM SUBJECTS BY NUMBER OF EMPLOYEES

EMPLOYEES	PROGRAM NO. (%)	NO PROGRAM NO. (%)	TOTAL
1 - 5	5 (20)	20 (80)	25
6 - 10	3 (16)	15 (84)	18
11 - 20	9 (36)	16 (64)	25
21 - 50	12 (63)	7 (37)	19
51 - 100	6 (60)	4 (40)	10
	35	62	97

APPENDIX M

ENVIRONMENTAL ACTIVITIES

ENVIRONMENTAL ACTIVITIES

PROGRAM SUBJECTS

QUESTION	YES	NO	TOTAL	%
20- Prepare permits	11	9	20	55
21- Attend meetings	6	14	20	30
22- Write letters Make calls	7	18	25	28
23- Take samples	10	10	20	50
24- Make reports	15	5	20	75
25- Study lab data	9	11	20	45
26- Written reports	11	9	20	37
27- Operate PC Equip.	5	15	20	25
28- Read study regs.	15	5	20	75
29- Collect data	10	14	24	42
30- Supervise others	15	5	20	75
31- Contact TSD	22	3	25	88
32- Reports to EPA	13	7	20	65
TOTAL	149	138	287	52

ENVIRONMENTAL ACTIVITIES

NO-PROGRAM SUBJECTS

QUESTION	YES	NO	TOTAL	R
20- Prepare permits	2	11	13	12
21- Attend meetings	0	17	17	00
22- Write letters Make calls	1	34	35	03
23- Take samples	0	17	17	00
24- Make reports	1	16	17	06
25- Study lab data	0	17	17	00
26- Written reports	2	15	17	13
27- Operate PC Equip.	1	16	17	06
28- Read study regs.	3	14	17	18
29- Collect data	2	31	33	06
30- Supervise others	5	12	17	29
31- Contact TSD	12	23	35	34
32- Reports to EPA	3	14	17	18
TOTAL	36	254	290	12

TOPIC A
ENVIRONMENTAL MANAGEMENT

BY SIC CODE

SIC CODE	PROGRAM	NO PROGRAM
3000	25	00
3200	73	14
3300	47	00
3400	77	11
3500	45	17
3600	38	00
3700	44	00
3800	00	00
3900	25	03
Average	53	10

BY SIZE

SIZE	PROGRAM	NO PROGRAM
1 - 5	47	05
6 - 10	71	08
11 - 20	39	03
21 - 50	56	12
51 - 100	60	19
	54	07

TOPIC B
WASTESTREAM MONITORING AND LABORATORY ANALYSIS
BY SIC CODE

SIC CODE	PROGRAM	NO PROGRAM
3000	54	00
3200	67	00
3300	38	00
3400	60	15
3500	47	9
3600	50	00
3700	50	00
3800	00	00
3900	33	00
Average	48	06

BY SIZE

SIZE	PROGRAM	NO PROGRAM
1 - 5	25	00
6 - 10	88	06
11 - 20	38	04
21 - 50	41	00
51 - 100	44	11
	45	04

TOPIC C
POLLUTION CONTROL EQUIPMENT OPERATIONS

BY SIC CODE

SIC CODE	PROGRAM YES	PROGRAM NO	%	NO PROGRAM YES	NO PROGRAM NO	%
3000	1	3	25	0	1	00
3200	1	0	100	0	1	00
3300	0	5	00	0	2	00
3400	1	3	25	1	3	25
3500	2	3	40	0	5	00
3600	0	2	00	0	0	00
3700	0	1	00	0	0	00
3800	0	0	00	0	1	00
3900	0	1	00	1	3	25
Average			22			10

BY SIZE

SIZE N	PROGRAM YES	PROGRAM NO	R	NO PROGRAM YES	NO PROGRAM NO	R
1 - 5	0	2	00	0	3	00
6 - 10	3	0	100	1	3	25
11 - 20	0	5	00	0	6	00
21 - 50	2	5	28	0	3	00
51 - 100	0	6	00	0	3	00
			22			05

TOPIC D
SUPERVISION OF OTHER EMPLOYEES
BY SIC CODE

SIC CODE	PROGRAM YES	PROGRAM NO	PROGRAM R	NO PROGRAM YES	NO PROGRAM NO	NO PROGRAM R
3000	3	1	75	0	1	00
3200	1	0	100	0	1	00
3300	3	2	60	1	2	33
3400	3	1	25	1	2	33
3500	3	2	60	3	2	60
3600	1	1	50	0	0	00
3700	1	0	100	0	1	00
3800	0	0	00	0	1	00
3900	1	0	100	0	4	00
Average			70			26

BY SIZE

SIZE N	PROGRAM YES	PROGRAM NO	PROGRAM R	NO PROGRAM YES	NO PROGRAM NO	NO PROGRAM R
1 - 5	2	0	100	0	3	00
6 - 10	3	0	100	2	2	50
11 - 20	2	3	40	1	5	17
21 - 50	6	1	86	1	2	33
51 - 100	3	3	50	1	2	33
			70			26

TOPIC E
CONTACT TSD AND HAULERS

BY SIC CODE

SIC CODE	PROGRAM YES	PROGRAM NO	PROGRAM R	NO PROGRAM YES	NO PROGRAM NO	NO PROGRAM R
3000	3	1	75	1	4	20
3200	0	1	00	1	2	33
3300	5	1	83	3	0	100
3400	4	1	80	4	5	44
3500	7	0	100	7	7	50
3600	2	0	100	0	0	00
3700	2	0	100	0	1	00
3800	0	0	00	0	1	00
3900	1	0	100	0	4	00
Average			86			40

BY SIZE

SIZE N	PROGRAM YES	PROGRAM NO	PROGRAM R	NO PROGRAM YES	NO PROGRAM NO	NO PROGRAM R
1 - 5	3	0	100	3	5	38
6 - 10	1	2	33	3	6	33
11 - 20	6	0	100	6	8	43
21 - 50	1	0	100	2	4	33
51 - 100	6	1	86	2	1	67
			86			41

APPENDIX N

ENVIRONMENTAL ATTITUDES

SUMMARY
PART A
ENVIRONMENTAL CONSULTANTS

PROGRAM VS NO PROGRAM SUBJECTS BY SIC CODE

SIC CODE	PROGRAM YES	PROGRAM NO	%	NO PROGRAM YES	NO PROGRAM NO	%
3000	6	6	50	3	3	50
3200	2	1	67	3	2	60
3300	12	4	75	1	5	17
3400	10	3	77	6	11	35
3500	8	7	53	10	13	43
3600	0	2	00	0	0	00
3700	1	4	20	2	1	67
3800	0	0	00	1	2	33
3900	1	2	33	6	6	500

BY SIZE

SIZE N	PROGRAM YES	PROGRAM NO	%	NO PROGRAM YES	NO PROGRAM NO	%
1-5	5	2	71	7	6	54
6-10	8	1	89	6	11	35
11-20	6	11	35	9	16	36
21- 50	14	10	58	8	4	67
51- 100	9	9	50	4	5	80

ATTITUDE PART B
IMPORTANCE OF ENVIRONMENTAL TASKS

BY SIC CODE

SIC CODE	PROGRAM N	PROGRAM MEAN	PROGRAM SD	NO PROGRAM N	NO PROGRAM MEAN	NO PROGRAM SD
3000	12	2.5	(1.6)	6	1.0	(0.0)
3200	3	2.0	(0.8)	5	1.0	(0.0)
3300	16	2.7	(1.4)	7	1.8	(1.0)
3400	13	2.5	(1.0)	18	1.6	(1.0)
3500	17	2.2	(1.2)	19	2.1	(1.2)
3600	6	2.5	(1.0)	3	2.3	(1.2)
3700	4	2.5	(1.6)	3	1.0	(0.0)
3800	0	0.0	(0.0)	3	1.0	(0.0)
3900	3	3.7	(1.8)	12	1.6	(1.3)

BY SIZE

SIZE	PROGRAM N	PROGRAM MEAN	PROGRAM SD	NO PROGRAM N	NO PROGRAM MEAN	NO PROGRAM SD
1-5	7	1.7	(0.7)	13	1.8	(1.6)
6-10	9	2.4	(1.0)	15	1.3	(0.8)
11-20	16	2.6	(1.3)	23	1.6	(0.9)
21-50	21	2.6	(1.6)	12	1.4	(1.0)
51-100	21	2.7	(1.4)	9	1.2	(0.4)

ATTITUDE PART C
FUTURE EXPECTATIONS- EPA AND SMALL PLANTS

BY SIC CODE

SIC CODE	PROGRAM N	MEAN	SD	NO PROGRAM N	MEAN	SD
3000	12	3.9	(0.9)	3	1.0	(0.0)
3200	11	3.5	(0.8)	4	3.0	(1.2)
3300	13	3.8	(0.8)	6	4.3	(0.5)
3400	15	3.5	(0.9)	12	3.3	(1.4)
3500	22	3.8	(1.8)	15	3.5	(1.2)
3600	7	3.7	(1.1)	-	-	--
3700	4	4.8	(0.4)	-	-	--
3800	2	2.5	(1.5)	3	3.7	(1.2)
3900	7	4.4	(0.7)	12	4.4	(0.6)

BY SIZE

SIZE	PROGRAM N	MEAN	SD	NO PROGRAM N	MEAN	SD
1-5	17	3.9	(1.0)	9	3.9	(1.4)
6-10	15	3.5	(1.1)	12	3.2	(1.4)
11-20	20	4.5	(1.0)	15	3.7	(1.4)
21-50	24	3.5	(1.3)	6	4.0	(0.0)
51-100	18	3.9	(0.8)	9	3.0	(1.4)

ATTITUDE PART D
FUTURE EXPECTATIONS- EPA AND YOUR PLANT

BY SIC CODE

SIC CODE	PROGRAM			NO-PROGRAM		
	N	MEAN	SD	N	MEAN	SD
3000	12	2.1	(1.4)	6	1.5	(1.1)
3200	7	3.1	(0.6)	10	2.0	(1.4)
3300	16	3.3	(1.3)	8	2.5	(1.1)
3400	13	2.8	(1.0)	21	2.7	(1.4)
3500	17	2.0	(1.2)	27	2.2	(1.3)
3600	6	2.2	(1.1)	1	1.0	(0.0)
3700	5	1.2	(0.4)	3	1.0	(0.0)
3800	-	---	-----	5	1.4	(0.8)
3900	4	4.5	(0.9)	15	2.7	(1.6)

BY SIZE

SIZE	PROGRAM			NO-PROGRAM		
	N	MEAN	SD	N	MEAN	SD
1-5	12	1.8	(1.0)	23	2.1	(1.3)
6-10	12	2.8	(1.2)	23	2.4	(1.3)
11-20	18	2.6	(1.5)	13	2.3	(1.5)
21-50	26	3.0	(1.5)	13	2.3	(1.4)
51-100	18	1.9	(0.9)	9	3.0	(1.4)

APPENDIX O

TASK IMPORTANCE

TASK COMPETENCY

ENVIRONMENTAL MANAGER
TASK LISTING

1. Monitoring the emissions - air, wastewater and solid waste which are produced by the industrial plant and collecting data on these emissions for use in making decisions and preparing reports.

2. Complying with all federal, state or local environmental regulations which apply to the plant.

3 Reading and studying environmental regulations and pollution control technologies which might be applicable to your industrial plant.

4. Preparing and submitting reports on environmental matters. These reports might go either to in-house staff or off-site to the EPA or other regulatory agency. A part of these reports would be to recommend and communicate company environmental policy and plans.

5. Conducting environmental compliance audits or assessments on all of the plant's wastestreams to determine environmental compliance.

6. Preparing, submitting and obtaining all necessary EPA and local agency permits such as discharge permits, pretreatment permits, waste generator permits.

7. Establish environmental policy for the plant in light of regulations and present compliance status and be able to communicate and defend that policy.

8. Determine the need and scope for environmental consultants and service contractors such as laboratories and waste haulers and prepare the documents to retain their services.

9. Manage and supervise all environmental projects. May include supervising personnel which operate pollution control equipment. Also serve as the plant's official representative to the EPA and other agencies in meetings and inspections.

TASK IDENTIFICATION

	PROGRAM YES	PROGRAM NO	PROGRAM %	NO PROGRAM YES	NO PROGRAM NO	NO PROGRAM %	TOTAL YES	TOTAL NO	TOTAL %
TASK 1	14	9	61	2	11	15	16	20	44
TASK 2	21	2	91	11	2	84	32	4	89
TASK 3	18	5	78	6	7	46	24	12	67
TASK 4	16	7	70	2	11	15	18	19	50
TASK 5	9	14	39	0	13	00	9	27	25
TASK 6	16	7	70	1	12	8	17	19	47
TASK 7	15	8	65	3	10	23	18	18	50
TASK 8	15	8	65	3	10	23	18	18	50
TASK 9	20	3	86	2	11	26	22	14	61
			70			26			54

TASK IMPORTANCE

TASK	PROGRAM N	MEAN	SD	NO-PROGRAM N	MEAN	SD
TASK 1	23	4.0	(1.2)	12	3.2	(1.5)
TASK 2	22	4.3	(0.9)	12	3.8	(1.6)
TASK 3	18	3.7	(1.2)	12	3.3	(1.4)
TASK 4	22	3.9	(1.1)	12	3.2	(1.5)
TASK 5	22	3.6	(1.3)	12	3.0	(1.5)
TASK 6	22	4.6	(0,8)	12	3.2	(1.7)
TASK 7	21	4.1	(0.9)	12	3.1	(1.5)
TASK 8	23	4.1	(0.9)	12	2.9	(1.4)
TASK 9	23	4.1	(0.9)	13	3.0	(1.6)

TASK IMPORTANCE

BY SIC CODE

SIC CODE	PROGRAM MEAN	NO PROGRAM MEAN
3000	4.0	1.0
3200	5.0	---
3300	4.1	---
3400	3.7	2.8
3500	3.9	3.4
3600	3.9	---
3700	4.2	5.0
3800	—	5.0
3900	5.0	2.4

BY SIZE

SIZE	PROGRAM MEAN	NO PROGRAM MEAN
1-5	4.4	4.0
6-10	4.1	1.2
11-20	3.7	3.2
21-50	4.3	3.9
51-100	4.0	2.2

COMPETENCY

BACKGROUND SECTION

QUESTION 15

PROGRAM			NO PROGRAM		
YES	NO	%	YES	NO	%
29	7	75	26	14	65

COMPETENCY

QUESTION 44

PROGRAM			NO PROGRAM		
N	MEAN	SD	N	MEAN	SD
33	3.4	(1.1)	59	3.2	(1.1)

COMPETENCY

BY SIC CODE

SIC CODE	PROGRAM N	PROGRAM MEAN	PROGRAM SD	NO PROGRAM N	NO PROGRAM MEAN	NO PROGRAM SD
3000	4	3.8	(0.4)	4	3.2	(1.1)
3200	4	3.2	(0.8)	8	4.0	(0.5)
3300	7	3.4	(1.2)	4	2.7	(0.7)
3400	5	3.6	(0.5)	13	2.7	(1.5)
3500	7	3.4	(0.9)	19	3.5	(0.9)
3600	2	1.5	(0.5)	1	3.0	(0.0)
3700	3	4.0	(0.8)	1	3.0	(0.0)
3800	-	-	-	3	3.3	(1.7)
3900	2	5.0	(0.0)	7	2.8	(0.6)
	33	3.4	(1.1)	59	3.2	(1.1)

BY SIZE

SIZE	PROGRAM N	PROGRAM MEAN	PROGRAM SD	NO PROGRAM N	NO PROGRAM MEAN	NO PROGRAM SD
1-5	4	3.5	(0.5)	18	3.4	(1.4)
6-10	3	4.0	(0.0)	15	3.2	(1.1)
11-20	8	2.5	(1.2)	16	3.1	(0.8)
21-50	12	3.7	(1.2)	7	2.8	(0.8)
51-100	6	3.7	(0.7)	3	4.0	(1.0)

APPENDIX P

EDUCATION

PAST EDUCATIONAL EXPERIENCE

BY SIC CODE

SIC CODE	PROGRAM YES	PROGRAM NO	PROGRAM R	NO-PROGRAM YES	NO-PROGRAM NO	NO-PROGRAM R	TOTAL YES	TOTAL NO	TOTAL R
3000	1	3	25	0	1	00	1	4	20
3200	0	1	00	0	1	00	0	2	00
3300	2	3	40	0	2	00	2	5	28
3400	2	2	50	0	4	00	2	6	25
3500	3	2	60	0	5	00	3	7	33
3600	1	1	50	0	0	00	1	1	50
3700	0	1	00	1	0	100	1	1	50
3800	0	0	00	0	1	00	0	1	00
3900	1	0	00	0	4	00	1	4	20
	10	13	43	1	18	05	11	31	26

BY SIZE

Size	PROGRAM YES	PROGRAM NO	PROGRAM R	NO PROGRAM YES	NO PROGRAM NO	NO PROGRAM R	TOTAL YES	TOTAL NO	TOTAL R
1-5	1	1	50	0	3	00	1	4	20
6-10	1	2	33	0	4	00	1	6	14
11-20	1	4	20	0	6	00	1	10	09
21-50	3	4	43	1	2	33	4	6	40
51-100	4	2	67	0	3	00	4	5	44
	10	13	43	1	18	05	11	31	26

DESIRE FOR EDUCATION

BY SIC CODE

SIC CODE	PROGRAM YES	PROGRAM NO	PROGRAM R	NO PROGRAM YES	NO PROGRAM NO	NO PROGRAM R	TOTAL YES	TOTAL NO	TOTAL R
3000	2	6	25	1	4	20	3	10	23
3200	3	4	64	1	8	23	4	11	27
3300	7	4	64	3	3	50	10	7	59
3400	0	9	00	4	13	31	0	22	00
3500	8	4	67	7	16	30	15	20	43
3600	1	3	25	0	1	00	1	4	20
3700	4	0	100	0	1	00	4	2	67
3800	0	0	00	1	3	25	1	3	25
3900	2	1	67	1	9	18	3	10	23
TOTAL	27	30	47	18	60	22	45	90	53

BY SIZE

SIZE	PROGRAM YES	PROGRAM NO	R	NO PROGRAM YES	NO PROGRAM NO	NO PROGRAM R	TOTAL YES	TOTAL NO	R
1-5	1	1	50	0	3	00	1	4	20
6-10	1	2	33	0	4	00	1	6	14
11-20	1	4	20	0	6	00	1	10	09
21-50	3	4	43	1	2	33	4	6	40
51-100	4	2	67	0	3	00	4	5	44
	10	13	43	1	18	05	11	31	26

WILLINGNESS TO ATTEND CLASSES

SUMMARY

PROGRAM N	PROGRAM MEAN	PROGRAM SD	NO PROGRAM N	NO PROGRAM MEAN	NO PROGRAM SD
34	2.9	(1.1)	59	2.4	(1.2)

BY SIC CODE

SIC CODE	PROGRAM N	PROGRAM MEAN	PROGRAM SD	NO PROGRAM N	NO PROGRAM MEAN	NO PROGRAM SD
3000	4	2.2	(0.4)	4	1.8	(0.8)
3200	5	3.2	(0.7)	8	1.4	(0.7)
3300	6	3.2	(1.2)	4	3.0	(1.6)
3400	5	2.4	(0.8)	13	2.4	(1.0)
3500	7	2.4	(1.3)	18	2.7	(0.9)
3600	2	2.5	(0.5)	1	1.0	(0.0)
3700	3	4.0	(1.0)	1	3.0	(0.0)
3800	-	-	-	3	3.0	(1.7)
3900	2	2.5	(0.5)	7	2.4	(1.4)

BY SIZE

SIZE	PROGRAM N	PROGRAM MEAN	PROGRAM SD	NO PROGRAM N	NO PROGRAM MEAN	NO PROGRAM SD
1-5	6	2.7	(0.5)	18	2.2	(1.2)
6-10	2	3.5	(0.5)	15	2.1	(1.2)
11-20	8	3.2	(1.3)	16	2.6	(1.2)
21-50	12	2.4	(1.1)	7	2.3	(0.9)
51-100	6	3.3	(1.1)	3	3.0	(0.0)

SIUC HSC FORM A

REQUEST FOR APPROVAL OF RESEARCH ACTIVITIES INVOLVING HUMAN SUBJECTS

This approval is valid for one (1) year from the approval date. Researchers must request a renewal to continue the research after that date. This approval form must be included in all Master's theses/research papers and Doctoral dissertations involving human subjects to be submitted to the Graduate School.

PROJECT TITLE: ENVIRONMENTAL COMPLIANCE PRACTICES AND TASK COMPETENCY IN SMALL INDUSTRIAL PLANTS

CERTIFICATION STATEMENT:

In making this application, I(we) certify that I(we) have read and understand the University's policies and procedures governing research activities involving human subjects, and that I(we) shall comply with the letter and spirit of those policies. I(we) further acknowledge my(our) obligation to (1) accept responsibility for the research described, including work by students under my(our) direction, (2) obtain written approval from the Human Subjects Committee of any changes from the originally approved protocol **BEFORE** making those changes, (3) retain signed informed consent forms, in a secure location separate from the data, for at least **three** years after the completion of the research, and (4) report immediately all adverse effects of the study on the subjects to the Chairperson of the Human Subjects Committee, Carbondale, Illinois, (618) 453-4533, and to the Director of the Office of Research Development and Administration, Southern Illinois University at Carbondale, (618) 453-4531.

JOHN F. MEISTER — 3/15/97

RESEARCHER(S) or PROJECT DIRECTORS — DATE

Please print or type out name below signature

Richard F Bortz

DR. RICHARD BORTZ — 3/15/97

RESEARCHER'S ADVISOR (required for all student projects) — DATE

Please print or type out name below signature

The request submitted by the above researcher(s) was approved by the SIUC Human Subjects Committee.

Robert C. Radtke — 4/21/97

CHAIRPERSON, SOUTHERN ILLINOIS UNIVERSITY HUMAN SUBJECTS COMMITTEE — DATE

VITA

GRADUATE SCHOOL
SOUTHERN ILLINOIS UNIVERSITY

John F. Meister
5616 Hoover St
Pine Bluff, AR 71602

Date of Birth: August 28, 1946

COLLEGES & UNIVERSITIES ATTENDED

Southern Illinois University Carbondale, IL 62901	Bachelor of Science Biology, 1973
Southern Illinois University Carbondale, IL 62901	Masters of Science 1995

THESIS TITLE: Viability of Wastewater Reuse
MAJOR PROFESSOR: Dr. Richard Bortz