Guidelines for Contractors in Dealing With Environmental Issues

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EXECUTIVE SUMMARY

This Handbook was written to provide Florida's construction professionals with a source of information on environmental issues that will both assist them in the conduct of their business and help make them become proactive in their dealings relative to the state's environment. Contractors have always had a great impact on the environment, it is a natural outcome of the type of work in which they are engaged. Consequently contractors are implicitly entrusted with handling some of the key components of their fellow citizens' quality of life: air, water, hazardous materials, solid waste, noise, and numerous other matters. This special obligation that contractors inherit because of their chosen profession is better handled with specific, accurate information so that the contractor will have the tools necessary to make decisions that minimize environmental impact. This volume is intended to provide the basis for construction professionals to carry out their obligations to protect the state's environment.

At its root, however, is the purpose of educating the industry to make it more environmentally aware. The assumption is that, at some level, we are all environmentalists. We all desire and require clean air, water, recycling, animal habitats, beautiful scenery, clear skies, peace and quiet, and a sense of harmony with nature. The degree of this requirement or desire will inevitably vary, even quite dramatically, between the professional or keen environmentalist and the contractor. Nonetheless there is a common ground and room for intelligent communication and debate. For the contractor to effectively interact on the same playing field as the environmentalist, he or she must have an environmental vocabulary and an elementary knowledge of ecology, state and federal law, and the rationale behind issues such as biodiversity. The contractor can then either agree or disagree, but the dialogue and discourse will at least be conducted in a intelligent, reasoned fashion.

The Handbook is organized with Chapter 1 as the Introduction. Chapters 2 through 13 address environmental technical issues, and Chapter 14 is a compilation of sources of assistance. The Handbook is designed to be used as a continuing education text in a course or as a general source of information.

The Center for Construction and Environment at the University of Florida will eventually utilize the contents of this Handbook as the basis for a published book. It is expected that the book should be available in construction industry bookstores throughout the state by the end of 1992 with a similar title. For the time being copies are available form the Executive Secretary, Building Construction Industry Advisory Committee, FAC101, University of Florida, Gainesville, Florida 32611.

ACKNOWLEDGMENTS

The work contained in this volume began almost two years ago in July 1990 with the germ of an idea that Contractors needed to have a source of information about environmental issues that was specifically written with them in mind. This idea extended to the desire to involve contractors in devise construction techniques to reduce environmental damage due to construction. As a result of the various interactions that resulted in the publication of this document, there are a significant number of parties to whom we would like to express our appreciation.

We would first like to acknowledge the support of the Building Construction Industry Advisory Committee (BCIAC) and of Joe Holland in particular for his incisive commentary on an earlier draft. Thanks also to the Executive Secretary of the BCIAC, Dr. Brisbane Brown, who was extremely supportive and encouraging throughout the project.

A long list of our students at the M.E. Rinker, Sr., School of Building Construction, University of Florida had major roles in the final product. Jason Hoffner managed the final formatting and publication of the Handbook. Roger McDonell and Greg Jones handled the desktop publishing of the final version as well as the scanning of graphics into the document. Final research, corrections, and writing were performed by Gary Floyd, Tina Ascherfeld, Lisa Hamilton, Armando Rodriquez, Tim Howard, Chris Cottrell, and Brian Ballenger. Joel Rodgers performed the original research and writing of the material on wetlands.

This Handbook is intended to be a first edition and future versions will be produced to improve on both the information and the style of presentation. Input from construction industry is critical to achieving this goal and is encouraged and welcome.

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CHAPTER 1
INTRODUCTION

1.0 Purpose

This handbook is designed to be a useful source of information on environmental matters for contractors operating in the state of Florida. It contains an up-to-date compilation of the major environmental issues which contractors must take into account when conducting their activities. Construction operations cut across the entire range of environmental issues, from solid waste disposal and hazardous wastes to such matters as wetlands, noise, and water pollution. Consequently it is important that contractors are well-informed about the current range of environmental matters which affect their businesses.

One of the basic premises of the Handbook is that the construction industry, as the rest of today's society, is concerned with the environment and has a strong desire to minimize the negative effects of their operations. There are many choices to be made about the exact methods of performing the wide range of tasks which are a normal part of construction. There are in fact many choices which the industry can make which will have no real cost impact on their bottom line but are simply better practices in terms of the environment. Where appropriate this reference will point out some of the options contractors have in not only obeying the law, but also in taking advantage of good practice in minimizing environmental damage. For too long construction has been tagged with the label of being anti-environment and it is hoped that efforts such as these will help the construction industry receive the rightful accolades it deserves in having exercised due caution about the environment.

One of the major problems which contractors face is the wide range of environmental regulations and the continuing changes pouring out of the Congress, the State Legislature, and numerous local jurisdictions. It is particularly difficult to adhere to the law when the situation is rapidly changing. By bringing information about the environmental effects of construction together in a single reference it is hoped that the consolidated facts presented here will somewhat ease the contractor's dilemma in this regard.

The Handbook is organized to inform the contractors about the environmental laws and regulations which they must abide by, provide descriptions of the intent and meaning of these laws, present information about the best methods available to meet the letter and the spirit of the law, provide points of contact for further assistance and references for additional information. The laws and regulations covered in this Handbook are federal and state level with a number of local ordinances included for the sake of completeness. The 67 counties and innumerable local jurisdictions preclude a full inclusion of all local variations in environmental legislation. It is imperative that the contractor check with local city and county building departments to insure that any variations due to local ordinances are understood.

As a final note, it is intended that this Handbook be published in a format which allows it to be updated periodically to maintain it in a useful state. Periodic changes will be issued so that the appropriate pages may be easily changed to reflect the latest information available. Assisting in this idea of providing the latest information, Chapter 16 contains a listing of points of contact which the contractor can use to determine the exact state of affairs for any given environmental issue.

1.1 Organization of the Handbook

For the most part the Handbook is arranged by category of environmental issue. Several chapters are designed to provide an overview of the law itself, the environmental permitting process, points of contact for assistance, and trends in environmental legislation which affect construction.

Chapter 2 describes the environmental permitting process. Again there are many variations in the process from county to county throughout Florida and the purpose here is to illustrate what may be considered a typical chain of events which must take place in order to allow a project to proceed from start to finish.

Wetlands issues are a major topic in Florida and they are the subject matter of Chapter 3. Contractors and developers who are involved in activities in areas designated as wetlands have numerous restrictions on the manner in which they are allowed to perform their operations and it is imperative that they are fully aware of the issues involved.

The disposal of solid waste from demolition and construction is the topic of Chapter 4. This is a source of handy information about the proper means of disposal of these materials. Landfill space in Florida, as in the rest of the country, is at a premium, and the costs of disposing of the debris resulting from construction will become an increasing problem in the future. Associated with this is a real cost in terms of tipping fees for disposal which the contractor has to pay to dispose of the derbris resulting from construction. Certain local areas are experiencing difficulties even at the present time in finding space to dispose of construction waste to the extent where construction permits may in fact be denied because of the lack of landfill capacity. The subject of recycling construction debris into other construction and non-construction products is also discussed.

Chapter 5 provides details regarding the use, handling, and disposal of hazardous materials used in construction. Recent court rulings have decreed that the construction industry must follow the OSHA regulations which were primarily intended for manufacturing operations. The full range of hazardous materials used on a construction site is quite extensive and it is worthwhile for construction professionals to be aware of this information and to insure their sites adhere to the provisions of the OSHA regulations. Chapters 6, 7, and 8 deal with water quality, air quality, and noise pollution. Again, these are all issues which

impact upon construction and awareness of these matters is important for the safe and proper conduct of operations.

A recent issue which, like many others, will more and more affect construction is the presence of radon gas on sites which are proposed for development. Chapter 9 covers this subject in good detail and describes the subject as well as provides information on practices which will insure that this problem is adequately and properly attended to in development and construction.

Construction operations inevitably will involve the destruction of some amount of plants and wildlife. One is made continually aware of this issue by news accounts of efforts to block development or construction in areas which are inhabited by endangered species. Chapter 10 provides the most current information for use by contractors in understanding their obligations with regard to this problem area.

Coastal areas are particularly sensitive to human activities and Florida is a significant state in this regard because of the its 8,426 miles of coastline which is a function of Florida's unusual geometry. As a result of this unique geography a significant amount of construction will occur on or near coastal areas. Chapter 11 discusses the ramifications of construction activities versus coastal protection.

Chapter 12 deals with the particularly sensitive issue of growth management and how it affects construction, particularly in light of state requirements on concurrency and the requirement that each county have a state approved growth management plan. This of course has a strong affect on the development of various regions with fallout on construction itself.

Occasionally a contractor will encounter the remnants of Florida's past history in excavations for construction. These sites are legislated to have special provisions for the examination of the artifacts which have been uncovered in the process of preparation for construction and Chapter 13 gives the contractor the necessary information to be able to comply with the legal requirements.

A summary of organizations, both governmental and trade, are listed in Chapter 14 along with points of contact and telephone numbers. In the event that the contractor requires further assistance in these matters these organizations provide an excellent source of technical, legal, and training information of which the contractor may take advantage.

1.2 Summary and Disclaimer

The use of this Handbook should provide contractors with a source of ready, useful information on the effects of environmental rules and regulations on the conduct of their businesses. Although it is hoped that the information provided here is complete and accurate it is nevertheless the ultimate responsibility of the contractor to be aware of the appropriate details of environmental law on construction activities. The authors and publishers of the Handbook have produced it with this in mind and are not responsible for the misuse or lack of full information obtained by anyone attempting to use the Handbook as the sole authoritative source of guidance for adhering to the full letter of the law.

CHAPTER 2
ENVIRONMENTAL PERMITTING

2.0 Introduction

Environmental permits are required for every construction job in which the construction of, or the result of the construction will result in a change that will physically alter the **environment**. This broad statement means that, except for the most minor of projects, all construction projects will require some form of environmental permit in order to obtain the final construction permit. The problem is that, unlike the majority of permits required in the construction process, environmental permits are not standardized. Each project has to be evaluated separately, depending on a myriad of variables. These variables can include:

(a) Which are the required permitting agencies?
(b) Does the project require Federal approval?
(c) Does the project require State approval?
(d) Does the project require County or City approval?
(e) What is required for application?
(f) What is the format for submissions?
(g) What is the process for each agency, application, or appeal?
(h) Does the project require an Environmental Impact Statement?

As can be seen from just these few questions, the process of obtaining environmental permits for construction projects can be one of the most difficult, costly, and time-consuming steps in the construction process.

The purpose of this chapter is to identify the general process of how to obtain an environmental permit. It would be a virtual impossibility to review every conceivable process that would be required from every agency at the federal, state and local level, so this chapter will focus on the general process required at every level, and leave the determination of the exact requirements for a particular project to the development team at the time.

2.1 Initial Considerations

The first step the developer must take when deciding whether or not he needs an environmental permit is to consider what impact the project might have on the environment. The areas that the developer must consider for the particular project can be divided into eight broad categories. These categories include:

1. Land
2. Water
3. Air
4. Noise
5. Ecology
6. Human Aspects
7. Economy
8. Resources

For example: A developer is considering the effects on the environment of building an apartment complex on a 25 acre parcel of land. The land contains a stream and fifteen acres of virgin forest. Under air, he would consider the effects of the added pollution from the automobiles of the future residents as well as emissions during construction. Land considerations might include the effects of the forest on the land, levelling of the land due to grading, drainage of the water from the land and into the stream, and possible sewage and solid waste removal. Stormwater drainage, the stream and effects of the increase in demand upon the local **aquifer** would be key water concerns. A list of endangered plants and animals would have to be obtained to determine if that would be a concern. A determination that the project would not have an adverse effect on the quality of sound of the area would have to be made. In addition, a decision would probably be made that the effects on human aspects, economic concerns and resources of the area at that time could not be evaluated. Thus, initial assessment would reveal the necessity to coordinate with agencies in charge of Air Quality, Land Management and Water Quality. A more comprehensive list of variables that the developer might consider is presented in **Table 2.1.**

The developer's next step would be to determine what agencies are involved with each of the eight broad categories mentioned above. This is one of the most difficult steps, as well as one of the most important. It is difficult because the developer has to determine which agency has jurisdiction over these areas. In addition, since the laws and jurisdictions are not always set in stone, the processes and requirements will often overlap. The importance of this step can not be underestimated. If the developer does not conduct a thorough investigation into who has jurisdiction, the project could be seriously delayed, costing time and money. The best place to start is usually the local Department of Environmental Services or the head of the County/City Commission.

Environmental Attributes

LAND
Soil Stability
Natural Hazards
Land-use Patterns

WATER
Aquifer Safe yield
Flow Variations
Oil
Radioactivity
Suspended Solids
Thermal Pollution
Acid and Alkali
Biochemical Oxy. Demand
Dissolved Oxygen (DO)
Dissolved Solids
Nutrients
Toxic Compounds
Aquatic Life
Fecal Coliform

AIR
Diffusion Factor
Particulates
Sulfur Oxides
Hydrocarbons
Nitrogen Oxide
Carbon Monoxide
Photochemical oxidants
Hazardous Toxicants
Odor

NOISE
Physiological Effects
Psychological Effects
Communication Effects

ECOLOGY
Large Animals
Predatory Birds
Small Game
Fish, Shellfish, Water Fowl
Field Crops
Threatened Species
Natural Land Vegetation
Aquatic Plants

HUMAN ASPECTS
Life Styles
Psychological Needs
Physiological Systems
Community Needs

ECONOMICS
Regional Economic Stability
Public-Sector Review
Per Capita Consumption

RESOURCES
Fuel Resources
Nonfuel Resources
Aesthetics

Table 2.1 Enviromental Attributes

The final step the developer should consider before entering the Environmental Permitting Process is to determine his "Environmental Permitting Team."

Small Project	Medium Project	Large Project
Owner	Owner	Owner
Contractor	Contractor	Contractor
	Architect	Architect
	Engineer	Engineer
	Project Manager	Project Manager
		Lawyer
		Environmental Specialists

Table 2.2 The Developer's Environmental Permitting Team

On smaller projects, such as renovations and single-family dwellings, the team may consist of just the owner and the general contractor. The impact on the environment would be minor, if any, and the process would usually be kept at the local level. As the project gets larger in scope, so does the possible need for more members on the team. Additional team members could include the project manager, the architect, design engineers, specialists in environmental testing and, if the job is large enough, a lawyer specializing, or at least knowledgeable, in environmental permitting.

The need to retain a lawyer for the larger projects is almost imperative. In the initial phases of the project, a lawyer can help determine the correct agencies and procedures for applying for the permit, determine the applicability of various statutes and rules and research the possibility of exceptions and variances to the statutes. As the project develops, the lawyer can assist in ensuring the developer submits the proper legal forms and, if the permitting agency is negligent, assist in ensuring the permitting agency follows the statutes correctly. For example: a permitting official may have a personal interest in keeping a piece of land from being developed. Attempts to delay and discourage the developer in numerous ways to include not reviewing the application in a timely manner or by the requesting of "special requirements" not previously identified could occur. The lawyer, knowing that there are federal and state guidelines regarding the timing of the application process and the manner in which it is to be conducted, could be extremely useful in keeping the process as timely as possible. Finally, having a lawyer who is knowledgeable of the situation would be critical should the development proposal go to court. As can be seen, on the larger construction projects a lawyer brought in to the team during the initial conception of the project could save enormous amounts of time and money.

2.2 The Environmental Permitting Process

2.2.1 Overview

In its simplest form, The Environmental Permitting Process has three steps:

(1) Application Procedures
(2) Agency Review
(3) Approval/Disapproval

The key to the process is the actions that take place during these three steps. All contractors should be familiar with the basic permitting process for the State of Florida (**Table 2.3**). Some of the key activities involved in the process may be identified as well as the maximum time limits allowed by the state.

2.2.2 Application Procedures

(1) Initial Contact

The first step in the application procedure is to contact the agencies that the developer has determined have jurisdiction over the project. Upon contacting them, the agency can then inform the developer whether or not they are the applicable agency. If they are not, then they can usually provide the developer with the correct agency. If they are the correct agency, they can inform the developer that:

(a) No permit is required;
(b) A general permit exists for that type of project;
(c) A letter of permission must be obtained;
(d) The full permit procedure must be followed.

If no permit is required, the developer proceeds with the other areas of his construction sequence. For the other three answers, the next step is a Pre-Application Meeting.

(2) Pre-Application Meeting

The Pre-Application Meeting can be one of the most important steps in the permitting process. It is at this meeting that the development permitting team meets the agency permitting team in person. The input received here and the way the teams relate will set the tone for the project. The developers need to ensure that they bring all of the information on the project that is available to them, including any drawings, test results, or studies that have been conducted. The development team also needs to ensure that they have invited all of the applicable agencies for the particular environmental area of concern.

Step 1.	Pre-application meeting with the Planning Council Staff.
Step 2.	Submit written notification of plan to Planning Council
Step 3.	Submit application forms to applicable agencies a. One copy to Department of Community Affairs b. Four copies to South Florida Water Management District c. Copies to State Departments of Natural resources, Enviromental Regulation, and Transportation
Step 4.	The Planning Council reviews your application
Step 5.	You meet with the Planning Council to identify issues that will arise during review of your plan
Step 6.	The Planning Council notifies you and your local government of inadequacies in the plan within 20 calander days of Step 4.
Step 7.	You notify the Planning Council on your plan to correct deficiencies within five working days of notification referenced in step 6.
Step 8.	You provide the Planning Council with required additional information.
Step 9.	Local government gets written notice to set public hearing for plan. A copy is sent to you.
Step 10.	Local government sets public hearing date, notifies you, the public, and the Planning Council.
Step 11.	Applicable agencies prepare Impact Report a. Planning council technical review/input b. Water management district review/input c. Agencies prepare report based on input d. Draft report sent to Planning Council, Local government, and you 10 days before meeting e. Planning Council meets with you
Step 12.	The Planning Council Report is issued within 50 Calander days of Step 7. Copies go to you and the local government.
Step 13.	The public hearing by local government on the regional impact of your development is held, within 60 calandar days of Step 7.

TABLE 2.3 Example of a Florida Permit Process

for the project. This would ensure that all of the agencies, as well as the developer, are operating under the same instructions and assumptions, as well as help identify overlapping or redundancy at the earliest possible time.

During the meeting, the focus should be on three areas:

(a) The requirements for obtaining the permit;

(b) The exact process followed by the applicable agency;

(c) Developing a working relationship with the applicable agencies.

If all of these areas are covered completely, the pre-application meeting will have been successful. If all of these areas are not satisfactorily covered, it may be prudent to schedule subsequent pre-application meetings, until these guidelines are sufficiently covered. In addition, the developer should ensure that the pre-application meetings with all of the different agencies be conducted. These meetings should be planned as close together as possible to ensure that all of the information is current and relevant. This enables the developer to best determine a plan for when to submit the application.

(3) Application Submission Timing

The pre-application meetings identified the requirements for application as well as the projected time required to complete the process. The developer needs to review this information to determine the optimum time and manner for submitting the applications. There are two basic concepts for determining when to submit the applications. The first is to submit them all at once. This method is acceptable, and even preferable, for small to medium size projects where the likelihood of changes and revisions is minimal. The second method is to submit the applications in stages. This method is better for the larger projects where the agencies often tend to request additions and make changes more often. This method would have the developer submit the first level of applications and wait until the agencies send their comments before conducting any further studies or tests. For example: the developer may be told in the pre-application meeting that it was necessary to conduct soil boring tests to a level of 12 feet. But during the review sequence, one of the reviewing departments noted that the soil boring tests would need to be taken to a depth of 18 feet to go under the aquifer for that particular parcel of land. By waiting to ensure exactly what the agency required, the developer would have saved some time and money. Whichever method the developer chooses, the end result should be for all permits to be approved in a logical sequence to keep costs down and reduce the possibility of one permit expiring before another required permit is even approved.

(4) Application Preparation

The next step is the actual preparation of the application packet. The requirements for these packets can vary tremendously, depending on the size and type of project to the level and statutes of the permitting agency. One thing is usually common though, they all usually have a standard application form of some type. The key to submission of these forms is to:

(a) Fill in all forms in a neat, professional manner.
(b) Use simple, concise language.
(c) Provide all of the requested information in the requested format.
(d) Cross-check information provided in each form to insure consistency.
(e) Make a duplicate copy for company files.

In addition to the standard application form, most application packets will require additional information. This information can include:

(a) Vicinity Maps
(b) Plan View Drawings
(c) Elevation or Section View Drawings
(d) Photographs
(e) Surveys
(f) Proof of Ownership
(g) Payment of initial fees
(h) Legal descriptions of the property
(i) Information for variance requests
(j) Information for rezoning requests
(k) Information for temporary use permits
(l) Information for special use permits

2.3 Agency Review

The Agency Review generally consists of four phases:

(a) Completeness Review
(b) Competence Review
(c) Legal Review
(d) Environmental Considerations

The Completeness Review, as the name implies, is the process in which the application packet is reviewed by the receiving agency for completeness. This review checks to make sure all of the necessary forms were submitted in the correct number and format. If the submission is not "complete," the receiving agency will usually notify the developer in writing of the deficiencies. The developer will then take corrective action and either resubmit the entire packet or just forward the requested documents. The developer should ensure that he is familiar with the particular process the receiving agency uses. Once the receiving agency determines that the submission is complete, it will then assign the request packet a "start time." This start time is the date that the permitting process is officially recording as the beginning of the permitting process. It is this date in which the maximum times for each step of the process is judged by (Table 2.3).

The Competence Review begins when the receiving agency distributes copies of the application packet to departments within its own organization and to other outside agencies. Each of these departments and agencies then review the request to ensure they meet existing regulations and guidelines. During this time, as well as during the submission, the agencies may require additional or supplemental information. These can come in the form of reports, which are usually informal, and assessments, which are usually more formal. These reports and assessments can include:

(a) Data Reports
(b) Technical Literature Reviews
(c) Technical Expert Reviews
(d) Development of Regional Impact (DRI)
(e) Planned Unit Development Packets (PUD)
(f) Environmental Impact Statement (EIS)

The agency requesting the information will, in most cases, provide the developer with the requirements and format for these reports and assessments (**Table 2.4**).

The reviewer also has the opportunity at this time to input his or her own experience into the review. For example: The reviewer may have worked on a similar project in the area and is familiar with certain factors that could influence the project that are not covered in the regulations. At this point, the injection of particular "subjective" input into the request can occur. The developer should be mindful that these suggestions are not written laws, and, if the developer thinks the input is detrimental to the progress of the permit, he or she may want to challenge the legality of any additional request for information.

During the Legal Review, the application is reviewed to determine the ability of the agency, under the law, to issue a permit, and the proof of the developer that the land is properly owned.
The Legal Review will also review the submission for consistency with any conflicting or pending legislation.

PROJECT	A	B	C	D	E	F	G	H	I
Airports, heliports, landing strips	X	X	X	X	X	X	X	X	?
Batch plants	X	X	X	X	X	X	X	X	?
Bulk storage	X	X	X	X	X	X			?
Commercial developments ≥ 3 acres	X	X	X	X		X	X		?
Commercial forest products removal		X	X			X	X		?
Construction in stream channels	X	X	X	X		X			?
Developed campgrounds	X	X	X	X	X	X	X		?
Educational facilities	X	X	X	X	X	X	X	?	?
Electrical substations, power plants	X	X	X	X	X		X		?
Fish and wildlife	X		X						?
Forest management programs	X	X	X					?	
Golf courses	X	X	X	X	X			X	?
Government buildings	X	X	X	X	X	X	X	?	?
Harbors and marinas	X	X	?				X		X
Highways, roads and structures	X	X	X	X	X	X		X	?
Medical facilities	X	X	X	X	X	X	X	?	?
Mobile-home parks	X	X	X	X	X	X	X	X	?
Motels, apartments with ≥ 5 units	X	X	X	X	X		X	X	?
Multiperson dwellings	X	X	X	X	X	X	X		?
Organized recreation camp	X	X	X	X	X		X	?	?
Overhead or underground utilities	X	X	X	X					
Parking lots	X	X	X	X	?	X		X	?
Peirs and shoreline construction	X	X							X
Pumping stations	X	X	X	X			X		?
Quarries	X	X	X	X	X	X		X	?
Radio, TV, telephone relay stations	X	X	X	X					
Sewage and water-treatment plants	X	X	X	X	X	X	X	X	X
Skiing facilities	X	X	X	X	X	X		X	
Solid-waste transfer stations	X	X	X	X	X		X		?
Stations, transmission lines, structures	X	X	X	X			X		?
Stream crossing	X		X	X	X	X	X	X	?
Subdivisions	X		X	X	X	X	X	X	?
Variances	X	X	?	?	X			?	?
Water storage tanks and reservoirs	X	X	X	X	X	X		X	
Wrecking yards	X	X	X	X	X	X	X		?

A. Environmental Impact Statement
B. Plot Plan
C. Grading and Slope Stabilization Report
D. Vegetation Preservation and Protection Report
E. Slope Analysis Map
F. Storm Drainage and Hydrology Report
G. Fire Protection Report
H. Soil and Geology Report
I. Shoreline Report
X = Required ? = Requirement depends on project

TABLE 2.4 Sample Supplemental Reports By Project Type
Source: California Office of Planning and Research, 1984

Upon compiling their individual reports, the receiving agency usually evaluates the information and presents it, with a recommendation to a ruling body for decision. It is at this point that the final public hearings are held and the entire request is decided upon its Environmental Considerations. With the reports, the public input, additional tests, if required, and institutional knowledge, the governing body renders a decision. In most cases, the decision will be either:

(a) Approved
(b) Approved with Considerations
(c) Intent to Deny
(d) Denied

Should the decision be ''Approved with Considerations,' the request will be considered as approved upon the developer meeting certain requirements set by the ruling authority. The developer must meet these requirements within a certain set time to be accepted as approved. If the decision is ruled as ''Intent to Deny'' the developer is informed that the request has been formally denied, but that the files are still active. This means that the developer has a chance to remedy certain deficiencies noted by the reviewing agency and, upon completing these changes, can appeal the decision either before the ruling authority or before a judge, depending on the agency regulations. If the decision is 'Denied,'' the file is considered as closed and no appeal process is provided. The developer will have to either make changes and resubmit at a later date or drop the project altogether.

2.4 Summary

The environmental permitting process can be a costly and time-consuming step in the construction process. It is important that the developer be familiar with the process so that decisions that will result in the maximum benefit for the project can be made. He or she must first know the terms that are associated with environmental permitting so that the ability to ''talk the talk'' with the applicable agencies can happen. The areas which are involved with environmental permitting and the agencies which regulate these areas must be known. Armed with this information, the developer must then know the process that the environmental permitting agencies will follow in deciding on the request for the permit. By knowing this information, the developer will be able to complete the permitting process in a timely and cost efficient manner and will help to insure the successful completion of the project. This chapter is dedicated to ensuring that the developer has that knowledge.

2.5 Definitions

Aquifer	A water bearing stratum of permeable rock, gravel, or sand
Environment	The combination of all external influences and conditions affecting the life, development and ultimate survival of an organism.

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CHAPTER 3
WETLANDS

3.0 Introduction

Florida is a highly attractive and beautiful state that is quickly becoming the third most populated state in the U.S. With so much to offer: good weather, beautiful coasts, lush landscapes, thousands of miles of streams and just as many lakes, great fishing and exotic animals, it is easy to understand its attraction. Not until recently however has the cost of this rapid expansion become clear. Ironically, the part of Florida that is generally thought of by many as unattractive and virtually useless is actually the heart and soul of the state: the Wetlands.

3.1 Functions of Wetlands

Wetlands play many roles in the ecosystem of Florida. The coastal estuaries and their wetlands are spawning grounds, nurseries, and food sources for two-thirds of the fish and shellfish caught along the Atlantic coast and in the Gulf of Mexico. Wetlands serve as nesting grounds for many species of waterfowl, waterbirds, and songbirds (**Figure 3.1**). Approximately 20% of the plants and animals listed by the federal government as threatened or endangered rely heavily on wetlands. Although not normally considered good water recharge areas because of the sheer volume of water stored in Florida's wetlands, they do account for a significant amount of recharge to Florida's underground waters. Wetlands form an integral part of a region's hydrologic system in that they temporarily store flood water, thus reducing damage associated with flood flows. A large portion of the sediments and pollutants are picked up by surface water and flow into the wetlands, passing through a biological filtering system before discharging into our lakes and streams. On the coasts, the groundwater pressure created by the wetlands holds back saltwater intrusion. Aesthetics, recreation, and education are just some of the other benefits wetlands offer.

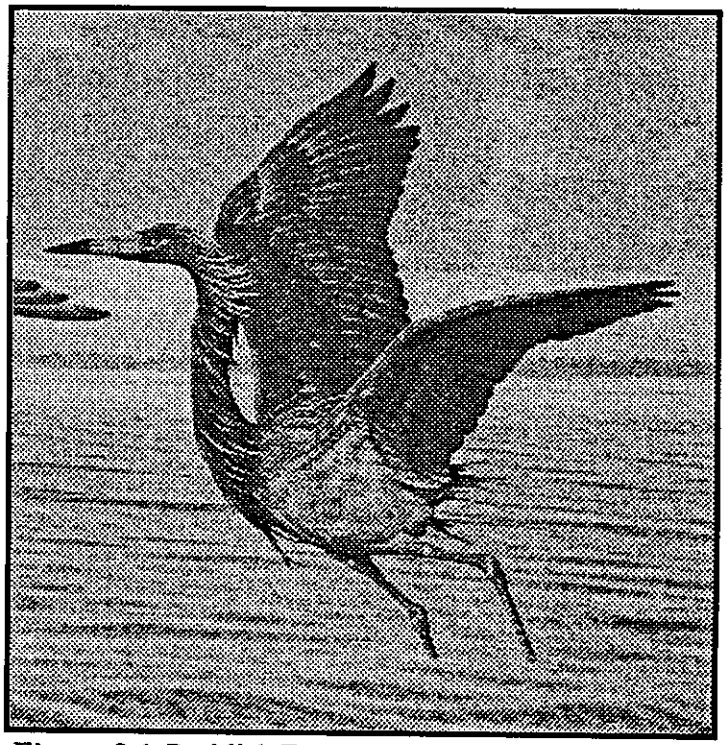

Figure 3.1 Reddish Egret

On a larger scale it has been speculated that without its wetlands, Florida would become a desert. This is due to the cycle of evaporation of standing water into the atmosphere, consequently resulting in rainfall. Areas around the world's northern hemisphere at the same

latitude as Florida are all deserts, the only exception being the Mekong Delta region of Vietnam, a major wetland area.

3.2 What is a Wetland?

Although authorities usually adopt their own definition of a wetland, citing slight characteristic differences in vegetation, soil, and animal types, the meanings vary little. A widely accepted official definition of a wetland is that adopted by the U.S. Army Corps of Engineers (COE) which states:

> Wetlands are areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support and under normal conditions do support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, bogs, marshes, and similar areas.

Although many governmental agencies define wetlands by similar standards, there are differences. Although keeping up with these variations can be frustrating, the differences may be very important to understand. The Florida Department of Environmental Regulation refers to Chapter 17-312.020 of the Florida Administrative Code.

Wetlands generally occur along gradually sloping areas between uplands and deep water environments, such as rivers and lakes, or form in isolated basins. Nearly all vegetated wetlands are located inland in fresh water areas with the remainder being coastal.

3.3 Decline of Wetlands

Only in the last 20 years has the importance of wetlands been recognized and actions have been taken to slow their decline. It is estimated that less than 50% of the original 215 million acres of wetlands in the United States exist today.

The estimated wetland loss in Florida is even higher at 60%. Wetlands are drained or filled for such uses as agriculture, mining, forestry and urbanization. In the past, Florida went to great lengths to rid itself of much of its water because of pressure to use the wetlands for agriculture, and other purposes (Figure 3.2). As a result, Florida is experiencing a number of water management concerns, including flood control, drought, pollution, water supply, conservation, environmental and ecological problems with which the state must now deal.

3.4 Dredge and Fill Permits

More often than not a developer or building contractor becomes involved in wetlands and their regulation when they have the need to dredge or fill these areas to obtain the necessary site conditions for

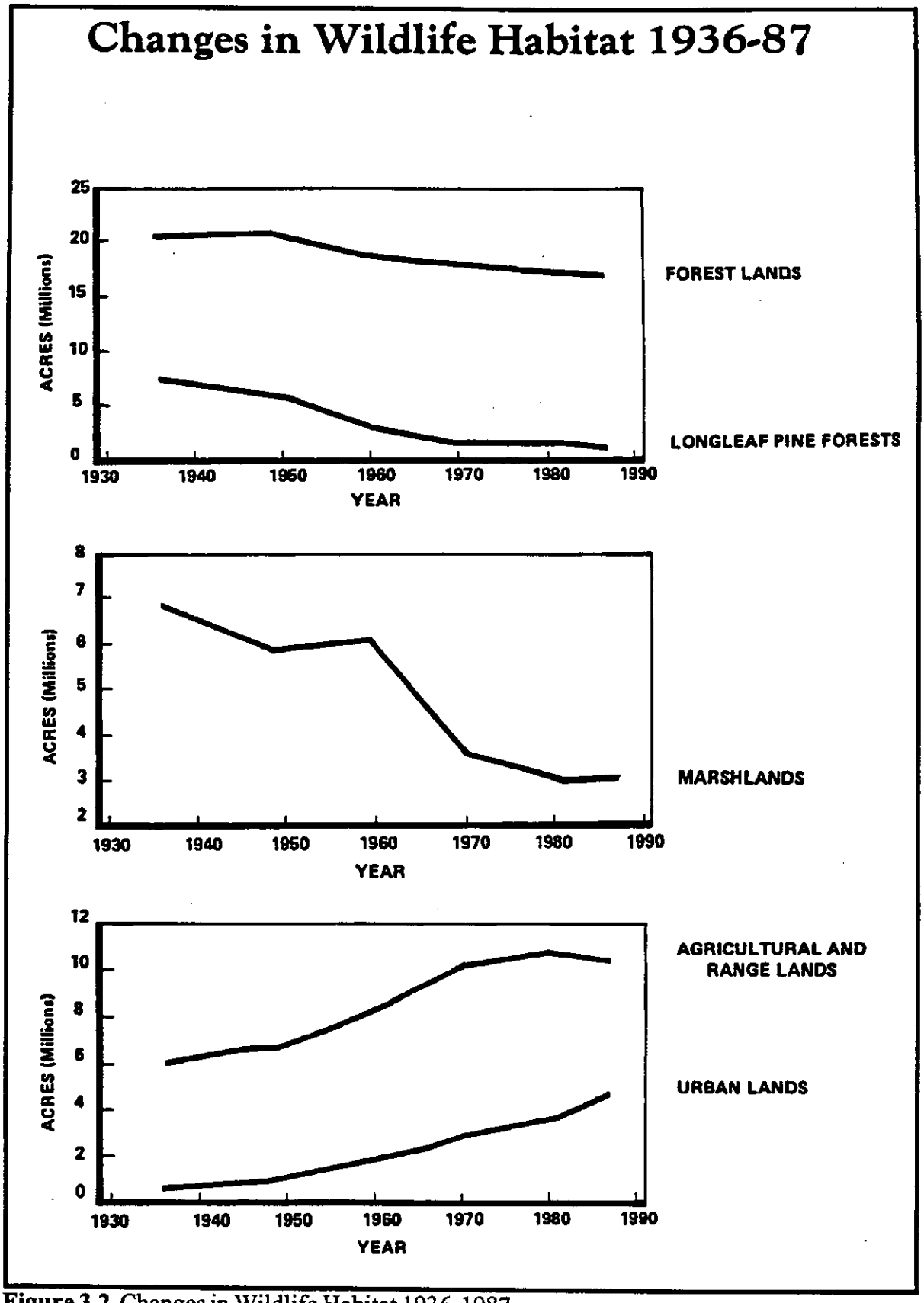

Figure 3.2 Changes in Wildlife Habitat 1936-1987

a project. Since wetland areas are relatively cheap compared to higher and dryer land, they are generally purchased with the intention of filling them with soil, concrete, and other material to make these areas useful to developers, farmers and others. Mining companies often purchase wetlands to dig for resources. To protect Florida's valuable and sensitive wetlands, U.S. and Florida law requires anyone conducting activity that may cause harm to these areas to obtain a Dredge and Fill Permit. This permitting program regulates the discharge of dredge or fill material into waters of the United States, including wetlands adjacent to waters. Permit applications are evaluated using EPA guidelines and issued by either the COE or the Florida Department of Environmental Regulation (DER).

Factors taken into account when reviewing permit applications include:

* impact on the environment
* impact on society
* other alternatives
* necessity for dredging or filling

3.4.1 Violation of Dredge and Fill Regulation

Regulation of the Dredge and Fill program is the responsibility of the COE and DER. Violations are handled through the EPA, COE, or DER. Noncompliance with the permit or failure to obtain a permit may result in an administrative order requiring compliance within a specified period of time or civil action will be taken. Depending on the severity of the violation, penalties can range from civil action such as temporary or permanent injunctions, to criminal prosecution in the case of willful or negligent violations.
Those in violation can be fined between $2,500 and $25,000 per day of violation, or imprisoned for up to one year, or both.

3.4.2 Types of COE Dredge and Fill permits

Individual Permits - Major projects usually require processing by the district office as individual permits, with public notices and, under certain circumstances, public hearings and formal Environmental Impact Statements.

Letters of Permission - Used to authorize Section 10 activities such as minor structures and limited dredging operations with a contained, upland disposal area.

General Permits - Cover a clearly specified category of projects which have little or no significant environmental impact. These include private and commercial docks, riprap revetments, boat ramps and slips, outfall structures, and other activities.

Nationwide Permits - Provide prior approval on a truly nationwide basis for a large group of minor activities including the repair of certain structures, structures in residential canals, minor road crossing fills, and other, or similar works.

Water management districts and local governments may, and often do have their own permitting programs along with the federal and state programs.

3.5 Jurisdictional Declaratory Statements (JDS)

Defining whether or not a portion of land is considered a wetland (waters of the state) is very difficult for a layman. As the DER puts it; "The Department recognizes that the natural border of certain water bodies listed in Section 17-312.030 F.A.C., may be difficult to establish because of seasonal fluctuations in water levels and other characteristics unique to a given terrain" (F.A.C., 17-312.045). In Florida a property owner or anyone who has a legal or equitable interest in the property can petition the DER for a Jurisdictional Declaratory Statement (JDS) which will determine whether or not the property contains a wetland.

The fees associated with the JDS are:

(A) For property 0 - 50 acres in size _____	$ 250
(B) For property 50+ - 100 acres in size _____	$ 500
(C) For property 100+ - 500 acres in size _____	$ 1,000
(D) For property 500+ - 750 acres in size _____	$ 2,000
(E) For property 750+ - 1000 acres in size _____	$ 2,500
(F) For property greater than 1000 acres in size	$ 2,500

(plus $500 for each 500 acres over 1000 acres, up to a maximum of $10,000)

The JDS can be invaluable to property owners and developers in that it leaves no doubt as to what constitutes waters of the state on a given property. For additional information concerning the JDS refer to Chapter 17-312.040 of the Florida Administrative Code (F.A.C).

3.6 Current Wetlands Regulatory Programs

Federal, state and local government each have some form of program that regulates the use of wetlands. Some focus on regulating alterations of wetlands, others regulate the use of wetlands in order to protect natural resources such as clean water, plants, and animals. Still others deal with activities that affect wetlands in a indirect way, such as dams.

3.6.1 Federal Programs

The Federal wetland regulatory program of Section 404 of the Clean Water Act is the dominant program in regulating wetland destruction nationwide. Section 404 requires anyone attempting to dredge or fill material into U.S. waters, including wetlands, to first receive a permit from the COE. Other impacts such as chemical and biological alteration are included.

Guidelines set by both the EPA and the COE usually prohibit the discharge of dredge and fill material into U.S. waters unless:

* No other practical alternative is available that would lessen the harmful effects.

* Discharges will cause no significant impact on waters into which they are discharged into.

* All applicable laws must be obeyed.

* Every effort to lessen adverse effects on the ecosystem, usually mitigation, is taken.

The task of carrying out the Section 404 program rests heavily on the COE and the EPA. Also involved is the **U.S. Fish and Wildlife Service (FWS)** and the **National Marine Fisheries Service (NMFS)**, both which serve as advisors.

The responsibility of the EPA is to review permit applications being evaluated by the Corps and make any necessary comments. The EPA also must: handle general enforcement; administer provisions for state assumption of the permit programs; determine applicability of exemptions specified in section 404(f); design guidelines for the specification of disposal sites and deny or restrict the use of any area as a disposal site.

The FWS role in the dredge and fill program as stated in the Fish and Wildlife Coordination Act (FWCA) is as a consultant to the EPA and COE. Their role in permitting decisions is specified by the Memorandum of Agreement between the Corps and the Department of the Interior (DOI). The FWS also represents the DOI in their review and negotiations of Dredge and Fill permits.

When dredge and fill activities affect marine resources, the NMFS has the responsibility of review and consultation just as the FWS. Its role is defined in the Memorandum of Understanding with the Corps. The NMFS has responsibilities stated in several Acts concerning wetlands; the Marine Protection Research and Sanctuaries Act of 1972 and the Endangered Species Act are just a few.

3.6.2 State Programs

States can assume substantial authority to regulate their wetlands under federal and state laws. Florida has adopted its own programs in hopes of gaining better control of activities affecting wetlands. Backed by new and stricter state laws, these programs seek to fill the voids in federal programs that do not suit the state's special needs. The focus of these programs is to consider the cumulative effects of activities, such as Dredging and Filling, on a body of water.

Anyone performing activities in or around Florida's waters is required to obtain a permit from the state's primary environmental permitting agency, the **Department of Environmental Regulation (DER)**. The Department's Division of Water Management is responsible for administering the Wetland Resource Permits (dredge-and-fill) and works closely with the Water Management districts and the **Florida Department of Natural Resources (DNR)**.

Depending on the size or type of project for which a permit is sought, wetland resource permits are issued either by the Department's Tallahassee Office, its District Offices, or by a water management district to which the permitting program has been delegated.

DNR is the primary agency involved in the coastal permitting program and when state lands such as aquatic areas (for example, lake bottoms) are involved.

The **Game and Fresh Water Fish Commission (GFWFC)** has become more involved in enforcement of wetlands regulation. When violations are determined as criminal **GFWFC** will be notified and will make any arrests that are necessary.

3.6.3 Local Programs

In Florida, state wetland regulatory laws delegate implementation of state programs to the local government.

Local governments have several other methods which they often use concurrently to provide local wetland regulation: subject ordinances with specific permitted and conditional uses for designated areas, wetland conservation districts and a map designating woodlands under consideration. Restrictions on dredge and fill activities have become a major thrust of these programs.

Wetland ordinances may be adopted as a part of the local zoning code, as a specific district, as a separate ordinance within the municipal code or as a element of the comprehensive open space plan.

3.7 Major Wetland Regulations Affecting Dredge and Fill Activities

3.7.1 Federal Regulations

* The Rivers and Harbors Act of 1899. This act prohibited the unauthorized obstruction or alteration of any navigable water of the United States. Section 10 of this Act prohibits the excavation of material from, or the deposition of material into, any navigable water of the United States without a permit or other authorization from the United States Army Corps of Engineers. The Act also restricts the accomplishment of any other work that would affect location, course, capacity, or condition of such navigable waters. This Act was drafted with the intention of maintaining safe waterways for travel and commerce. Under this Act the Corps limited its jurisdiction to activity affecting the navigable capacity of waterways, reviewing permit applications on the basis of impact on navigation (Federal Register, July 19, 1977).

Because of public pressure up in the COE to broaden their scope to include more protection of the environment, in 1968 the Corps published the following pursuant to its duties under the 1899 Act. "The decision as to whether a permit will be issued must rest on an evaluation of all relevant factors, including the effect of the proposed work on navigation, fish, wildlife, conservation, pollution, aesthetics, ecology and the general public interest."(33 C.F.R.)

* Federal Water Pollution Control Act (FWPCA) of 1972.
This act prohibited the discharge of pollutants into navigable waters without a permit, and section 404 of this act regulated the discharge of dredge and fill material. Section 404 of the FWPCA establishes a permit program, which is administered by the secretary of the Army acting through the Chief of Engineers to regulate the discharge of dredge material and those pollutants that comprise fill material into the waters of the United States. Applications for Section 404 permits are evaluated by guidelines developed by the administrator of the Enviromental Protection Agency(EPA) in conjunction with the Secretary of the Army. The Chief of Engineers can make a decision to issue a permit that is inconsistent with those guidelines if required for navigation. Section 404(c) gives the Administrator, EPA, further authority subject to certain procedures, to restrict or prohibit the discharge of any dredged or fill material that causes an unacceptable adverse effect on municipal water supplies, shellfish beds and fishery areas, wildlife, or recreational areas (Federal Register, July 19, 1977).

After a court order, the Corps redefined their definition of "navigable waters" to also include artificially created channels connected to navigable waters, nonnavigable interstate waters up to their

headwaters, tributaries to navigable waters up to their headwaters, intrastate waters up to their headwaters that are used for interstate commerce, and woodlands adjacent to such waters (Brown and Starnes, p.125, 1983).

* 1977 Clean Water Act. This Act was the first federal act to address itself to woodlands. In this Act, dredge, fill, and discharge regulations included woodlands that are adjacent to United States waters. The terms ''woodlands'' and ''adjacent'' were defined separately. The term ''woodlands'' was defined as those areas that are inundated or saturated by surface water or groundwater at a frequency and duration to support, and under normal circumstances do support, a prevalence or vegetation typically adapted for life in saturated soil condition. The term ''adjacent'' was defined as bordering, contiguous, or neighboring woodlands; woodlands separated from other waters of the United States by man-made dikes or barriers, natural river berms, beach dunes, and the like are ''adjacent woodlands.''

To regulate fill and dredge under the 404 Program, the Corps implemented a revised permit system. They developed two types of permits.: A general or nationwide permit and individual permits. Activities that fall under the general permit are ''permitted'' and are not required to go through the application process. For all other dredge and fill operations individual permits are required.

The 1977 Act exempts the discharge of dredged and fill material in connection with certain minor activities from all permit requirements provided that the discharge is not incidental to an activity intended to convert an area of navigable waters to a new use that involves impairment of flow or circulation of waters (Federal Register, July 19, 1977).

* Emergency Woodlands Resources Act of 1986.
  This act was established to promote, in concert with other federal and state programs, conservation of wetland resources. It is also designed to help fulfill international migratory bird treaty obligations through further governmental and private sector cooperation and addition public acquisition of woodlands.

* Marine Protection Research and Sanctuaries Act of 1972.
  Section 103 of this Act authorizes the COE to issue permits, after notice and opportunity for public hearings, for the transportation of dredged material for ocean disposal.

Because of wetlands' influence on many important issues: water, flooding, wildlife, fish and plant life, many other national regulations exist that dictate what can and cannot be done with woodlands. Recently, wetland activity has come under even more scrutiny and stricter rules are probably on the horizon.

3.7.2 State Regulations

* Warren S. Henderson Woodlands Protection Act of 1984

This act is the primary state statute concerning woodlands protection in Florida and is administered by DER. The legislation provides criteria for permit issuance; enforcement; agricultural activities; revisions of the vegetative index; review of applications for the use of state lands; a woodlands indicator index; restrictions on dredge and fill activities; and redefines the term "waters" to include reference to the everglades.

* Florida Statutes that Dictate Wetland Management:

Chapter 403 - Environmental Control(DER, Dredge and fill permits)
Chapter 380 - Florida Environmental Land and Water Act of 1972
Chapter 373 - Florida Water Resources Act of 1972
Chapter 372 - Game and Fresh Water Fish
Chapter 259 - Land Conservation Act of 1972
Chapter 253 - Authorizes state regulatory programs for woodlands and water resources
Chapter 163 - Local Government Comprehensive Plan Act of 1975

* Florida Administrative Codes Affecting Dredging and Filling

Chapters 17-312, 17-4, 17-27, 17-103

3.7.3 Local Regulations

Local governments here in Florida have substantial regulatory authority over woodlands through their zoning and other land use and development programs. Some implement a specific wetland ordinance while others may choose to protect woodlands through comprehensive zoning programs. Other local control measures can include building codes, performance standards, flood plain regulations, and others.

It is important to understand the local policy in the area in which the activity, eg. dredging and filling, is taking placing because of the many variations from county to county, city to city.

3.8 TYPES OF WETLAND ALTERATION

The alteration of a wetland refers to any activity that changes its natural state and effects its ability exist and support life dependant upon it. Three types of wetland alteration are recognized; physical, chemical, and biological.

3.8.1 Physical Alterations

Filling: adding any material to change the bottom level of a wetland or to replace the wetland with dry land.

Draining: removing the water from a wetland by ditching, tilling, pumping.

Excavation: dredging and removing soil and vegetation from a wetland.

Diverting Water Away: preventing the flow of water into a wetland by removing water upstream, lowering lake levels, or lowering ground water tables.

Clearing: removing vegetation by burning, digging, application of herbicide, scraping, mowing or otherwise cutting.

Flooding: raising water levels, either behind dams or by pumping or otherwise channeling water into a wetland.

Diverting or Withholding Sediment: trapping sediment, through construction of dams, channelization or other types of projects; thereby inhibiting the regeneration of woodlands in natural areas of deposition, such as deltas.

Shading: placing pile-supported platforms or bridges over woodlands, causing vegetation to die.

Conducting Activities in Adjacent Areas: disrupting the interactions between woodlands and adjacent land areas, or incidentally impacting woodlands through activities at adjoining sites.

3.8.2 Chemical Alterations

Changing Nutrient Levels: increasing or decreasing levels of nutrients within the local water and/or soil system, forcing changes in wetland plant community.

Introducing Toxins: adding toxic compounds to a wetland either intentionally (for example herbicide treatment to reduce vegetation) or unintentionally, adversely affecting wetland plants and animals.

3.8.3 Biological Alterations

Grazing: consumption and compaction of vegetation by either domestic or wild animals.

Disrupting Natural Populations: reducing populations of existing species, introducing exotic species or otherwise disturbing resident organisms (Figure 3.3).

Figure 3.3 Red Crowned Parrot

3.9 MITIGATION

In a attempt to help those applicants that do not meet the criteria for a dredge and fill permit and to avoid costly litigation, many federal, state, and local agencies have developed mitigation policies and practices. In common usage, mitigation means alleviating or reducing severity or harm. In governmental policy terms, it is much more complex and continually changing. Many of these mitigation policies and practices have become highly controversial. Some environmentalists believe mitigation policies and practices of these permitting agencies are bent, broken or ignored in an attempt to avoid costly and time consuming litigation.

Almost every wetland regulatory agency, federal,state, and local, that considers mitigation an alternative has its own definitions of mitigation options. One example is the Council on Environmental Quality's (CEQ) list for all federal activities affecting the environment as follows in its 1978 National Environmental Policy Act (NEPA) guidelines:

- avoiding adverse impacts to woodlands altogether by denying a project permit;
- minimizing impacts by limiting the degree or magnitude of the project;
- rectifying the impact by repairing , rehabilitating, or restoring the affected environment;
- reducing or eliminating the impact on woodlands by preservation and maintenance operations during the life of the project; and
- compensating for the wetland losses by replacing or providing substitute resources or environments.

On a state level, Florida's DER has developed detailed mitigation rules for the evaluation of permit applications. These rules define mitigation as an action or series of actions that will offset the adverse impacts of a project on the waters of the state altered by the project. Mitigation does not mean:

(a) avoiding environmental impacts of a project restricting, modifying or eliminating the proposed dredging and filling

(b) making cash payments

(c) conveyance of interest in land unless the conveyance will offset potential adverse impacts of the proposed dredging and filling, such as cumulative impacts. The state will consider marsh creation as a mitigation option if the permit applicant wishes.

Two strategies used to offset a project's impact on a wetland area are: minimizing the impacts as much as possible and compensating for the impacts. Though both strategies may be used together, compensating is better suited for projects where minimizing adverse effects is difficult. With compensation, the developer is allowed to eliminate the wetland and in return must either restore other woodlands or create new ones at another site.

On the average, for every one acre of wetland destroyed, two to three acres must be restored or created. Finding a suitable site for wetland restoration or creation can be difficult.

As stated earlier, mitigation, its policies and practices, can be very controversial. Much of the debate is over policies that are not very clear, such as: what amount of mitigation should be required; who should undertake and pay for mitigation; how to measure the values of woodlands being measured; when should mitigation take place; how compliance with mitigation requirements can be ensured; and the methodology used to determine appropriate mitigation.

In some cases, the expense of mitigation can reduce the profitability of projects that are no longer feasible. Some developers complain that agencies sometimes use conditions as leverage to discourage projects. The possibility of being taken to court by environmentalist groups as well as the lack of incentive and cohesion, some agencies make concessions hard to come by. Because of this some developers see litigation as a more attractive means of reconciliation. Mitigation through state and local agencies is, on the whole, simpler than through federal agencies like the COE and EPA.

Section 404 (FWPCA) states that any wetland losses by the private sector must be mitigated through federal, state and local woodlands regulatory programs. DER requires the applicant to provide alternatives and provide financial support if mitigation costs exceed $20,000. It is estimated that 66 percent of all individual permits have been modified substantially to minimize project impacts.

3.10 Violation of Wetland Regulation

In the case of woodlands, as is the case with other areas of the law, "ignorance of the law is no excuse." If violations such as ignoring permit conditions, failure to obtain a permit, or others do occur, then the authorities will prosecute the responsible party. Anyone from the owner or developer to the general contractor and subcontractors on down to the machine operator can be held responsible. Generally the first action of the authorities is to issue an administrative order requiring compliance within a specified period of time or take civil action. Violations can be deemed as civil or criminal depending on the circumstances. Penalties may be heavy fines, stopping work with temporary or permanent injunctions, corrective measures like rebuilding or creating new woodlands, or even criminal prosecution if violation is willful or negligent.

3.11 Contractor's Responsibilities

First and foremost, the contractor should be knowledgeable of the regulations and procedures of wetland regulating agencies having jurisdiction in the project's area. The ability to foresee problems associated with woodlands can be invisible to the construction professional. Sometimes the contractor may be one of the few if not the only person associated with the project that has some knowledge of wetland regulation. Violations of wetland regulations, whether or not intentional, can be detrimental to all. With the ever increasing scarcity of land available, woodlands are becoming involved more and more. It may be very helpful to obtain a copy of Chapter 17-312 of the Florida Administrative Code and understand it before proceeding with work effecting woodlands. Also seek help from governmental agencies if questions arise, in order to be able to make appropriate decisions.

Also the contractor should understand whose responsibility it is to apply for and obtain the necessary permits for the job. They must see that a project complies with all other federal, state, and local laws, codes and ordinances regarding woodlands before ground is broken. But it is the contractors job to be aware if permits have been obtained and to comply with the conditions of those permits. Contractors would be wise to see that all of these conditions have been met before they bid the job for these reasons:

* Permit conditions may require that work on your part be done a specific way, using time consuming and costly methods.

* Ground breaking could be delayed many months or even years waiting for project to be approved.

* The inclusion in the bid provisions for liability

Refer to chapter 18 for points of contact and any further questions on wetland problems.

Wetlands issues are being talked about frequently by the higher scholars of government. Topics such as, "No net loss" and compensation for profits lost to property owners due to wetland restrictions continue to be issues in Congress and have been batted around for several years.

3.12 Definitions

Adjacent means bordering, continuous, or neighboring. Woodlands separated from other waters of the United States by manmade dikes or barriers, natural river berms, beach dunes, and the like are "adjacent woodlands." (EPA)

Approved Program means a state program approved by the EPA. An "approved State" is one administering an "approved program."(EPA)

Best Management Practices (BMP's) means methods, measures, practices, or design and performance standards to prevent or reduce the pollution of waters of the United States. BMP's include but are not limited to schedules of activities, prohibitions of practices, and maintenance procedures. (EPA)

Discharge of Dredge and Fill Material means any addition of dredged material into waters of the United States. The term includes, without limitation, the addition of dredged material into waters of the United States and the runoff or overflow from a contained land or water disposal area. Discharges of pollutants into waters of the United States resulting from the subsequent onshore processing of dredged material that is extracted for any commercial use (other than fill) are not included in this term. They are subject to Section 402 of the Clean Water Act even though the extraction and deposit of such material may also require a permit from the Corps of Engineers. (EPA)

Discharge of Fill Material means the addition of fill material into waters of the United States. The term generally includes the following activities:

(1) placement of fill that is necessary for the construction of any structure
(2) the building of any structure or impoundment requiring rock, sand, dirt, or other materials for its construction
(3) site-development fills for recreation, industrial, commercial, residential, and other uses
(4) causeways or road fills
(5) dams and dikes
(6) artificial islands
(7) property protection and/or reclamation devices such as riprap, groins, seawalls, breakwaters, and revetments
(8) beach nourishment
(9) levees
(10) fill for structures such as sewage treatment facilities, intake and outfall pipes associated with power plants and subaqueous utility lines
(11) artificial reefs. (EPA)

Disposal Site means that portion of U.S. waters enclosed within fixed boundaries and consisting of a water surface area (when present), a volume of water (when present), and a substrate area. In the case of woodlands on which water is not present, the disposal site consists of the woodlands surface area. Fixed boundaries may consist of fixed geographic point(s) and associated dimensions, or of discharge point and specific associated dimensions. (EPA)

Dredged Material means material that is excavated from waters of the United States. (EPA)

Dredging means excavation, by any means, in waters. It also means the excavation, or creation, of a water body which is, or is to be, connected to waters, directly or via an excavated water body or series of excavated water bodies. (Florida Statute 403.911)

Estuary means a semi-enclosed, naturally existing coastal body of water which has a free connection with the open sea and within which seawater is measurably diluted with fresh water derived from river systems. (Florida Statute 403.911)

Fill Material means any material used primarily either to replace water with dry land or to change the bottom elevation of a water body. The term does not include any pollutant discharged into the water primarily to dispose of waste, as that activity is regulated under Section 402 of CWA. The Director, in consultation with the Section 402 permitting authority, will determine the primary purpose of proposed activities. (EPA)

Filling means the deposition, by any means, of materials in waters. (Florida Statute 403.911)

General Permit means either a State or Corps of Engineers Section 404 permit authorizing discharges of dredged or fill material from clearly described categories of activities that are similar in nature, will cause only minimal adverse environmental effects when performed separately, and result in minimal cumulative adverse effects on the environment. These Section 404 permits are issued on a local, state, regional, or nationwide basis. (EPA)

Headwaters means any point of a stream where water flow is less than 5 cubic feet per second under normal conditions.

Lagoon means a naturally existing coastal zone depression which is below mean high water and which has permanent or ephemeral communications with the sea, but which is protected from the sea by some type of naturally existing barrier. (Florida Statute 403.911)

Nationwide Permit means a Department of the Army authorization for certain discharges of dredged or fill material into waters throughout the nation. (EPA)

Waters of the United States means:

1. The territorial seas with respect to the discharge of dredged or fill material.

2. Coastal and inland waters, lakes, rivers, and streams that are navigable waters including adjacent woodlands;

3. Tributaries to navigable waters including adjacent woodlands;

4. Interstate waters and their tributaries, including adjacent woodlands; and

5. All other waters of the United States not identified in paragraphs 1-4, which could affect interstate commerce. The landward limit of jurisdiction in tidal waters, in the absence of adjacent woodlands, shall be the high tide line and the landward limit of jurisdiction of all other waters, in the absence of adjacent woodlands, shall be the ordinary high water mark. (EPA)

3.13 Additional Information

FEDERAL AND STATE WETLAND AGENCIES

DEPARTMENT OF ENVIRONMENTAL REGULATION (DER) DISTRICT AND BRANCH OFFICES

Water Management Program Administrators **(WMPA)**
Wetland Resource Managers **(WRM)**
Branch Office Environmental Managers **(EM)**

Northwest District
160 Governmental Center
Pensacola, Florida 32501-5794 SUNCOM 695-8300

Northwest District Branch
340 W. 23rd Street, Suite E
Panama City, Florida 32405 SUNCOM 777-4375

Northwest District Branch
2600 Blair Stone Road
Tallahassee, Florida 32399-2400 SUNCOM 278-3704

Northeast District
7825 Bay Meadows Way
Suite 200 B
Jacksonville, Florida 32256-7577 SUNCOM 880-4340

Central Florida District
3319 Maguire Road, Suite 232
Orlando, Florida 32803-3767 SUNCOM 325-1011

Central Florida District Branch
13 East Melbourne Avenue — SUNCOM350-4800
Melbourne, Florida 32901 — FAX: 407-984-4809

Southwest District
4520 Oak Fair Boulevard
Tampa, Florida 33610-7347 — SUNCOM 552-7612

Southwest Florida District Branch
7451 Golf Course Boulevard
Punta Gorda, Florida 33982-9359 — SUNCOM 721-7636

South Florida District
2269 Bay Street
Fort Myers, Florida 33901-2896 — SUNCOM 748-6975

South Florida District Branch
11400 Overseas Highway
Suites 219-224 — SUNCOM 451-5094
Marathon, Florida 33050

Southeast Florida District
1900 S Congress Avenue, Suite A
West Palm Beach, Florida 33406 — SUNCOM 232-2650

Southeast Florida District Branch
2745 SE Morningside Boulevard
Port St. Lucie, Florida 34952 — SUNCOM 252-5053

DEPARTMENT OF NATURAL RESOURCES

Bureau of Beaches and Shores
Department of Natural Resources
3900 Commonwealth Boulevard
Tallahassee, FL. 32303
904-488-3180

Bureau of State Land Management
Department of Natural Resources
3900 Commonwealth Boulevard
Tallahassee, FL. 32303
904-488-9120

Bureau of Survey and Mapping
Department of Natural Resources
3900 Commonwealth Boulevard
Tallahassee, FL. 32303
904-488-2427

U.S. FISH AND GAME COMMISSION OFFICES

Northwest Region

6938 Highway 2321
Panama City, Florida 32409
904-265-3676

Northeast Region

Route 7 Box 440
Lake City, Florida 32055
904-758-0528

Central Region

1239 S.W. 10th Steet
Ocala, Florida 32674
904-629-8162

South Region

3900 Drain Field Road
Lakeland, Florida 33803
813-644-9269

Everglades Region

511 North Military Trail
West Palm Beach, Florida 33415
407-683-0748

FEDERAL AND STATE WETLAND AGENCIES

GAME AND FRESH WATER FISH COMMISSION

Game and Fresh Water Fish Commission
620 South Meridian Street
Bryant Building
Tallahassee, Florida 32301
904-488-1960
Executive Director, Colonel Bob Brantly

ENVIRONMENTAL PROTECTION AGENCY (EPA)

Environmental Protection Agency
345 Courtland Street, N.E.
Atlanta, Georgia 30309
404-881-4201

WATER MANAGEMENT DISTRICTS

Northwest Florida
Water Management District
Rt. 1, Box 3100
Havana, FL. 32333
904-487-1770

Suwannee River
Water Management District
Rt. 3, Box 64
Live Oak, FL. 32060
904-362-1001

St. Johns River
Water Management District
P.O. Box 1429
Palatka, FL. 32078-1429
904-328-8321

Southwest Florida
Water Management District
2379 Broad St.
Brooksville, FL. 33512-9712
904-796-7211

South Florida
Water Management District
P.O. Box V
West Palm Beach, FL. 33402-9958
305-686-8800

U.S. COAST GUARD PERMITTING OFFICES

South Florida
Commander, Seventh Coast
Guard District
51 S.W. First Avenue
Miami, Florida 33130
305-350-5611

North Florida
Commander, Eighth Coast
Guard District
500 Camp Street
New Orleans, Louisiana 70130
504-589-6298

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CHAPTER 4
SOLID WASTE AND RECYCLING

4.0 Introduction

The term "waste management" is becoming a household word in the construction industry. This is not surprising if one looks closely at exactly what is happening both in and out of the construction industry. With economic and population growth commonplace in American society, industry also grows to meet the needs of the people and, in so doing, creates, along with the people themselves, mountains of waste materials (**Figure 4.1**). It is well known that the need for landfills is growing rapidly and if something is not done soon, there will be serious repercussions in the very near future. There is an obvious moral imperative to curb the wasteful trends of our society. For example, it is predicted that the state of New York's current landfill sites will reach capacity by 1995. If these trends continue, future generations will be living in a world of trash and other discarded materials.

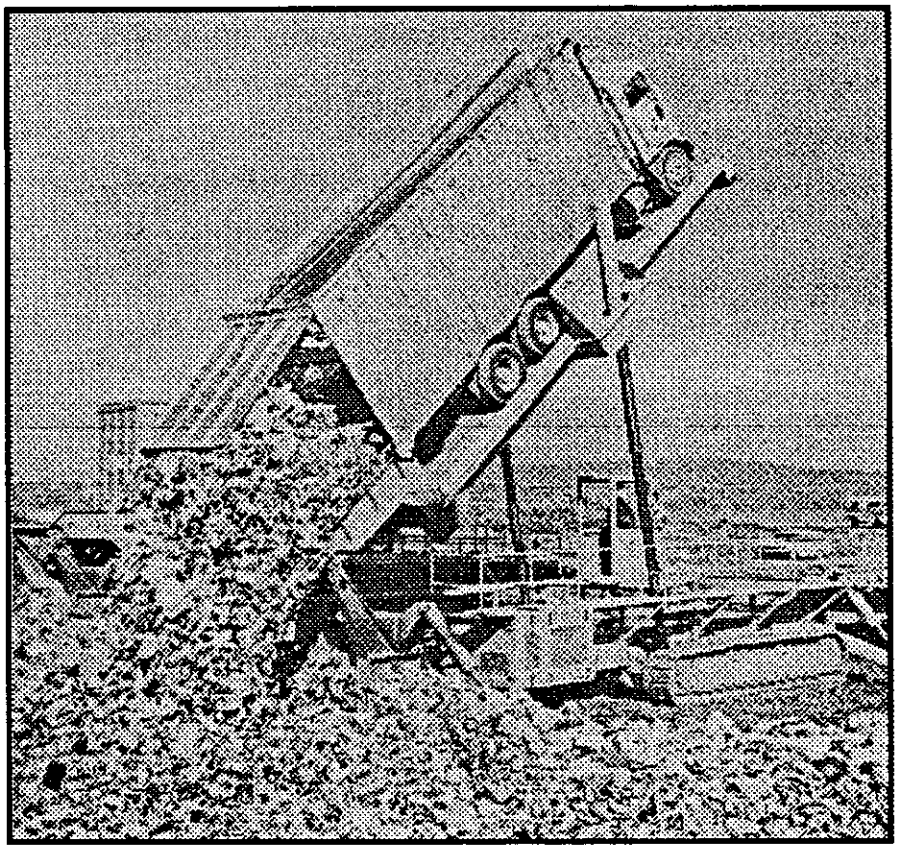

Figure 4.1 The Ever-Increasing Mountain of Solid Waste.

More relevant to today's society are the economic ramifications that waste management pose to the construction contractor. It is becoming more difficult to dispose of **construction and demolition (C&D) waste** due to congressional legislative action, stricter demands by organizations such as the Environmental Protection Agency and the Initiative for Environmental Sensitivity in Construction, and corresponding rises in the cost to dispose of the debris. Contractors are having to haul their debris to distant landfills and pay more to do so. Fortunately there are other alternatives to disposing of C&D waste than just dumping it into a landfill. Some other options are reduction of the waste stream at its source, **resource recovery** through energy generation facilities and recycling. The most viable option is **recycling** because it holds the greatest potential as a long term solution to the problem. Only after all recycling steps have been taken should any debris be disposed of in a landfill.

The emphasis of this chapter will be on the recycling of C&D waste and its various components. The four types of landfills and their role in the construction and demolition waste problem will also be discussed. The laws governing these topics will also be covered.

4.1 Sanitary Landfills

Sanitary landfills exist throughout the world (**Figure 4.2**). Many problems exist with these landfills. First, landfills consume otherwise usable land. Land is expensive and scarce. Second, landfills are too convenient. This may not seem like a problem, but contractors and others are dumping items into landfills that could easily be recycled. Examples of these are aluminum from household trash, and wood studs from demolition of a residence. The benefits from recycling range from saving the environment to saving money.

As presently defined, sanitary landfills are divided into four different classes. The class type is based on the amount and type of waste.

4.1.1 Class I Landfills

Class I landfills receive an average of 20 tons or more of **solid waste** per day. If a scale is not available, a volume of solid waste equal to 50 cubic yards or more after covering will meet the Class I specifications. Requirements for a Class I landfill include the following:

(1) An approved Class I landfill liner

(2) A leachate collection and removal system

(3) Coverage of solid waste at the end of each working day.

4.1.2 Class II Landfills

Class II landfills receive an average of less than 20 tons of solid waste per day. If a scale is not available, a volume of solid waste less than 50 cubic yards after covering will meet the Class II specifications. Requirements for a Class II landfill include the following:

(1) An approved Class II landfill liner

(2) A leachate collection and removal system

(3) Coverage of solid waste at least once every four days.

4.1.3 Class III Landfills

These landfills receive only C&D material and yard trash. If C&D or yard trash is mixed with other types of solid waste, the disposal site shall be classified as a Class I or Class II landfill.

4.1.4 Construction and Demolition (C&D) Debris Landfills

C&D landfills receive only construction and demolition waste. Construction and demolition waste is defined as materials generally considered not to be water soluble and non-hazardous in nature. This includes materials such as steel, glass, brick, concrete, asphalt roofing material, pipe, gypsum wallboard, and lumber. This waste can be created by the construction, demolition, renovation, or maintenance of a structure. These landfills also will take rocks, soils, tree remains, trees, and other vegetative matter which normally results from land clearing or land development. Mixing construction and demolition waste with other types of solid waste will cause it to be classified as something other than construction and demolition waste.

4.2 Recycling of Construction and Demolition Waste

The state of the art in recycling is not widely known by contractors. The following paragraphs reflect a visit to two recycling centers in Jacksonville, Florida. These companies, Krush Krete and Realco Recycling, recycle construction and demolition debris.

Krush Krete is a concrete recycling center and recycles 100% of the C & D waste it receives. Realco Recycling handles the broader spectrum of construction and demolition debris ranging from gypsum to steel. These items are 98% recyclable with the other 2% being sent to a landfill. The Realco Recycling Process is shown in **Figure 4.1**.

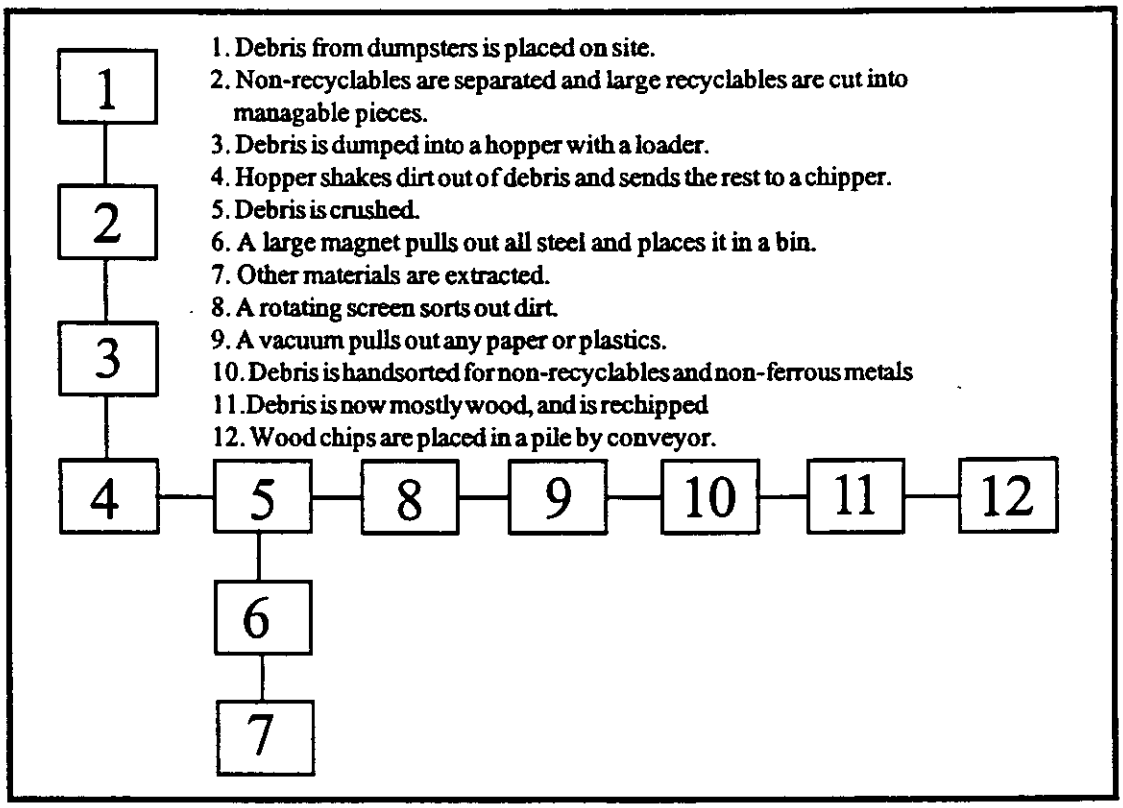

Figure 4.3 The Realco Recycling Process

Of extreme interest to the contractor is the reduced cost of these items on both the dumping side and the purchasing side. To dump concrete at the city landfill costs $15.00/ton. At the concrete recycling center, dumping cost are $5.00/ton for concrete with steel reinforcing, and $2.00/ton for concrete without reinforcing. The cost of dumping debris at the city landfill would be $55.00/ton; at the recycling center this is reduced to $25.00/ton. These lower costs mean big savings for companies that perform demolition work. Contractors dumping debris from new construction can also save money.

The process that the concrete goes through for recycling is relatively simple. The process uses a concrete recycling plant that can be portable or permanent (**Figure 4.4**). Concrete comes to the site in a dumpster and is loaded by a small crane into a hopper, the first part of the concrete crusher. This hopper leads into a primary crusher where the concrete is crushed into sizes that are determined by the crusher. After this first crusher, the concrete is screened to separate fines in a water wash. Next, smaller aggregate such as No. 8 (It should be noted that screens of any size can be placed in the system to achieve the size aggregate needed) are separated and dumped into a pile by conveyer. Succeeding this is another screen which separates aggregate such as No. 57 and dumps it into a pile (**Figure 4.5**). Any concrete left in the cycle after this is run though a secondary crusher and then rescreened.

It should be noted that for concrete pavement, research is being carried out on a new machine that will lift the concrete, crush it, and separate the steel. All this is done in one pass over the pavement. Currently, the researchers envision this one pass machine as a highway reclamation machine. It will be attached to two other segments. The second segment will include crushing, grading, and mixing equipment. In essence, it is a mobile batch plant.

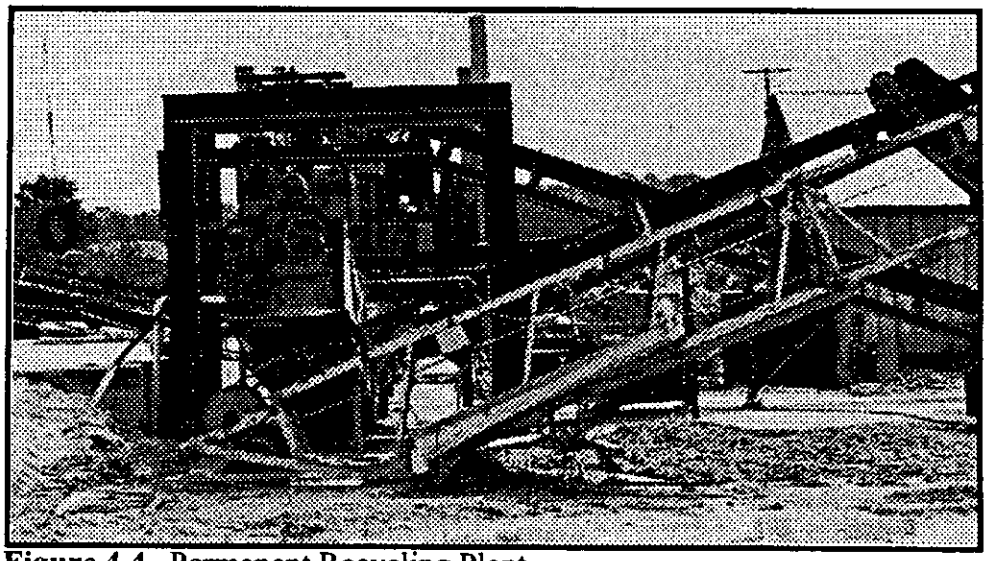

Figure 4.4 Permanent Recycling Plant

The last segment uses existing slipform technology and simply pours the concrete back into place. To summarize, the idea is to take existing damaged highways that need restoration, and replace them by using the old highway as aggregate in a single pass. The potential cost savings for the government have been estimated at $850 million dollars annually if the system is used on a national scale.

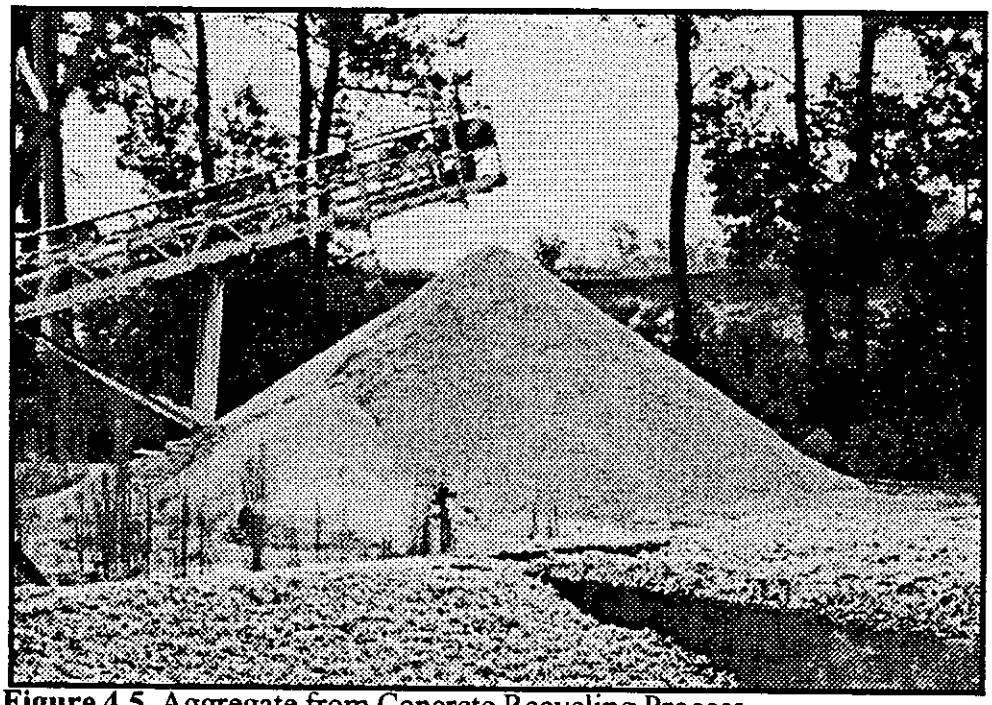

Figure 4.5 Aggregate from Concrete Recycling Process.

4.2.1 Concrete Recycling

There is potential savings for contractors constructing roads, parking lots, or anything that requires paving. Recycled concrete is crushed into usable aggregate products. These can be classified into four main categories.

(a) Crushed demolition debris - mixed crushed concrete and brick that has been screened and sorted to remove excessive contamination.

(b) Clean graded mixed debris - crushed and graded concrete and brick with little or no contamination.

(c) Clean graded brick - crushed and graded brick containing less than 5% brick, concrete or stony material and little or no contaminants.

(d) Clean graded concrete - crushed and graded concrete containing less than 5% brick or stony material and little or no contaminants.

All of these have uses throughout the construction industry but the first category is by far the most prevalent in the United States. Out of these uses four main applications can be called out:

1) General bulk fill
2) Fill in drainage projects
3) Sub-base material in road construction
4) Aggregate for new concrete.

Table 4.1 shows the suitability of the various recycled aggregate types for these uses.

Recycled Aggregate Category	General Bulk Fill	Fill in Drainage Projects	Material for road Construction	New Concrete Manufacture
Crushed Demolition Debris	Suitable	Usually suitable	Not usually suitable	Not suitable
Graded Mixed Debris	Suitable	Usually suitable	Suitable in some cases	Suitable in some cases
Clean Graded Brick	Highly suitable	Suitable	Usually suitable	Suitable in some cases
Clean Graded Concrete	Highly suitable	Highly suitable	Suitable	Usually suitable

Table 4-1. Suitability of Recycled Aggregates

General bulk fill - The noted materials are good for most bulk fill applications. It should be noted, though, that materials with a high timber or sulfate content should not be used in critical applications. These materials are usually used for less demanding applications such as landscaping, levelling, and the construction of acoustic barriers.

Material for road construction - Currently in the United Stated there are no specifications for recycled materials specifically for use in road construction. In the United Kingdom, though, the 'Specification for Highway Works', Department of Transport, calls out crushed concrete as acceptable material for granular fill in applications such as drainage works, earthwork, road base, and road sub base. Although not specifically called out in U.S. Department of Transportation specifications, recycled aggregates do pass many of the requirements and are useful for road construction.

Aggregate for the production of new concrete - To be classified as usable for concrete, aggregate must satisfy many requirements. The first of these is strength. It must be strong enough for the grade of concrete required, and possess good dimensional stability. Second, it cannot react with any of the other products placed in the mix. Finally, the aggregate should have a suitable particle shape and grading to produce a concrete with acceptable workability. Of the recycled aggregates clean brick and concrete aggregates best meet these requirements.

Aggregates for cement bound material - Research has shown that recycled aggregates are effective for cement bound materials and lean concrete applications. Although specifications exist for items such as crushed air blast furnace slag, the community is still waiting for such specifications to cover recycled products.

Here again a savings is seen for the contractor. Virgin materials for these jobs cost $16-$17/ton; but, recycled concrete sells for $10.50/ton. Obviously, all of these can add up to big savings. There are differences between recycled aggregates and natural aggregates though. These differences can be summarized as follows:

(a) Particle shape and surface texture - Recycled aggregates tend to have a particle shape which is more irregular than natural aggregates and also possess a coarser surface.

(b) Density - The density of recycled aggregates is usually lower than that of natural aggregates due to the presence of old mortar, bricks and other low density material. This factor tends to make many recycled products unusable for DOT projects.

(c) Water absorption - The biggest difference between recycled aggregates and natural aggregates is recycled aggregates absorb more water. Recycled aggregates tend to hold 5.3% to 8.3% water while natural aggregates only hold 1.5% to 3.1% water. This is a notable difference, and one that shows recycled aggregates, although useful in many applications, should not be treated as if they were natural aggregates.

(d) Durability - It has been found that in repeated freeze-thaw conditions, recycled aggregates bound in concrete were superior in durability to their natural river gravel counterparts.

Evident as it may be that many uses for recycled aggregates exist, their use is not widespread. This is due to a number of factors.

(a) Lack of incentive - Since no standards exist for the use of recycled aggregates, the incentive to make better quality aggregates for items such as normal or lean concrete mix are not there. The reason is that if no one will buy a product there is no reason to make it.

(b) Cost - The cost of setting up a recycling center is considerable. Until more contractors become interested in concrete recycling, and take their debris to these recycling centers, the availability will be low.

(c) Attitude to recycled products - Many people inaccurately believe that recycled products are inferior. In fact research has shown they are very competitive with natural aggregates in the properties explained earlier. The point to keep in mind is that recycled aggregates are a different product, and can not be used as straight substitutes for natural products. They must receive separate mix designs. The largest problem in this area is that most of the people who see recycled products as inferior are the architects and consultants. For this reason, they will not write in recycled products as substitutes on projects. It appears likely that these attitudes will continue until detailed laboratory evidence and a set a standards can be prepared and presented to such associations as the American Institute of Architects.

4.2.2 Steel Recycling

The reasons why steel should be recycled are obvious. The amount of energy that could be saved in one year by recycling construction and demolition steel would theoretically be enough to light the city of Los Angeles for eight years. In the near future the mines that produce the virgin materials necessary to make the steel products used in construction will no longer be able to do so as our natural resources rapidly become depleted. By recycling construction and demolition steel, we will be taking one more step towards reducing the amount of landfill space needed, preserving the dwindling amount of natural resources remaining, potentially saving the contractor money and helping to better the environment.

Construction and demolition steel can be recycled in a number of different ways:

(1) through a concrete recycling plant

(2) as part of the C&D recycling process

(3) as part of the one pass method.

In each of the above the steel that is gathered is sent to a steel mill where it will be converted to a useful form. The steel can also be collected from the job site directly and be used on another project if found to be adequate or taken directly from the site to the steel mill to be recycled.

The steel reinforcing found in almost all concrete, whether it be in the form of welded wire mesh or rebar, is practically 100% recyclable. There is no reason for any of this steel to find its way to a landfill where it will sit useless for thousands of years, taking up much needed space. When the concrete and steel does make its way to the recycling plant, the steel is separated in the initial stages of the concrete recycling operation. Upon breaking up the concrete, the steel is pulled, either by hand or by machine, and stacked into a separate pile to be sent to the mill. The operation is very simple, cost effective and efficient, and most importantly, environmentally conscious.

As part of the C&D process, the large pieces of steel such as I-beams, flag poles or other such items are pulled before the sorting process begins. All the small steel such as welded wire mesh, rebar or other small items will go through the process described in section 4.2.2 up to the magnet which pulls the pieces out and drops them into a designated dumpster which will be sent to the steel mill for recycling.

As part of the one pass method for concrete roadways, the steel is pulled out after the concrete is cracked and is then sheared into small pieces by a guillotine type blade. Afterwards, the steel is again sent to the mill for refabrication.

Construction and demolition steel can also be reused if it meets the required standards. I-beams, joist, trusses and other items can be reused in order to save the contractor time and money. If the steel is damaged in some way, it can be collected and sent directly to the steel mill for refabrication. The larger pieces should be separated out and returned to the mill, while the rest of the steel and debris should go to the recycling plant, or if there is not one available, then to the C&D landfill.

4.2.3 Asphalt Recycling

In the past, the recycling of asphalt roadways has been cheaper and more efficient than cold milling and replacing roadways with virgin materials. However, there have been problems associated with hot mix recycle trains that heat the road with LP gas burners. The primary problem is that if more than 1 in. of pavement must be penetrated, brown smoke is generated. However, the in-place method produces less smoke than a recycling plant. Other problems with previous in-place methods were the quality of the mixture produced and the limited depth to which the asphalt could be recycled.

New technology has recently produced an in-place hot recycling train that uses a stainless steel preheater and an improved mixer that solves most of the problems of its predecessor, lowers costs and produces good quality. The new train, first tested in the Summer of 1987 in Portland Ore., was a prototype model built for Taisei Rotec Inc. The process went virtually error free and the city of Portland considered the finished product to be of good quality and inexpensive. The estimated cost to cold mill and replace the two mile stretch of roadway was $350,000 and the new train was able to complete the work for about $295,000. Access to

the road was also an important factor in the decision to go with the in situ work. To cold mill and replace the roadway would have meant prolonged and repeated disruption of traffic as well as major public inconvenience. With the new train, only at one time was there a short stretch of road closed and only for a short period of time.

The new train uses radiant heat to melt the existing roadway instead of by convection. In so doing, the problem of smoke is eliminated and the new train can heat up to about 2 in. deep instead of 1 in. using the old train. The only draw back here is that the new train runs slower than the old, about 12 - 13 fpm compared to 20 - 25 fpm. The mix quality of the new train is also better due to an added feature of a mixing box located on the front of the train. The virgin material, held in a front hopper, is mixed with the existing and sent through two augers and into a screed which then lays the material back down onto the roadway.

The simplicity and low cost of the process, as well as the improved environmental conditions makes Taisei Rotec Inc. prototype model the wave of the future in asphalt roadway recycling.

4.2.4 Construction and Demolition Debris Recycling

The process of recycling construction and demolition debris is more involved. Dumpsters full of debris are dumped next to the first part of the recycling system. The first step is to pull out any materials that should not enter the system, such as tires, plastics, and hazardous materials. Also extremely large pieces are separated and chopped into smaller, more manageable pieces. A front end loader then scoops up the debris and dumps it into an initial hopper. The load is shaken and smaller fines are separated to a conveyor. This conveyer dumps its load into a screen that sorts out any larger particles and dumps them back into the primary cycle. The primary load is then sent through a chipper which chops up everything from wood to steel into smaller pieces. This mass of debris is then run under a magnet which separates all the steel and places it in a bin. When full this bin is sold to the steel mill. The debris is then put into a rotating screen which sifts out 3/4" or smaller particles. This pile can be used as cover for something such as a landfill. Next, the debris is placed on a shaking conveyer which first passes under a vacuum. The vacuum sucks any paper or plastic that has gotten into the cycle and places it into a pile. After passing under the vacuum, laborers pull materials such as aluminum, copper, and any paper or plastics that escape the vacuum. The final portion of the line is a secondary chipper which chips the wood and places it into a pile that is commonly sold to paper mills as fuel.

4.3 Regulations Concerning Solid Waste

The following regulations affecting construction contractors are part of the Florida Administrative Code Title 17, which are administered by the Offices of the Florida Department of Environmental Regulation.

* Chapter 17-7 Resource Recovery and Management.
* Chapter 17-701 Solid Waste.
* Chapter 17-730 Hazardous Waste.

4.4 Definitions

Clean Debris - any solid waste that is virtually inert and which is not a pollution threat to ground water or surface waters and is not a fire hazard, and that is likely to retain its physical and chemical structure under expected conditions of disposal or use. The term includes brick, glass, ceramics and uncontaminated concrete including embedded pipe or steel. Mixing of clean debris with other types of solid waste will cause it to be classified as other than clean debris. Clean debris that is disposed of shall be considered construction and demolition debris.

Construction and Demolition Debris - materials generally considered to be not water soluble and non-hazardous in nature, including but not limited to steel, glass, brick, concrete, asphalt roofing material, pipe, gypsum wallboard, and lumber from the construction or destruction of a structure as part of a construction or demolition project or from the renovation or maintenance of a structure. The term includes rocks, soils, trees, and other vegetative matter which normally results from land clearing or land development operations for a construction project. Mixing of construction and demolition debris with other types of solid waste, including material which is not from the actual construction or destruction of a structure, will cause it to be classified as other than construction and demolition debris.

Disposal - the discharge, deposit, injection, dumping, spilling, leaking, or placing of any solid waste or hazardous waste into or upon any land or water so that such solid waste or hazardous waste or any constituent thereof may enter other lands or be emitted into the air or discharged into any waters, including groundwater, or otherwise enter the environment.

Hazardous Waste - a solid waste identified by the Florida Department of Environmental Regulation as a hazardous waste in Florida Administrative Code Chapter 17-730. Refer to Chapter 5 of the Construction and Environment Handbook.

Pollution - the presence in the outdoor atmosphere or waters of the state of any substances, contaminants, noise, or man-induced alteration of the chemical, physical, biological or radiological integrity of air or water in quantities or levels which are or may be potentially harmful or injurious to human health or welfare, animal or plant life, or property, including outdoor recreation.

Resource Recovery - the process by which materials, excluding those under control of the Nuclear Regulatory Commission, that still have useful physical or chemical properties after serving a specific purpose, are reused or recycled for the same or other purpose, including use as an energy source.

Recycling - the reuse of solid waste in manufacturing, agriculture, power generation, or other processes.

Solid Waste - sludge from a waste treatment works, water supply treatment plant, or air pollution control facility or garbage, rubbish, refuse, or other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from domestic, industrial, commercial, mining, agricultural, or governmental operations. Solid waste does not include scrap, or new or used material, separated at the point of generation and held for purposes of recycling.

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Naar, J. (1990). Design for a Liveable Planet. New York: Harper & Row, Publishers.

CHAPTER 5
HAZARDOUS MATERIALS AND COMMUNICATION

5.0 Introduction

Millions of workers are frequently exposed to one or more chemical hazards. Hazardous materials pose a serious problem for workers and their employers. Chemical exposure may cause or contribute to many serious health effects such as kidney and lung damage, cancer, burns and rashes. Some chemicals may also be safety hazards and have the potential to cause fires and explosions or other serious accidents. The Occupational Safety and Health Administration (OSHA) has begun to enforce a regulation called the "Hazard Communication Standard" for two reasons:

(1) employers and employees know little or nothing about hazardous materials,

(2) the dangerous nature of exposure to materials.

This regulation applies to employers in the manufacturing and non-manufacturing sector. The basic goal is to ensure that employers and employees know about chemical hazards and how to protect themselves. This knowledge should help to reduce the illnesses and injuries associated with a chemical source. This chapter will outline the portions of the OSHA Standard and other pertinent regulations which are important for the contractor to understand in order to properly comply with the regulation.

5.1 Basic Definitions

Chemicals which are used in construction can have one of three basic classifications:

- Hazardous
- Non-Hazardous
- Consumer Product

Determining the classification of chemicals on a construction site is accomplished by reading the labels on the chemical containers and the accompanying manufacturer's data sheets.

A **Hazardous Chemical** is any chemical that is classified as hazardous by OSHA or that carries a manufacturer's warning label such as **"Warning, This Product is Hazardous to Your Health."** Additionally a chemical which is listed as hazardous on the product's **Material Safety Data Sheet (MSDS)** is considered to be hazardous by virtue of this listing. The **MSDS** may not accompany the product and it may be necessary for the employer to write away to the manufacturer or other agencies for this information. **MSDS's** for generic chemicals are available from the sources in **Table 5.1**.

AGC Computer MSDS and Chemical Information Database Associated General Contractors of America 1957 E Street N.W. Washington, DC 20006 (202) 393-2040	Material Safety Data Sheets Genium Publishing Corporation 1145 Catalyn Street Schenectady, NY 12303 (518) 377-8854
OHS Occupational Health Services, Inc. 400 Drive Seacaucus, NJ 07094 (201) 865-7500	Chemtox VNR Information Services (VIS) 115 Fifth Avenue New York, NY 10003 (212) 254-3232
IHS Informational Handling Services Inc. 15 Inverness Way East P.O. Box 1154 Englewood, CO 80150 (800) 525-7052	TOXICALERT Hazox P.O. Box 637 Chadds Ford, PA 19317 (215) 388-2030

Table 5.1 Sources of Information on Hazardous Materials

A **Non-Hazardous Chemical** is one that either has no warning language on the label or one that does not meet OSHA's criteria for a hazardous chemical. If the manufacturer does not provide a warning label on the container or a MSDS for the product, the employer can treat it as a non-hazardous chemical which is not subject to OSHA's control requirements.

Consumer Products are materials intended for consumer use and are regulated by the Consumer Product Safety Commission. These materials are not covered by OSHA's control requirements if the product is used for its intended purpose in accordance with the consumer warning labels. However, if the consumer product is used for purposes for which it was not designed, or in a manner not in accordance with the warning labels, the chemicals are then considered to be hazardous.

5.2 Hazardous Chemicals and Their Effects

If handled improperly, hazardous chemicals can cause immediate or future illness, cancer, and death. Although there are numerous well-known hazardous chemicals such as acids, caustic soda, and cyanide, there are many other materials whose hazardous effects are not well known. It is important for the contractor to be aware of which materials on the site are hazardous and the proper means for handling and disposing of them. Hazardous materials will immediately or eventually have adverse effects on

either the workers, or the population in general by means of dispersion by wind, water, or disposal. Even in the absence of a Federal standard, proper use and handling is essential when dealing with hazardous chemicals.

Hazardous materials are substances which can be classified as having one or more of the following characteristics:

- **Ignitable**
- **Corrosive**
- **Reactive**
- **Toxic**

OSHA provides a more detailed description of hazardous materials as chemicals with any of the following properties:

- Listed in the toxic registry of carcinogenic chemicals by the International Agency for Research on Cancer (IARC)
- Listed as a carcinogen or potential carcinogen in the Annual Report on Carcinogens by the National Toxicology Program (NTP)
- Regulated by OSHA as a carcinogen
- Corrosive as defined by the U.S. Department of Transportation in Appendix A 49 CFR Part 143
- Highly toxic (any chemical recognized as poisonous)
- Irritants - A chemical that causes a reversible inflammatory effect on living tissue
- Sensitizer - a chemical that causes a substantial proportion of persons or animals to develop an allergic reaction
- Any by-product that has any effects listed above

"By-products" encountered on construction sites which are considered to have effects which can be classified as **"hazardous"** are the following:

- Wood dust
- Welding fumes
- Grinding dust
- Concrete dust
- Mineral wool fiber dust
- Certain by-products of chemical, mechanical and thermal actions

5.2.1 Hazardous Chemicals in Construction

A list of common chemicals which are encountered on construction sites is shown in Table 5.2 along with their **Chemical Abstract Registry (CAS)** number. The CAS number is useful for obtaining additional information in the form of the MSDS on generic name chemicals.

Descriptions of the more common classes of hazardous chemicals found on construction sites are described in paragraph 5.5.

5.2.2 Contact with Hazardous Chemicals

Chemicals are present in three forms: solid, liquid, and **gas**. They have an effect on human physiology when they enter the body through one of several routes. These routes of entry into the human body are:

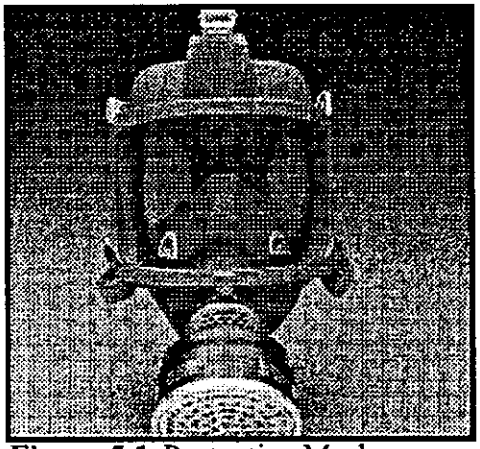

Figure 5.1 Protective Mask

- Breathing (Inhalation)
- Absorption through the skin
- Swallowing
- Injection

Breathing can result in damage to the nose, throat, and lungs by substances such as ammonia. Absorption into the blood stream is a further effect which results in concentration of chemicals in the organs and subsequent damage. Dust from substances such as asbestos and other solid fibers can cause lung damage after prolonged exposure. The use of an **approved respirator** is the primary means of preventing harmful effects from inhaling hazardous chemicals (**Figure 5.1**).

Skin absorption is common for construction workers who have frequent contact with solvents such as gasoline, mineral spirits, toluene, and pesticides. These materials pass easily through the skin and into

TABLE 5.2

List of Standard Chemicals
Common in Construction Operations

Chemical	CAS No.	Chemical	CAS No.	Chemical	CAS No.
Acetic Acid	64-19-7	Cadmium Dust	7440-43-9		
Ethoxyethyl Acetate	111-15-9				
Acetone	67-64-1	Cadmium Fume	7440-43-9	Ethyl Benzene	100-41-4
Acetaldehyde	75-07-0	Cadmium Chloride	10108-64-2	Ethylene Glycol	107-21-1
Acetylene	74-86-2	Cadmium Compounds	7440-43-9	Ethylene Glycol	
Acrylate	*	Cadmium Oxide	1306-19-0		
Monopropyl Ether	111-76-2				
Acrylic Paint	*	Calcium Chloride	10043-52-4	2-Ethoxyethanol	110-80-5
Aliphatic Hydrocarbons	*	Calcium	7440-70-2	Ethyl Methyl Ketone	78-93-3
Aluminum Dust	7429-90-5	Calcium Oxide	1305-78-8	Emery	
112-62-9					
Aluminum Oxide	7429-90-5	Calcium Hydroxide	1305-62-0		
Ethane	74-84-0				
Aluminum Vapor	7429-90-5	Calcium Carbonate	1317-65-3		
Ethanol	64-17-5				
Ammonia	7664-41-7	Calcium Sulfate	10101-41-4	Ethyl Alcohol	64-17-5
Amine Modified Phenol	*	Calcium Silicate	1344-95-2	Ether	*
Arsenic	7440-38-2	Carbon Tetrachloride	56-23-5		
Ethylene	74-85-1				
Aromatic Hydrocarbons	*	Chromic Acid	7738-94-5	Fiberglass	*
Aromatic Isocyanate	*	Chromium Dust	7440-47-3	Freon 20, R20+	75-45-6
Argon	7440-37-1	Chromium Fumes	7440-47-3		
Fluorides	*				
Asbestos	1332-21-4	Chromates	7440-47-3	Fluoride Gas	7782-41-4
Asphalt Dust	8052-42-4	Copper Dust	7440-50-8		
Formaldehyde	50-00-0				
Asphalt Fumes	8052-42-4	Copper Fumes	7440-50-8	Fatty Amido-Amine	*
Asphalt Liquid	8052-42-4	Copper Compounds	7440-50-8	Formic Acid	64-18-2
Benzene	71-43-2	Chlorinated Hydrocarbons	*		
Furfuryl	98-01-1				
Benz (A) Pyrene	96-09-3	Chloroform	67-66-3	Furfuryl Alcohol	98-00-0
Barium Fluoride	7787-32-8	Cobalt	7440-48-4	Fuel Oil 100 6	*
Beryllium Dust	7440-41-7	Cresol	1319-77-3	Graphite Natural	7782-42-5
Beryllium Vapor	7440-41-7	Cellulose	9004-34-6	Graphite Synthetic	*
Beryllium Oxide	1304-56-9	Chlorine	7782-50-5		
Gypsum	10101-4-4				
Brass Dust	*	Chlorinated Biphenyl	1336-38-3	Grain Alcohol	64-17-5
Brass Fumes	*	Coal Tar	8007-45-2		
Glycerine	56-81-5				
Bronze Dust	*	Coal Tarpitch	8007-45-2		
Halothane	151-67-7				
Bronze Fumes	*	Cresyl Glycidyl	54-47-2	Heptane	142-82-5
Bromine Dust	7726-95-6	Cresyl Glycidylether	59-47-2	Hexane (N-)	63834-51-5
Bromine Fumes	7726-95-6	Cyclicamine	8015-55-2		
Hydrochloric Acid	7647-01-0				
Bromine Compounds		Chloride Monomor	*		
Hydrofluoric Acid	7664-39-3				
(Dentaflouride)	7789-30-2	Clay	*	Hydroxyacetic Acid	64-19-7
Butane	106-97-8	Cresylic Acid	1319-77-3		
Hydrogen	1333-74-0				
Butanone (MEK) (2-)	31494-72-6	Cyclohexane	110-82-7	Hydrocarbons	*
Butoxyethanol (2-)	111-76-2	Di-Chloro-Ethyl Ether	111-44-4	Hexone	108-10-1
Butoxyethyl Acetate	105-46-4	Diethyl Ether	60-29-7	Hydrogen Chloride	7647-01-0
Biphenols	92-52-4	Diacetone Alcohol	123-42-2	Hydrogen Fluoride	7664-39-3
Boron Oxide	1303-86-2	Dichlorodifluoromethane	75-43-4	Hydro Fulnone	7664-39-3
Bleach	7681-52-9	Diethylene Glycol	111-46-6		
Helium	7440-59-7				
Butyl Alcohol	71-36-3	Diisobutyl Ketone	108-83-8	Hydraulic Fluid	*
Butyl Cellosolve	111-76-2	Diesel Fuel 1, 2, 4	*	Hydrogen Bromide	10035-10
Carbon Black	1333-86-4	Dust	*	Hydrogen Sulfide	7783-06-4
Carbon Dioxide	124-38-9	Denatured Alcohol	64-63-0	Hydrogen Cyanide	74-90-8
Carbon Monoxide	630-08-0	Epoxy	14016-29-6	Hydrogen Peroxide	7722-84-1

CAS No. = Chemical Abstract Registry Service Number

TABLE 5.2

List of Standard Chemicals
Common in Construction Operations

Chemical	CAS No.	Chemical	CAS No.	Chemical	CAS No.
Iron Dust	*	Methyl Ketones	*	Silica	14808-60-7
Iron Fumes	1309-37-1	Maleic Anhydride	108-31-6	Sodium Bichemate	144-55-8
Iron Oxide	1309-37-1	Methyl Chloroform	71-55-6	Sodium Hydroxide	1310-73-2
Insoluble Saccharine	81-07-2	Methyl Isobutyl Carbinol	108-11-2	Sodium Tetraborate	
Isoamyl Acetate	123-92-2	Marble	1317-65-3		
Pentahydrate	1303-96-4				
Isoamyl Alcohol	123-51-3	Methanol	67-56-1	Stoddard Solvent	8052-41-3
Isobutyl Alcohol	78-83-1	Methyl Alcohol	67-56-1	Sulfuric Acid	7664-93-9
Isophorone	78-59-1	Naptha	8030-30-6		
Silicon	7440-21-3				
Isopropyl Acetate	108-21-4	Nitroglycerin	55-63-0	Sodium Hyprochlorite	
7681-52-9					
Isopropyl Alcohol	67-63-0	Nickel Oxide	1314-06-3		
Styrene	100-42-5				
Isoproponol	75-33-2	Nickel Dust	7440-02-0	Sodium Silicate	16893-85-9
Isobutane	75-28-5	Nickel Fumes	7440-02-0	Sodium Saccharin	128-44-9
Isobutyl Acetate	110-19-0	Nitric Oxide	10102-43-9		
Sulfur	7704-34-9				
Isobutyl Isobutyrate	97-85-8	Nitrogen Dioxide	10102-44-0	Selenium	7782-49-2
Iodine	7553-56-2	Normal Butyl Acetate	123-86-4	Talc	
14807-96-6					
Kerosene	8008-20-6	Oxalic Acid	144-62-7		
Tetrahydrofuran	109-99-9				
Keptone	143-50-0	Ozone	10028-15-6	Tin Dust	7440-31-5
Lead Dust	7439-92-1	Oxygen	7782-44-7	Tin Fumes	7440-31-5
Lead Fumes	7439-92-1	O-Dichlorobenzene	95-50-1	Titanium Dust	7440-32-6
Lead Chromate	7758-97-6	Octane	111-65-9	Titanium Fume	13463-67-7
Lead Silico	10099-76-0	Pentachlorophenol	87-86-5	Toluene	108-88-3
Lime Stone	1317-65-3	Perchlorethylene	527-18-4	Toluene Diisocyanate	584-84-9
Lacquer	*	Petroleum Distillates	*		
Trichloroethane (111)	79-01-6				
LPG	74-98-6	Phosphoric Acid	7664-38-2		
Triethylamine	121-44-8				
Manganese Dust	7439-96-5	Portland Cement	*	TAR	*
Manganese Fumes	7439-96-5	Potassium Hydroxide	1300-58-3	Tungsten Dust	7440-33-7
Methoxy Propanol (2-)	7565-13-1	Propane	74-98-6	Tungsten Fumes	7440-33-7
Methoxy-2-Propanol (1-)	107-98-2	Propanol (2-)	96-23-1	Toluol	108-88-3
Methyl Chloride	74-87-3	Pyrethrum	8003-34-7	Titanium Dioxide	13463-67-7
Methyl Ethyl Ketone	78-93-3	Plaster of Paris	26499-65-0	Triphenyl Phosphate	115-86-6
Methyl Isobutyl Ketone	110-12-3	Phenol	108-95-2		
Transite	*				
Methyl Pentanone (4-)	108-11-2	Polychlorinated Biphenyls	1336-36-3	Turpentine	8006-64-2
Methyl Pyrrolidone (N-)	872-50-4	Poly Amide Resin	63428-83-1	V & P Naptha	8032-32-4
Methybisphenyl Isocyanate	101-68-8	Polystyrene	9003-53-6	Vinyl Chloride	75-01-4
Methytene Chloride	75-09-2	Petroleum Fuels	8006-61-9	Waxes	*
Molybdenum Fumes	7439-98-7	Polyurethane	9009-54-5	Wood Dust	*
Mica	12001-26-2	Poly Sulphide	505-60-2	Xylene	1330-20-7
Mineral Spirits	8030-30-6	Poly-Amines	25038-54-4	Xylol	
1330-20-7					
Morpholine	110-91-81	Poly-Amides	*	Urethane	51-79-6
Methyl Chloride	74-87-3	Phenylallyl	122-39-4	Zinc Dust	1314-13-2
Magnesium Oxide	1309-48-4	Pentane	109-66-0	Zinc Fumes	1314-13-2
Methane	74-82-8	Phosphoric Acid	7664-38-2	Zinc Oxide	1314-13-2
Methacrylic Acid	79-41-4	Propyl Alcohol	71-23-8	Zinc Chloride	7646-87-7
Methanethiol	74-93-1	Rock Dust (Silica S)	*	Zinc Chromate	13530-65-9
Monethyl EtherAcetate	109-86-4	Rosin Core Solder	*		
MethyleneDianiiine	101-77-9	RubberSoivent(NAPTHA)	*		

CAS No. = Chemical Abstract Registry Service Number

the bloodstream. Skin damage due to cuts, scrapes, or dryness are additional factors which will speed the entry of chemicals through the skin. Absorption can be prevented by the use of gloves, appropriate attire **(Figure 5.2)**, and by washing the skin immediately after contact with hazardous chemicals. It stands to reason that the removal of chemicals by washing should not be done with gasoline, paint thinner, or mineral spirits. A product made for this purpose should be used.

Figure 5.2 Full Body Protection

Swallowing of hazardous chemicals is a natural result of failing to properly wash hands after working with chemicals and then consuming food. Smoking and drinking in an area where chemicals are present is another scenario for ingesting hazardous materials.

Injection of chemicals during construction, although not likely, is still a plausible situation due to the presence of compressed air, grease guns, and hydraulic lines. Caution needs to be exercised around pressurized systems and pressure-driven equipment to prevent chemicals from being driven into the body. Workers should be prohibited from cleaning themselves or their clothing with compressed air lines since a possible result is surface chemicals being driven through the skin.

5.3 Employer's Obligations for Compliance

The Federal OSHA Hazard Communication Standard specifically requires employers to:

- Develop a **written hazard communication program** for each work site
- Establish a **method to communicate to other employers** about chemical hazards on site
- Establish a **training program for employees** before they work with hazardous materials and when new hazardous chemicals are introduced into the workplace.

It is important to note that the OSHA regulation on Hazardous Compliance differ from previous OSHA

regulations in that it is "performance-oriented" rather than "compliance-oriented", as is the case with other OSHA regulations. This is a very important distinction. For compliance-oriented standards the employer is required to enforce the law at the job-site. A performance-oriented standard requires compliance but also requires the employer to educate the employees about every aspect of the standard. An OSHA auditor must check not only site operations for compliance, but also the effectiveness of the implementation of the communication standard. Consequently, if the inspector were to question one of the employees about Hazardous Communications and the employee was unaware of the correct answers to the question, this is a citeable situation. The fine could range from $1,000 to $10,000. Presently 50% of OSHA's general inspections are conducted on construction industry job sites.

5.3.1 Written Communication Program

The written communication program serves as the focal point of the employer's compliance with the Hazardous Communications Standard. The written program must include a chemical inventory list which establishes methods for employees to obtain information about chemicals being used on site **(Figure 5.4)**. The program should include information on:

- Chemical inventory on site
- Container labelling
- Material Safety Data Sheets (MSDS)
- Requirements of the Hazardous Communication Standard
- Hazards associated with non-routine tasks
- Other forms of hazard warning

5.3.2 Communication to Other Employers

The employer on a construction site, whether the general contractor, the subcontractor, or the construction manager, must keep other employers on-site informed of the hazardous chemicals which are known to be present. Employers are in turn responsible for informing their employees of the presence and use of hazardous materials by other contractors on the site.

5.3.3 Training Program for Employees

Violations of the Hazard Communication information and training requirements have been on the "Top Ten" list of citations for the past three years:

1990 - 4,924 citations
1989 - 5,997 citations
1988 - 4,979 citations.

Contractors are required to provide their employees periodic training regarding chemicals that are used in the workplace. The training must have the following major elements:

- Provisions of the OSHA Hazards Communication Standard
- How to detect a chemical exposure
- Physical and health hazards of chemicals in use
- Use and availability of Material Safety Data Sheets
- Safe work practices and/or necessary personal protective equipment

The employees must be trained each time they work with a chemical and as new chemicals are introduced to the work place. Records of training must be kept that indicate date, time, place, chemicals covered, name of employee, and name of the instructor. At the present time the regulations do not allow prior training by a previous employer to count as training for the new employer. The training program must be carried out as if the new employee were untrained.

As part of the training program, information containing the requirements of the Hazardous Communication Standard must be posted at each job site.

5.4 Labels and Warnings

Every chemical manufacturer and importer must ensure that all containers of hazardous chemicals shipped are properly labeled. Every user of hazardous chemicals must ensure that each container of hazardous chemicals used is properly labeled. The labels must contain:

- identification of the hazardous chemicals
- appropriate hazard warnings
- names and addresses of the chemical manufacturing or importers, or other responsible party.

All incoming shipments of hazardous chemicals should be inspected for proper labelling. If a container is not labeled, obtain a label or the label information from the manufacturer, importer, or other responsible party and prepare a label using information obtained from these sources. Employers are responsible for ensuring that containers in the work place are labeled, tagged, or marked. Do not remove or deface existing labels on containers unless the container is immediately marked with the required information. Employees should be instructed on the importance of labeling portable containers into which they have poured hazardous substances, for their temporary use.

5.5 Material Safety Data Sheet (MSDS)

The MSDS for a given chemical is a vehicle for the manufacturer to provide the users of the substance with information necessary for proper application. The MSDS also provides information on the steps necessary to protect the user of the product. Although they vary somewhat in format, the basic information provided on the MSDS is the same. This information allows the user to identify, understand, and work safely with the chemical substance. It states what the material looks like, and how it smells and feels. It also tells the user how to safely store the product.

The MSDS contains both the common and chemical names of the substance. It provides the manufacturer's name, address, and a telephone number for obtaining additional information or answering questions about a product.

A section of the MSDS contains an area labelled ''Health Hazards'' which explains the dangerous aspects of the product and the result of overexposure. If exposure limits have been set they will be specified. Information on First Aid procedures is provided for use in emergencies. The use of protective equipment in conjunction with the product will also be described. Any category where no relevant information exists must appropriately noted.

The MSDS sheets must be maintained at the work place and as part of the training program the employees should be educated about these sheets and their location. A sample MSDS is shown in Figure 5.5.

5.6 Common Hazardous Materials Used In Construction

The most common hazardous materials found in construction activities fall into one of the following categories:

- **Solvents**
- **Acids and Bases**
- **Metals**
- **Acetylene and Fuel Gases**
- **Carbon Monoxide**

MATERIAL SAFETY DATA SHEET

Material Safety Data Sheet

May be used to comply with OSHA's Hazard Communication Standard, 29 CFR 1910.1200. Standard must be consulted for specific requirements.

U.S. Department of Labor
Occupational Safety and Health Administration
(Non-Mandatory Form)
Form Approved
OMB No. 1218-0072

IDENTITY *(As Used on Label and List)*	*Note: Blank spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate that.*

Section I

Manufacturer's Name	Emergency Telephone Number
Address *(Number, Street, City, State, and ZIP Code)*	Telephone Number for Information
	Date Prepared
	Signature of Preparer *(optional)*

Section II — Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity; Common Name(s))	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)

Section III — Physical/Chemical Characteristics

Boiling Point		Specific Gravity (H_2O = 1)	
Vapor Pressure (mm Hg.)		Melting Point	
Vapor Density (AIR = 1)		Evaporation Rate (Butyl Acetate = 1)	

Solubility in Water

Appearance and Odor

Section IV — Fire and Explosion Hazard Data

Flash Point (Method Used)	Flammable Limits	LEL	UEL

Extinguishing Media

Special Fire Fighting Procedures

Unusual Fire and Explosion Hazards

Section V — Reactivity Data

Stability	Unstable		Conditions to Avoid
	Stable		

Incompatibility (*Materials to Avoid*)

Hazardous Decomposition or Byproducts

Hazardous Polymerization	May Occur		Conditions to Avoid
	Will Not Occur		

Section VI — Health Hazard Data

Route(s) of Entry: Inhalation? Skin? Ingestion?

Health Hazards (*Acute and Chronic*)

Carcinogenicity: NTP? IARC Monographs? OSHA Regulated?

Signs and Symptoms of Exposure

Medical Conditions Generally Aggravated by Exposure

Emergency and First Aid Procedures

Section VII — Precautions for Safe Handling and Use

Steps to Be Taken in Case Material Is Released or Spilled

Waste Disposal Method

Precautions to Be Taken in Handling and Storing

Other Precautions

Section VIII — Control Measures

Respiratory Protection (*Specify Type*)

Ventilation	Local Exhaust	Special
	Mechanical (*General*)	Other

Protective Gloves	Eye Protection

Other Protective Clothing or Equipment

Work/Hygienic Practices

5.6.1 Solvents

A **solvent** is a material which dissolves other substances. In construction they take the form of **cleaners, degreasers, thinners, fuels,** and **glues.**

Solvents belong to one of three classes depending on their chemical composition:

- Water form (acids, alkalis, detergents)
- Carbon or organic (acetone, toluene, gasoline)
- Chlorine (methylene chloride, trichloroethylene)

Solvents enter the body by either inhalation or skin absorption. Inhaled solvents may cause dizziness and headaches. Further exposure may cause damage to the nose, throat, eyes, lungs, liver, blood, kidneys, and the digestive system.

Solvents which are absorbed into the skin may cause dryness, rashes, and cracking. Further absorption may result in entry into the bloodstream and damage to the central nervous system and organs.

Protection from solvents can be provided with a minimum amount of knowledge. The following is a list of suggestions that should be used when using these materials:

- Provide all employees with a through understanding of the chemicals being handled.
- Use personal protective equipment like gloves, safety glasses, and proper respirators
- Insure the work area is properly ventilated
- Avoid skin contact with solvents
- If skin contact occurs, wash the area with plenty of soap and water
- If solvent contacts the eyes, the area should be flushed with water for 15 minutes and medical aid should be sought.

5.6.2 Acids and Bases

Acids and bases are corrosive and can cause damage to the skin and eyes. The amount of damage done depends on the concentration of the acid or base and the duration of the contact. Acids and bases can be solids (granules or powders), liquids, or gases.

Acids which are commonly used in construction applications include:

- **sulfuric acid**
- **hydrochloric acid**
- **acetic acid**
- **nitric acid**
- **muriatic acid**

Sulfuric acid reacts with water to produce heat and can therefore cause immediate burns. **Hydrochloric acid** can be absorbed into the tissue and though not noticed at first, will result in deep burns. **Acetic** and **nitric** acids do not react with water and, if inhaled in sufficient amounts, will penetrate into the lungs, causing serious damage.

Bases are chemicals which feel slippery or soapy and in concentrated form dissolve tissue easily. Concentrated caustic gases such as ammonia vapors can damage the respiratory system. Cement and mortar are alkali compounds which can cause damage when they react with moisture in the body.

Workers can be protected from the potential damage of acids and bases by:

- Providing all employees with a through understanding of the chemicals being handled
- Using personal protective equipment
- Flushing the area with cool water for at least 15 minutes without rubbing the affected areas, if skin or eye contact occurs
- Adding acid to water to prevent spatter
- Keeping acids and bases apart and immediately cleaning up spills

5.6.3 Metals

Metals can easily be deposited in the lungs and cause damage due to many of the operations which are common in construction:

- welding
- brazing
- polishing
- coating
- finishing
- drilling

The fumes, vapors, and dust which result from these operations are readily inhaled into the body. Some metals like mercury and lead can be absorbed directly through the skin. Some of the common toxic metals which are used in construction are:

- cadmium
- nickel
- lead
- zinc
- copper
- brass
- magnesium

Cadmium and its compounds can be toxic and in large doses, fatal. Welding cadmium coated metals is the most common cause of exposure. Use of an approved respirator can protect the individual against the inhalation of this substance.

Inhalation of **nickel** and its compounds can inflame and irritate the skin and cause nasal sinus conditions and lung cancer. Exposure to the skin can cause an itching rash.

Lead poisoning, caused by soldering pipes, casting lead seals and repairing pipes, can cause eventual damage to the central nervous system, brain, kidneys, and the reproductive system.

Fumes from **zinc**, **copper**, **brass**, and **magnesium** are encountered in welding, brazing, cutting work. Inhalation can cause metal fume fever, a flu-like condition with coughing, shortness of breath, fever, chills, profuse sweating, and chest pains.

5.6.4 Acetylene and Fuel Gases

Acetylene and Fuel Gases are especially dangerous substances used in construction because mishandling them can have catastrophic results. These gases are typically stored in cylinders in liquid form under pressures typically in the range of 250 to 300 psi. Hydrogen, used in special welding applications, may be pressurized in cylinders up to 2000 psi.

Acetylene itself has the widest explosion range of any commonly used gas and is explosive in combinations with air from 2.6 to 80 percent. Hydrogen has similar properties with an explosive range from 4 to 70 percent air. As a rule of thumb, any mixture of these two gases with air is probably explosive.

Acetylene and hydrogen are lighter than air; these gases will accumulate in spaces above the leak. LP gases, on the other hand, are heavier than air and will accumulate on the floor or diffuse through the air.

Acetylene is stored in an acetone base in the cylinders. By itself, however, it is highly explosive if pressurized to 25 psi or higher. Pure acetylene should never be stored at over 15 psi, the highest safe pressure for storage.

Oxygen under pressure is explosive in contact with oil or grease. Therefore handling pressurized oxygen could result in an accident.

Although not a hazardous material by definition, compressed air is dangerous because of the high energy inherent in its pressurized state. Lack of careful attention to its use could result in the cylinder becoming a high velocity projectile or the hoses attached to the cylinder becoming lethal whips.

5.6.5 Carbon Monoxide

Carbon monoxide is a toxic gas produced by generators, trucks, and other combustion sources. It is important that devices which burn fuel for heating or power generation, which would be used in enclosed spaces, be properly exhausted from the space and provided with sufficient ventilation air for combustion.

5.6.6 Asbestos, PCB, and Lead

Asbestos, PCB and Lead are important, current issues regarding hazardous materials. Therefore, they are presented in detail in Appendix 5.1.

5.7 Subject Matter for Employee Training

In order to meet the OSHA Standard the employer must insure that his workers are appropriately trained. The Associated General Contractors have developed a series of short discussion topics which could be used for this purpose. These are entitled Tool Box Safety talks. Among the subject matter which supervisors could use as a basis for training are:

- Welding and Burning Safety
- Acetylene and Fuel Gases
- Trichloroethylene Safety Precautions
- Dermatitis in Handling of Cement Products
- Handling Gasoline
- Carbon Monoxide
- Special Hazards

- Goggles Vs. Eye Injuries
- Scent of Danger
- Safety Shower/Eye Wash
- Guidelines for Chemical Personal Protective Equipment
- Cleaning Drums
- Our Skin Around Us
- Respect Oxyacetylene

5.8 Laws Covering Hazardous Materials

The basic Federal regulation around which hazardous materials usage on the construction site is regulated is: OSHA 1926.59-Hazard Communication.

Transportation of hazardous chemicals is covered by: Hazardous Materials Transportation Act (49 U.S.C. 1801 et seq.).

Consumer products are defined and regulated by: Consumer Product Safety Act (15 U.S.C. 2051 et seq.)

The following regulation defines chemicals as hazardous: Toxic and Hazardous Substances, Subpart Z, OSHA 29 CFR Part 1910.

5.9 Points of Contact for Assistance

- OSHA
- Florida Department of Environmental Regulation (DER)
- Associated General Contractors (AGC)
- National Association of Homebuilders (NAHB)
- Chamber of Commerce
- Center for Construction and Environment, University of Florida

5.10 Definitions

Acids and Bases	Corrosive materials that cause damage to the skin and eyes.
Acetic and Nitric Acid	Chemicals that do not react with water and if inhaled will penetrate into the lungs, causing serious damage.
Approved Respirator	A safety device that prevents harmful effects from inhaling hazardous chemicals that is approved to use for a particular application.
By-Products	A material produced in making something else.

CAS Number	(CAS - Chemical Abstract Registry) Used for obtaining additional information about a generic or non-brand name chemical that is listed on the MSDS sheet.
Carbon Monoxide	A toxic gas produced by generators, trucks and other combustion sources.
Corrosive	Includes materials which can cause damage on contact with skin, eyes, or when inhaled as you breathe.
Consumer Products	Materials intended for consumer use which are regulated by the Consumer Product Safety Commission.
Hazard Comm. Standard	OSHA's regulation to protect employees, employers and the general public against hazardous materials.
Hazardous Chemical	Any chemical which carries a manufacturer's warning label.
Hydrochloric Acid	A chemical that will be absorbed into the tissue and will result in deep burns.
Ignitable	Includes materials that will burn. Usually they are liquids that give off vapors that can ignite, however they can be gases, dusts or solid materials.
MSDS	(Material Safety Data Sheet) A vehicle for a given chemical for the manufacturer to provide the users of the substance with information necessary for proper application and safety information.
Muriatic Acid	A chemical that will react will be absorbed into the tissue and cause deep burns.
Non-Hazardous Chemical	A chemical that either has no warning language on the label or one that does not meet OSHA's criteria for a hazardous chemical.
Reactive	A material which can change violently when combined with certain other materials or conditions.
Solvents	A material which dissolves other substances.
Sulfuric Acid	A chemical that reacts with water to produce heat and therefore causes immediate burns.
Toxic	These are materials that are poisonous, or can cause cancer, or birth defects, or other health problems.

5.11 Works Cited

An excellent reference for contractors who need information on training programs to meet the OSHA Standard's training requirements is:

The Associated General Contractors of America (1989). Hazard Communication Guide for Construction. Washington

The following are references which can be used to obtain more information about the nature of various materials which are considered to be hazardous and their effects:

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The following publications are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. NIOSH is an abbreviation for the National Institute for Occupational Safety and Health.

- **Occupational Health Guidelines**, NIOSH Pub No. 81-123
- **Pocket Guide to Chemical Hazards**, NIOSH Pub No. 85-114
- **Registry of Toxic Effects of Chemical Substances**, NIOSH Pub No. 80-102
- **Chemical Hazard Communication**, OSHA Pub No. 3084

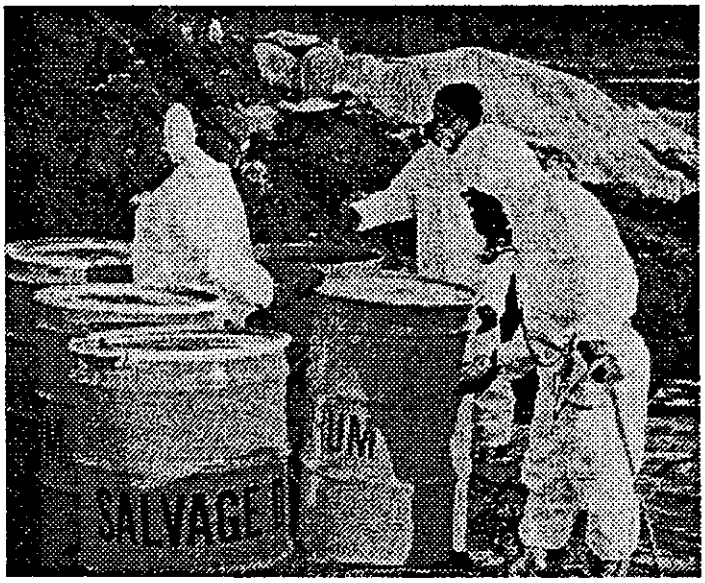
APPENDIX 5.1

CURRENT HAZARDOUS MATERIALS ISSUES: ASBESTOS, PCB AND LEAD

PART A

1. INTRODUCTION TO ASBESTOS

Dealing with asbestos is a particularly hazardous business. The procedures for removing asbestos are cumbersome, time-consuming and expensive. Nevertheless, the risks are too great to "cut corners". People who do not respect the dangers of asbestos die early with painful deaths. Most states and municipalities have enacted laws or issued regulations to control the cleanup of asbestos. Before any cleanup project is attempted, the local Board of Health should be contacted to ensure compliance with local variations on the procedures. Asbestos is usually generated on renovation projects rather than in the course of any new work. Asbestos exists in older buildings in the form of asbestos shingles, pipe insulation, and fireproofing. Asbestos should only be handled by experts. It is important that contractors and their employees know how to deal with asbestos.



2. REMOVING ASBESTOS

Since asbestos is only hazardous when airborne, and since it only becomes airborne from a **friable**, crumbly state, the key to the safe cleanup of asbestos wastes is to keep the material from becoming friable. This can be accomplished either by encapsulating the particles with a cementitious binder, or wetting the product sufficiently to cause the particles to either stick together of become so heavy as to prevent air flotation. Therefore, there is only one sound method to use, that is to wet the asbestos debris, thereby reducing the opportunity for particles to become airborne.

3. ASBESTOS CLEANUP

Before starting the cleanup, evacuate the area of all nonessential personnel. Make sure that the cleanup crew has proper face masks and disposable protective clothing. Clothing should include head covering (over the face masks), coveralls, booties and gloves. The head covering, booties and gloves should be sealed to the coveralls. Only properly trained employees should conduct the cleanup.

Isolate the work area. If a room can be isolated by merely closing doors and windows tightly, do so. Otherwise seal the space with 6-mil plastic sheeting duct-taped to walls, ceilings and floors to completely enclosed the contaminated area (**Figure 5.5**). Place asbestos warning signs on the doors or plastic sheeting. Make sure all vents and ducts are also sealed. Next, gather the tools needed to perform the cleanup. If the debris is dry or damp, but not wet, and small in size it can be vacuumed up with an HEPS

filtered vacuum. A regular vacuum must not be used because the bag will not trap the asbestos fibers, which will be blown around the room, making the problem worse. After the debris is thoroughly wetted, pick up larger pieces and carefully place them into a pre-labeled 6-mil polyethylene bag. Pick up smaller pieces with a shovel, dust pan, or trowel and put them into the same or similar bags. Use an ice scraper, trowel, or dustpan to push material onto the shovel for pickup. Do not use a broom or brush because they are difficult to clean and could cause fiber floatation into the air.

Carefully wash all shovels, trowels, scrapers and other tools that were used to collect asbestos waste. Either hold the items over a plastic bag and gently spray with a sprayer or if the items are not washable, throw them away. Put them in the bag with the debris.

The bags containing debris and tools should be twisted shut and sealed with duct tape. The sealed bags are then placed into a second 6-mil bag and sealed the same way. Then the area should be wet mopped and wiped clean. Respirators and other protective clothing used should be sealed in zip-locked bags and sealed in the same manner.

When the area has been determined to be safe the barriers are carefully removed and sealed in pre-labeled 6-mil polyethylene bags. These bags are then sealed inside a second set of bags. All the bags are then disposed as a manifested waste through a licensed disposal contractor.

4. Federal Involvement in Asbestos

Three federal agencies have played prominent roles in regulating the use and handling of asbestos:

- The Environmental Protection Agency (EPA). The responsibility for observing and complying with EPA regulations falls on the owners of buildings, abatement contractors, companies; including remodeling contractors, who become involved with or disturb asbestos, landfill operators, and to some extent, transporters of asbestos waste.
- The Occupational Safety and Health Administration (OSHA), U.S. Department of Labor. OSHA's regulations protect the safety and health of workers involved with asbestos. Responsibility for complying with OSHA requirements falls on all employers, including remodeling contractors.

The Consumer Product Safety Commission (CPSC). CPSC bans hazardous consumer products from the marketplace and issues educational materials to inform the public about hazardous products. The Commission has banned several asbestos-containing consumer products and has issued information to consumers regarding the dangers.

PART B

1. Polychlorinated Biphenyl (PCB)

All spills of Polychlorinated Biphenyl (PCB's) are best left to experts. The PCB cleanup process outlined in this section is cumbersome. People will be tempted to skip the dust mask and protective clothing and protective clothing to cut corners. However, the risks are tremendous and the time saving shortcuts are not worth the costs. Those who attempt to do so, will lose. PCB wastes are almost always associated with the disposal of old electrical system components, particularly transformers. The PCB's were used as admixtures to lubricating oils due to the various insulating properties that they impart to the oils. Those oils are usually removed with the electrical equipment. They must remain inside until the equipment is opened at a licensed disposal facility and the oil is properly removed. That is clearly the best method of handling PCB wastes.

2. PCB SPILLS

Occasionally an electrical component will break or spill the lubricating fluids, and wastes containing PCB's will contaminate an area. In such cases health risks are associated with ingestion, rather than inhalation. That means that a soil contaminated with PCB waste is not inherently dangerous, as it exists on the floor or the ground.

Cleanup activities are designed to minimize the spread of the material to avoid direct skin contact by people and to dispose of the wastes in a safe manner.

In the event of a spill, one should stop the flow by using a dry absorbent or sand to soak up the oil. An outdoor spill should be quickly stabilized with absorbent and covered with 6-mil polyethylene sheeting to prevent contamination of groundwater. Indoor spills should be kept away from floor drains, sinks and sumps. Sink disposal is NOT an appropriate disposal technique for PCB's.

3. PCB CLEANUP

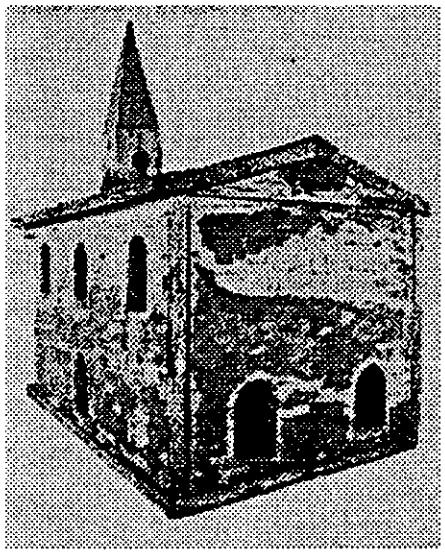
Large spills, whether indoors or out, should be cleaned up only by trained contractors. First, gather the required tools and equipment. Then isolate the area with signs and barriers and ensure that cleanup personnel are wearing proper protective equipment. Next carefully shovel the absorbent material on

contaminated soil into 3-mil plastic bags. Twenty-five to thirty pounds is enough for any one bag. Seal each bag by twisting the top closed and sealing it with duct tape. Seal those bags inside a second set of bags in the same manner. Use an ice scraper, piece of wood, or other disposable object to push the material onto the shovel. Dispose of the shovel in the bag with the contaminated wastes. If workers come in direct contact with PCB waste, the affected skin areas should be thoroughly washed with a mile solvent (such as alcohol or grease cutting hand cleaners), then washed with soap and water to remove the solvent. Contaminated clothing should be immediately removed and disposed of in a 6-mil polyethylene bag, appropriately labeled. Cleanup crews should wear protective booties, and gloves, taped to the coveralls. They should also wear dust masks and goggles before attempting any cleanup activities. All bags must be disposed of through a licensed hazardous waste disposal contractor.

PART C

1. LEAD

Lead is a toxic metal. A lead compound was once the most common pigment in house paint, and some small children suffered brain damage from repeatedly eating paint chips containing lead. Since 1940, nontoxic pigments have replaced lead in paints made for home interiors. A lead compound has also been added to gasoline to improve its octane rating, however this use is also being phased out. Most children who develop damaging lead levels do so through normal, everyday behavior. Studies by Xavier University of Louisiana suggest that the primary source for most urban children is exposure to soil and dust contaminated by the legacy of leaded gasoline. Humans are most vulnerable to the effects of lead during their first six years, when the brain is undergoing its greatest development and body weights are lowest. Lead attacks the nervous system.



The Department of Housing and Urban Development is responsible for administering lead paint abatement programs in public housing. The Environmental Protection Agency sets standards for lead exposure in water supplies, plumbing and air; and the Department of Health and Human Services has overseen a major report on lead poisoning as well as efforts to research toxicity and develop public health programs. Still, most of the responsibility falls on state and local agencies, and ultimately on individuals and community groups.

2. Lead Liability

The concern of the housing industry, and remodelers is that any legislation could require abatement before remodeling would be allowed, which would make remodeling and renovation costs prohibitive for many homeowners. In addition, in order to protect themselves from liability, lenders could require inspections of privately owned for sale homes for lead based paint and when it is found, require that the paint be removed prior to closing. Such abatement expenses would reduce owner's equity and decrease units' values and could result in abandoned properties.

3. Preventing Lead Poisoning

Lead poisoning is preventable, but more action is needed at every level of society. Lead paint can be removed or managed so as to reduce children's exposure. Improper removals, however, can increase risk by freeing lead dust into the air. Lead paint in good condition may be better left alone, or covered with new paint.

Contaminated dirt can be planted with grass or other vegetation, or at least wetted to reduce dust. The top three inches of soil can be removed and replaced with six inches of clean fill.

Nonetheless, the general public must begin to take greater action to prevent further pollution while we still have most of our health. Most importantly the primary victims are the small children of the world; they just can not say "no" to lead.

PART D

1. Definitions

Friable Products that when dry, can be crumbled, pulverized, or reduced to powder by hand pressure causing them to emit fibers into the atmosphere with relative ease.

PART E

1. Work Cited

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National Association of Home Builders (1989). AsbestosHandbook for Remodeling (Washington, DC) National Association of Home Builders.

CHAPTER 6
WATER QUALITY

6.0 Introduction

Water is a critical issue in Florida. It will have a great impact on development and construction activities for the foreseeable future. Recent years of drought throughout Florida have lowered water table levels to record lows. Saltwater intrusion into wells has become a severe, even crisis level problem in many coastal areas. Various local jurisdictions are purchasing land in nearby counties to assure themselves a continued supply of potable water. The ever increasing pressure on the state's water supply will probably not abate, especially in light of population growth projections for the state. It is imperative, therefore, that the construction industry, as well as manufacturing, agriculture, and homeowners, take all possible measures to conserve and protect this valuable resource in their operations.

6.1 Florida's Water System

Florida has about 7,800 lakes and more than 1,700 streams and rivers ranging in length from less than half a mile to about 500 miles long. Furthermore, Florida has more than 4,000 square miles of estuaries, harbor, and bays **(Table 6.1)**.

Major Rivers of Florida

River	Region	Length (mi)	Basin Area (mi²)	Discharges To
Coastal				
Apalachicola[1]	Northwest	524	19,600	Apalachicola Bay
Suwannee[1]	Suwannee	280	9,950	Gulf of Mexico
St. Johns[2]	St. Johns	273	9,168	Atlantic Ocean
Choctawhatchee[3]	Northwest	230	4,646	Choctawhatchee Bay
Escambia[3]	Northwest	240	4,233	Escambia Bay
Peace[2]	Southwest	133	2,403	Charlotte Harbor
Ochlockonee[1]	Northwest	206	2,250	Ochlockonee Bay
Withlacoochee[2]	Southwest	138	2,035	Withlacoochee Bay
St. Marys[1]	Suwannee	127	1,480	Cumberland Sound
Yellow[3]	Northwest	110	1,365	Blackwater Bay
Perdido[3]	Northwest	68	925	Perdido Bay
St. Marks[2]	Northwest	37	871	Apalachee Bay
Blackwater[3]	Northwest	62	860	Blackwater Bay
Tributary				
Oklawaha[2]	St. Johns	148	2,718	St. Johns River
Kissimmee[2]	Kissimmee-Everglades	170	2,300	Lake Okeechobee
Withlacoochee[1]	Suwannee	120	2,290	Suwannee River
Alapaha[1]	Suwannee	130	1,840	Suwannee River
Santa Fe[2]	Suwannee	87	1,384	Suwannee River
Chipola[3]	Northwest	115	1,237	Apalachicola River
Shoal[2]	Northwest	50	499	Yellow River

[1] Most distant source in Georgia
[2] Most distant source in Florida
[3] Most distant source in Alabama

TABLE 6.1 Major Rivers of Florida

Florida's water quality is still quite good in spite of the population pressures that are at the source of most water quality problems. The following is a brief description of the water quality in specific areas of the state.

(1) Northern Florida

(a) The Perdido River and Bay have good water quality except for Elevenmile Creek which receives effluent from a paper mill and Bayou Marcus Creek which receives urban stormwater.

(b) The Escambia, Blackwater, and Yellow rivers have very good water quality.

(c) The Chocawhatchee River water quality is good although several tributaries have low biological density, low dissolved oxygen and bacterial problems from sewage and poultry processing discharges.

(d) A tributary to the Chipola River receives discharges from a Superfund site known as Sapp Battery. The river's water quality is generally good.

(e) The Apalachicola River water quality is very good with a few tributaries receiving sewage and fishing wastes.

(f) The Ochlockonee River water quality is only fair above Lake Talquin because of sewage and Fuller's earth mining discharges. Below the dam water, quality is good.

(g) St. Marks, Wakulla, and Aucilla River water quality is good with only local problems. Discharges from a paper mill cause poor water quality in the Steinhatchee River basin and the Fenholloway River.

(h) The Suwannee River and its tributaries have very good water quality except near discharges from phosphate mines.

(2) Northeast Florida

This part of the state has more areas of poor water quality than any other part of the state due to population pressures.

(a) St. Mary's River water quality is good except at its mouth where there are paper mill effluents.

(b) The St. John's River has water quality problems along its entire length due to discharges from Orlando area communities and rural areas.

(c) The major tributary to the St. John's, the Oklawaha River, has poor water quality in its upper reaches particularly in Lake Apopka. In its lower reaches the water quality is good.

(d) The Kissimmee River is part of the Kissimmee-Okeechobee-Everglades hydrologic system which is the foundation of South Florida's water supply. The Kissimmee contributes 20 percent of the phosphorus entering Lake Okeechobee, a factor which is tending to kill the lake. The Kissimmee once meandered 98 miles between Lake Kissimmee and Lake Okeechobee but was straightened out and channelized into a 48 mile long canal which has caused enormous environmental damage.

(e) Estuarine waters along the east coast have water quality problems from sewage, urban stormwater and dredging and filling.

(3) Southwest Florida

Water quality varies and in populated areas the water quality is only fair.

(a) Springs feed the Crystal River and Anclote River areas and consequently the water quality is excellent.

(b) Due to urban discharges the water quality in Boca Ciega Bay is only fair.

(c) The Hillsborough River receives discharges from citrus processing, sewage and phosphate mining and the water quality is not good.

(d) The Alfia River water quality is poor in the North Prong due to phosphate mining, sewage, and range land stormwater.

(e) Both the Manatee and Little Manatee River have generally good water quality.

(f) Hillsborough Bay which receives nutrients from the Hillsborough and Alfia Rivers has poor water quality.

(g) Old Tampa Bay has fair water quality; it receives effluents in the form of storm water discharges and treated sewage.

(h) Tampa Bay water quality is good to fair, it receives storm water and sewage discharges from the communities on its rim.

(i) The Myakka River has good water quality as does the Caloosahatchee River except near Ft. Myers.

(j) Charlotte Harbor has generally good water quality but is high in nutrients from the Myakka and Peace River.

(k) The Peace River's problems are caused by mining, agricultural, and municipal wastes. Nutrients are high and the water quality is fair.

(4) South Florida

The major water quality problems in this area revolve around the Kissimmee River-Okeechobee-Everglades basin. Significant amounts of phosphorous originate from dairy farms, beef pasture, sugar cane, vegetable farms, and pastures in the Everglades Agricultural Area.

(a) Biscayne Bay is affected by toxic discharges from the Miami River and by urban runoff.
(b) Water quality in the coastal areas and the Florida Keys is generally good with localized problems near sewage outfalls, canals, and marinas. Water quality is fair to poor in the canals.

6.2 Classification of Streams

Surface and ground waters within Florida are classified by use and each classification is protected by a set of stringent water quality standards. The standards detail the limits for various pollutants which might be found in Florida's waters as the result of industrial, commercial, agricultural, or domestic activities. **Table 6.2** defines the five classes of streams. Most Florida surface waters are Class III, suitable for propagation and management of fish and wildlife and for recreation.

Stream Classification	
Class I	Potable water supplies
Class II	Shellfish, propagation, or harvesting
Class III	Recreation, propagation and maintenance of a healthy, well-balanced population of fish and wildlife.
Class IV	Agricultural water supplies
Class V	Navigation, utility, and industrial use

Table 6.2 Stream Classifications in the State of Florida

6.3 Ground Water

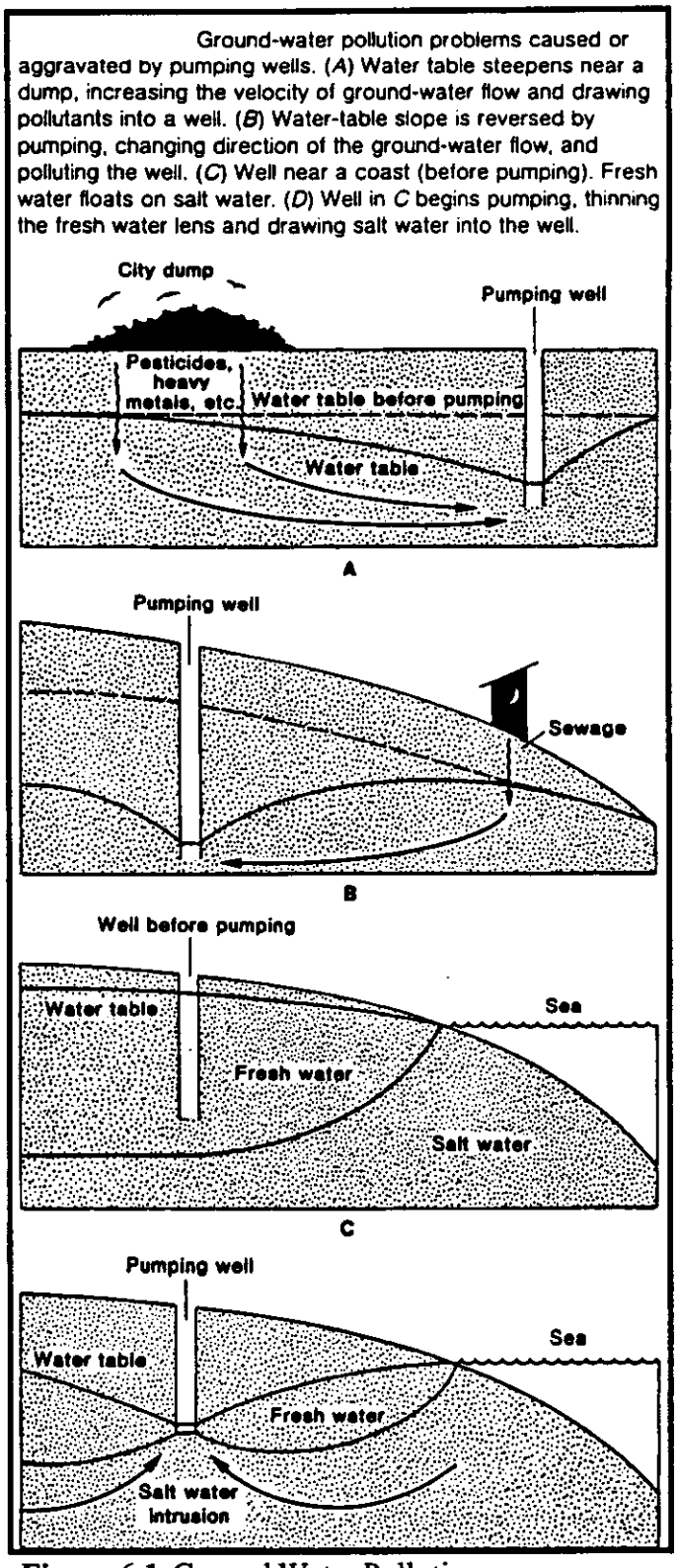
Florida is unusually dependent upon its ground water because it is not only a source of drinking water but is closely linked to Florida's natural systems of lakes, streams, rivers, swamps, marshes and even its dry uplands. Some statistics bear out the importance of ground water:

(1) 92 percent of Florida's population drinks ground water

(2) 20 percent drinks ground water directly from the ground without treatment

(3) More than 7.5 billion gallons are pumped from Florida's **aquifers** each day

Ground water supports the water levels of lakes and the base flow of streams. It keeps the wetlands alive during dry spells. The dry sandy uplands are the regions where rain water is able to easily percolate to the aquifers below. Yet the uplands are under risk because of the pressures on their development.



Ground-water pollution problems caused or aggravated by pumping wells. (*A*) Water table steepens near a dump, increasing the velocity of ground-water flow and drawing pollutants into a well. (*B*) Water-table slope is reversed by pumping, changing direction of the ground-water flow, and polluting the well. (*C*) Well near a coast (before pumping). Fresh water floats on salt water. (*D*) Well in *C* begins pumping, thinning the fresh water lens and drawing salt water into the well.

Figure 6.1 Ground Water Pollution

Ground water is easily polluted by chemical spills, pesticides applied to crops or fields, discharges from sewage plants, or leaks from underground storage tanks **(Figure 6.1)**. One gallon of gasoline, for example, spilled into an aquifer can make one million gallons of water undrinkable. A pint of oil can produce a one acre oil slick. As an aside, approximately 15 million gallons of motor oil are thrown away in Florida each year. This oil could be reclaimed to save 56,000 barrels of oil each day

since it takes 42 gallons of crude oil to make two and a half quarts of lubricating oil. This same amount of new lubricant could be made by re-refining one gallon of reclaimed oil.

There are about 6,000 surface impoundments including stormwater and sewage retention ponds, abandoned mines and **sinkholes**, and up to 9,600 drainage wells which act as conduits by directing stormwater into the aquifer; therefore, they are major potential sources of groundwater contamination. In addition, there are 9,800 underground **injection wells** in Florida ranging from small drainage wells to large diameter wells used for the disposal of sewage and industrial waste. An improperly constructed or operated injection well can contaminate underground drinking water; as a result, Chapter 17-28 of the Florida Administrative Code was adopted in 1982. This rule categorizes injection wells into five classes **(Table 6.3)** based on the quality of the injected fluid, the use of the well, and the depth of the injection zone with respect to drinking water aquifers (Fernald & Patton, 1985).

Injection Well Classification	
Class I	Inject industrial wastes, treated sewage effluent, or reverse osmosis reject waters below drinking water aquifer
Class II	Inject fluids from the production of oil and gas
Class III	Extraction of minerals
Class IV	Inject hazardous wastes into or above drinking water aquifers. This class is banned in Florida.
Class V	Inject fluids by gravity flow into drinking water aquifers.

Table 6.3 Classifications of Injection Wells

The Department of Environmental Resources (DER) has adopted rules that limit the kinds of waste that can be pumped into the ground through injection wells. In addition, the rules insure that injection wells are properly built so wastes cannot escape into the aquifer. DER administers the federal program for injection wells under the Federal Safe Drinking Water Act.

Pesticides are major polluters of ground water. There are now 12,000 pesticides registered in Florida. One pesticide, ethylene dibromide, has been found in about 1,300 of 11,000 wells tested since 1983. Twenty-two of the 67 counties are affected. About 50 other wells have shown various types of

contamination such as gasoline, wood preservatives, and pesticides. Miami, Belleview, and Pensacola have all lost wells due to contamination by petroleum products and solvents.

The relation between fresh water and salty water in an aquifer is delicate and readily upset by human developments. Any development that lowers the freshwater level in an aquifer will result in some movement of saltwater. **Saltwater intrusion (Figure 6.1)** is the result of one or more of the following practices: pumping of wells near the coast, pumping from overly deep wells, poor well construction, uncontrolled flowing wells, wells with corroded well casings, or large-scale drainage from uncontrolled drainage canals at the coasts (Fernald & Patton, 1985).

6.4 Ground Water Standards

Florida's ground water rules are perhaps the most stringent in the nation. All new developments and industries must adhere to standards that prohibit the discharge of any toxic or carcinogenic materials into the groundwater. Discharges must be to drinking water standards at the edge of a small "zone of discharge."

DER is now considering amending the rules to provide more protection to public drinking water and wellfields. The so-called G-1 rule will provide safeguards in "zones of protection" around public drinking water wells as well as the wellfields to keep pollutants from drinking water supplies.

Two protective rings, "the zones of protection," will be set around wells or wellfields which qualify for the G-1 rule. No new discharges are allowed inside a 200 ft. zone of exclusion. A larger zone, based on the travel time it takes the material to move through the aquifer in five years, is also included. In the five-year zone of protection:

(1) All new discharges that contain any of a number of hazardous substances are excluded.

(2) New sanitary landfills are excluded.

(3) All new agricultural stormwater facilities which contain hazardous constituents such as pesticides are prohibited but normal farming activities are allowed.

(4) New industrial stormwater discharges are prohibited if the discharge contains hazardous substance unless the discharge is totally contained.

(5) Direct discharge of wastes into sinkholes is prohibited.

(6) A discharge from a sewage treatment plant will be allowed if it meets extremely stringent ground water standards at the point of discharge, if all industrial discharges into the plant are treated beforehand to remove all hazardous constituents, if a highly trained, full-time operator is on duty, and if stringent rate-of-discharge restrictions are followed.

(7) For wetlands discharges all G-1 rule requirements must be met.

The 1983 Water Quality Assurance Act directed DER to establish a ground water monitoring network. The purpose of the Act was to increase the role of local governments and agencies in the identification of hazardous waste generators and sitting of disposal facilities. Each county must identify all hazardous waste generators within the county, the types and quantities of wastes generated, current management practices, abandoned dump sites, and operating procedures at sanitary landfills. Furthermore, each county must designate areas within the county where hazardous waste storage facilities may be located (Fernald & Patton, 1985). This Act helps to establish the relationships between land use and ground water quality and to predict water quality trends.

6.5 Stormwater Management

Stormwater causes more than half the water pollution in Florida and in some watersheds it may be the entire load. Like other sources of pollution there is often a correlation between stormwater and population. However, storm runoff is also a problem in rural settings as well. Rural sources can contribute large quantities of water pollutants. Agricultural pollutants come from sediments, fertilizers, pesticides, animal wastes, and nutrients. In the cities, runoff from paved areas such as streets and parking lots adds oils, greases, and **heavy metals** to Florida's surface and ground waters.

Stormwater is responsible for 80-95 percent of all the heavy metals that enter Florida's waters, almost all the sediments, large nutrient loads, and nine times more **Biochemical oxygen demand (BOD)** than secondarily treated sewage. It is a major contributor to the overenrichment (**eutrophication**) of Florida's freshwaters, particularly its lakes, by the nutrients nitrogen and phosphorous. The northern portion of Lake Okeechobee is an example of the effects of uncontrolled stormwater discharges where agricultural runoff from north of the lake adds major amounts of phosphorous.

Stormwater also contributes to the loss of seagrasses in Florida's coastal waters because of **turbidity** from sediments and other suspended solids. Stormwater has often caused productive oyster harvesting to close due to bacterial contamination.

Florida's stormwater program is administered jointly by DER and the water management districts. Most new developments, except for single family housing, must obtain stormwater permits. Depending on the size of the project, the permits require that runoff from the first inch of rainfall or first half-inch of runoff be treated. The goal is to remove 80 percent of the pollution. Discharges to Outstanding Florida Waters (see section 6.7) require more treatment. Most developments today are built with stormwater systems which are designed to reduce pollution into the local waterways.

6.6 Dredging and Filling - Wetlands

Dredging and filling causes water quality problems as well as destroying fish and wildlife habitat. Suspended sediments and resuspension of heavy metals are among the problems caused by dredging and filling. The Clean Water Act, the Rivers and Harbors Act of 1899, and the Wetlands Protection Act of 1984 regulate dredge and fill activities. Dredging and filling usually require both federal and state permits (Fernald & Patton, 1985).

Destruction and alteration of habitat are perhaps the most serious problems associated with dredging and filling. Since 1850 Florida has lost 12 million acres of wetlands or 40 to 60 percent of Florida's original wetlands acreage. South Florida may have lost 40 percent of its wetlands between 1900 and 1973 alone, and a million and a half acres since 1952.

Wetlands are important because they ameliorate flooding and act as barriers against storm water tides and storm surges along the coast. They play a role in ground water recharge, they store surface waters, and they filter pollutants that would otherwise reach Florida's waterways. Wetlands are also important habitats for fish and wildlife. The subject of wetlands is covered in greater detail in Chapter 3 of this Handbook.

6.7 Outstanding Florida Waters

Outstanding Florida Waters (**see Appendix 6.1 for complete listing of Outstanding Florida Waters**) is a designation given to water bodies in Florida which deserve an added degree of protection against water pollution. DER is not allowed to issue permits for direct or indirect discharges into these water bodies if it would result in a degradation of the water quality. Permits for dredge and fill may only be issued if the department determines that it is in the public interest.

Waters currently designated are those in National Parks, refuges, seashores, preserves, marine and estuarine sanctuaries, state parks and recreation areas, scenic or wild rivers, lands purchased under the Conservation and Recreation Lands program, Aquatic Preserves, and "special waters".

Special waters include most of Florida's important water bodies, including the Apalachicola River and Bay, the Suwannee River, and the waters around Florida's Keys. The Environmental Regulation Commission designates special waters after extensive review and public workshops in the affected areas.

6.8 Water Pollution Sources

The basic concern in protecting the water supply is centered about two general categories of pollutants: biological and chemical. Since biological sources of pollution are unlikely in construction, the subject of potential industrial sources of chemical pollution are covered here.

Common Pollutants

Category	Examples	Possible Health and Environmental Effects	Affected Water Uses	Principal Sources
Oxygen Demanding Materials	Sewage, paper manufacturing wastes	Deficiencies in oxygen levels which can stunt growth and reproduction of aquatic species. Can also cause fish mortality.	Water supply, recreation, fishing and fish propagation	Domestic waste, industrial waste, urban and agricultural runoff
Infectious Agents (Bacteria and Viruses)	*E. Coli* (indicator species), *Salmonella typhosa*	Diseases in humans and animals. Can cause fish mortality.	Water supply, recreation	Domestic waste, agricultural runoff
Nutrients	Nitrogen, phosphorus	High levels can cause excessive aquatic plant and algae growth and can contribute to fish mortality.	Water supply, recreation, fishing and fish propagation, boating	Domestic and industrial waste Many land use activities
Toxic Substances	Ammonia, mercury, lead	Cancer, injury, or death in living organisms, including humans and all aquatic species.	Water supply, recreation, fisheries, agriculture	Industrial waste, agricultural runoff (pesticides, herbicides)
Thermal Pollutants	Power plant discharges	Fish and manatee mortality. Shifts in structure of biological community.	Fisheries	Power plants, industrial processing
Sediments and Minerals	Sand, silt, clay	Cover substrate and increased aquatic species mortality.	Water supply, recreation, fisheries, navigation	Many land use activities
Oil and Hazardous Substances	Oil, gasoline, PCBs	Fish, bird, and other animal mortality.	All uses	Industrial waste, urban stormwater, highway runoff

Table 6.4 Common Pollutants

Industrial wastes in this sense are a variety of toxic inorganic, metallic, and organic compounds: arsenic, mercury, chromium, zinc, cyanide, chloroforms, and pesticides as identified in the Clean Water Act of 1977.

Metallic mercury and metallic salts of mercury, as an example, are converted into an organic form called methyl mercury which can be then concentrated in the food chain. The result for humans at the end of the food chain is the likelihood of central nervous system disorders.

Table 6.5 is a listing of the maximum contaminant levels for inorganic chemicals in drinking water supplies as directed by Section 1412 of the Public Health Service Act. In addition for water to be acceptable for domestic use, it must have less than the specified amount of inorganic contaminants, must be clear (free from turbidity and color) and must have a pleasant taste.

Contaminant	Level (milligrams per liter)
Arsenic	0.05
Barium	1.0
Cadmium	0.10
Chromium	0.05
Lead	0.05
Mercury	0.002
Nitrate	10.0
Selenium	0.01
Silver	0.05

Table 6.5 Maximum Contaminant Levels

Also, the Public Health Law sets maximum levels for organic chemicals as indicated in **Table 6.6.** In addition to the Federal Standards dictated by the Clean Water Act and the Public Health Service, the State of Florida also maintains water quality standards which are among the most stringent in the nation. These drinking water standards were adopted in 1984 and establish maximum contaminant levels for eight volatile organic chemicals in community drinking water systems **(Table 6.7).**

Contaminant	Level (milligrams per liter)
HYDROCARBONS	
Endrin	0.0002
Lindane	0.004
Methyoxylchlorethane	0.1
Toxaphene	0.005
CHLORPHENOXYS	
2,4-Dichlorophenoxyacetic Acid	0.1
2,4,5-Trichlorophenoxypropionic Acid	0.01

Table 6.6 Maximum Contaminant Levels for Organic Chemicals in Drinking Water

Community water systems in Florida must be tested every three years for 118 synthetic chemicals as well as the eight volatile chemicals in **Table 6.7**. The list of contaminants includes most of the EPA's "priority pollutants" as well as several pesticides such as EDB and aldicarb which are used in Florida and are suspected of contaminating ground water.

Contaminant	Max Allowable Level
Trichloroethylene	3 parts per billion
Carbon Tetrachloride	3 parts per billion
Vinyl Chloride	1 part per billion
1,1,1-trichloroethane	200 parts per billion
1,2-dichloroethane	3 parts per billion
Benzene	1 part per billion
Ethylene Dibromide	0.02 parts per billion
Tetrachloroethylene	3 parts per billion

Table 6.7 Maximum Allowable Contaminant Concentrations for Drinking Water in Florida (Volatile Chemicals)

6.9 Water Management Districts

Florida's Water Management Districts were established by the Florida Water Resources Act of 1972. The Act gives DER "general supervisory authority" over the water management districts

Northwest Florida Water Management District
Suwannee River Water Management District
St. John's Water Management District
South Florida Water Management District
Southwest Florida Water Management District

The districts are authorized to implement flood protection programs, perform technical investigations, develop water resource plans to include water shortage plans for times of drought, and to acquire and manage lands for water management purposes under the Save Our Rivers program. They administer major regulatory programs, including surface water management, consumptive uses of water, aquifer recharge, and well construction.

Under the Wetlands Act, the districts also regulate dredging and filling by agriculture or forestry. Some districts actually administer some of DER's water quality programs such as stormwater management. Four of the five districts now administer their own surface water management programs. The Northwest Water Management District, the smallest of the five is not administering the state stormwater program.

The water management districts are involved in other programs such as the Kissimmee River restoration, the Upper St. John's River restoration, and the Save Our Rivers Program. The districts also undertake special programs such as studying the effects of landfills on ground water quality, flood plain mapping, and water conservation programs.

6.10 Construction Impacts of Water Quality

For contractors the net result of water quality laws and regulations is that the conduct of construction activities must take into account the potential degradation of the streams, rivers, ponds, lakes, aquifers, and other water resources which are on or near to the construction site.

Chapter 5 of this Handbook refers to the subject of hazardous materials. Clearly the careful use of these materials must be observed and the onus is on the contractor to insure that all personnel on the site have been thoroughly briefed on the presence and proper handling of these substances. Careless actions which allow these materials to enter the groundwater or surface water is a violation of the basic laws which seek to protect the State's water resources. A violation of the water quality regulations can result in heavy fines as well as expensive cleanup.

It is good practice to make a careful survey of the site prior to construction to identify situations which could result in the degradation of the water quality. Demolition and excavation operations should be well-planned to insure that undesirable materials will not leach into the local water table or become part of surface run-off.

Due to the fact that water is a critical and precious resource, contractors are encouraged to reuse or recycle groundwater where possible. DER's Ground Water Rules encourages water reuse wherever possible. Additionally, wastewater reuse is practiced in several areas of Florida. Treated sewage effluent is used to irrigate 2,000 acres of crops in Tallahassee, for citrus crops in Orlando, and for parks and golf courses in St. Petersburg.

6.11 Applicable Laws and Regulations

The laws which govern water quality at the Federal level are as follows:

The Public Health Service Act, Section 1412
EPA's "National Interim Primary Drinking Water Regulations"
The Federal Water Pollution Control Act (Clean Water Act)
Water Quality Assurance Act of 1983

The goal of these Federal statutes is to provide water quality sufficient for protection of human health, for protection and propagation of fish, shellfish, and wildlife, and for recreation in and on the water.

Florida law is embodied in the Department of Environmental Resources (DER) Regulation "Water Quality Standards", Chapter 17-3 of the Florida Administrative Code (F.A.C.). The objective of this standard and the Florida Statutes which implement the water quality standards is to provide an even-handed and balanced approach to the attainment of water quality objectives. Chapters 17-4 and 17-5 of the F.A.C. are additional regulations relative to water quality as they are a part of the State's comprehensive program to control, abate, and prevent water pollution.

6.12 Definitions

Aquifer A geological formation, group of formations, or part of a formation that contains sufficient saturated, permeable material to be able to yield significant quantities of water to wells and springs.

Sinkhole A depression in the land surface formed either by collapse of the roof of an underground cavern or cannel or by solution of near-surface limestones or similar rock.

Injection Well A well in which a fluid is injected into cracks crevices, or pores in a rock formation below the earth's surface.

Saltwater Intrusion	The phenomenon occuring when salt water moves laterally inland from the seacoast or vertically to replace fresh water.
Heavy Metals	Includes mercury, lead, chromium, copper, and cadmium.
Biochemical Oxygen Demand	The quantity of dissolved oxygen, measured in milligrams per liter or parts per million, required to stabilize decomposable organic matter by aerobic biochemical action.
Eutrophication	The processes that result in a higher concentration of dissolved nutrients in a water body.
Turbidity	A flowing mass of sediment-laden water that is heavier than clear water and therefore flows downslope along the bottom of the sea or a lake.

6.13 Works Cited

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APPENDIX 6.1: Oustanding Florida Waters

National Park	County
Bicayne	Dade
Everglades	Monroe/Dade/Collier

Wildlife Refuge	County
Caloosahatchee	Lee
Cedar Key	Levy
Chassahowitzka	Citrus/Hernando
Chinsegut	Hernando
Crocodile Lake	Monroe
Egmont Key	Hillsborough
Great White Heron	Monroe
Hobe Sound	Martin
Island Bay	Charlotte
J.N. "Ding" Darling	Lee
Key West	Monroe
Lake Woodruff	Volusia/Lake
Lower Suwannee	Dixie
Loxahatchee	Palm Beach
Matlacha Pass	Lee
Merritt Island	Volusia/Brevard
National Key Derr	Monroe
Okenfenokee	Baker
Passage Key	Manatee
Pelican Island	Indian River
Pig Island	Gulf
Pine Island	Lee
Pinellas	Pinellas
St. Johns	Brevard
St. Marks	Jefferson/Wakulla
St. Vincent	Franklin

State Park/Recreation Area	County
Anastasia	St. Johns
Bahia Honda	Monroe
Basin Bayou	Walton
Bear Creek	Gadsden
Big Lagoon	Escambia
Bill Baggs	Dade
Blackwater River	Santa Rosa
Blue Springs	Volusia
Caladesi Island	Pinellas
Caloosahatchee River	Lee
Chekika	Dade
Collier-Seminole	Collier
Dead Lakes	Gulf
Delnor-Wiggins Pass	Collier
Dr. J.G. Bruce St. George	Franklin
Falling Waters	Washington
Faver-Dykes	St. Johns
Flagler Beach St.	Flagler
Florida Caverns	Jackson
Fort Clinch	Nassau
Fort Cooper	Citrus
Fort Pierce Inlet	St. Lucie
Fred Gannon Rocky Bayou	Okaloosa
Grayton Beach	Walton
Highlands Hammock	Highlands/Hardee
Hillsborough River	Hillsborough
Honeymoon Island	Pinellas
Hontoon Island	Volusia/Lake
Hugh Taylor Birch	Broward
Ichetucknee Springs	Columbia/Suwannee
J.D. McArthur Beach	Palm Beach
John Pennekamp	Monroe
J.U. Lloyd Beach	Broward
Jonathan Dickinson	Martin
Lake Griffin	Lake
Lake Kissimmee	Polk
Lake Louisa	Lake

Lake Manatee	Manatee
Lake Rousseau	Citrus/Levy/Marion
Lake Talquin	Leon/Gadsden/Liberty
Little Manatee River	Hillsborough
Little Talbot Island	Duval
Long Key	Monroe
Manatee Springs	Levy
Mike Roess Gold Head Branch	Clay
Myakka River	Manatee/Sarasota
Ochlockonee River	Wakulla
O'Leno	Alachua/Columbia
Oleta River	Dade
Oscar Scherer	Sarasota
Pahokee	Palm Beach
Palm Beach Pines	Palm Beach
Pepper Beach	St. Lucie
Ponce de Leon Springs	Holmes/Walton
Port Charlotte Beach	Charlotte
St. Andrews	Bay
St. Lucie Inlet	Martin
Sebastian Inlet	Indian River/Brevard/Hamilton
	Madison/Suwanee
Three Rivers	Jackson
T.H. Stone Memorial	Gulf
Tomoka	Volusia
Torreya	Liberty
Wekiwa Springs	Orange/Seminole

State Ornamental Garden	**County**
Alfred B. Maclay	Leon
Eden	Walton
Ravine	Putnam
Washington Oaks	Flagler

State Preserves	**County**
Anclote Key	Pasco/Pinellas
Barefoot Beach	Collier
Cape St. George	Franklin

Cayo Costa	Lee
Cedar Key Scrub	Levy
Fakahatchee Strand	Collier
Haw Creek	Flagler/Putnam/Volusia
Lower Wekiva River	Lake/Seminole
Perdido Key	Escambia
Prairie-Lakes	Osceola
River Rise	Alachua/Columbia
San Felasco Hammock	Alachua
Savannas	Martin/St.Lucie
Tosohatchee	Orange
Waccasassa Bay	Levy
Weedon Island	Pinellas

Environmentally Endangered Lands	**County**
Barefoot Beach	Collier
Cayo Costa North Captiva	Lee
Cedar Key Scrub	Charlotte
Fakahatchee Strand	Franklin
Little St. George Island	Franklin/Gulf
Lower Apalachicola River	Lake/Seminole
Nassau Valley Marshes	Duval/Nassau
Palm Beach County Everglades	Palm Beach
Paynes Priarie	Alachua
Perdido Key	Escambia
River Rise	Alachua/Columbia
San Felasco Hammock	Alachua
Savannas	Martin/St.Lucie
Three Lakes Ranch	Osceola
Toshatchee Preserve	Orange
Volusia Water Recharge Area	Volusia
Weedon Island	Pinellas
Withlacoochee Tracts	Sumter

National Seashore	**County**
Canaveral	Brevard/Volusia
Gulf Islands	Escambia/Santa Rosa

Aquatic Preserve	County
Alligator Harbor	Franklin
Apalachicola Bay	Franklin
Banana River	Brevard
Biscayne Bay	Dade/Monroe
Boca Ciega Bay	Pinellas
Caladesi Island	Charlotte/Lee
Cape Romano-Ten Thousand Is.	Collier
Cockroach Bay	Hillsborough
Coupon B	Lee
Fort Clinch	Nassau
Fort Pickens	Santa Rosa/Escambia
Gasparilla Sound-Char. Harb.	Charlotte/Lee
Indian River,Malabar-Sebast.	Breverd/Indian River
Indian River,Vero Bch-Ft.Pie	Indian River/St. Lucie
Jensen Bch to Jupiter Inlet	Martin/Palm Bch/St.Lucie
Lake Jackson	Leon
Lignumvitae Key	Monroe
Loxahatchee River	Martin/Palm Beach
Matlacha Pass	Lee
Mosquito Lagoon	Volusia/Brevard
Nassau River-St.Johns	Nassau/Duval
North Fork, St. Lucie	St. Lucie/Martin
Pellicer Creek	St.Johns/Flagler
Pine Island Sound	Lee
Pinellas County	Pinellas
Rocky Bayou	Okaloosa
Rookery Bay	Collier
St. Andrews	Bay
St. Joseph Bay	Gulf
St. Martins Marsh	Citrus
Tomoka Marsh	Volusia/Flagler
Wekiva river	Lake/Orange/Seminole
Yellow River Marsh	Santa Rosa

Special Waters

Apalachicola River south of northern Gulf County Line
Aucilla River
Blackwater River
Chipola River
Choctawhatchee River
Crystal River, including Kings Bay
Little Manatee River-from its mouth to the western crossing of the river by S.R. 674, including Hayes, Mill and Bolster Bayous, but excluding South Fork, Ruskin Inlet and all other tributaries.
Ochlockonee River
Perdido River
St. Marks River except that part between Rattlesnake Branch and the confluence of the St. Marks and Wakulla Rivers.
Shoal River
Suwannee River
Wacissa River
Wakulla River

Scenic and/or Wild River Segment	**County**
Wekiva	Lake/Seminole

National Preserve	**County**
Big Cypress	Collier/Dade/Monroe

Marine Sanctuary	**County**
Key Largo Coral Reef	Monroe
Looe Key	Monroe

National Estuarine Sanctuary	**County**
Apalachicola Bay	Franklin
Rookery Bay	Collier

National Forest	**County**
Apalachicola	Leon/Franklin
Sopchoppy River	
Big Dismal Sink	

Ocala	Putnam/Marion/Lake
Alexander Springs	
Alexander Springs Creek	
Juniper Springs	
Juniper Creek	
Salt Springs Run	
Lake Dorr	
Lake Kerr	
Little Lake Kerr	
Osceola	Baker/Columbia
Deep Creek	
Robinson Creek	
Middle Prong, St. Marys River	
Ocean Pond	
Falling Creek	

CHAPTER 7
AIR QUALITY

7.0 Introduction

It was reported in Engineering News Record(ENR) on August 19, 1991 that McDonnell Douglas Corp was in the process of soliciting proposals from nine cities in the United States. The major goal of the proposal was to determine the problems an $800 million aircraft assembly plant could cause for a city and to include suggestions for solving those problems.

One city in the bidding was Houston Texas. The Greater Houston Partnership, which was handling the city's bid, believed that they had an advantage over some of the other cities due to their prior experience with pollution problems. Industries in the Houston area have been forced to develop clean air technologies. The Clean Air act has initiated the development of technologies that other cities do not have.

The Clean Air Act will affect McDonnell Douglas and their ability to assemble aircraft no matter which city they eventually choose. Title III of the Clean Air Act lists 189 toxics, most of which are used in the painting of aircraft. The company expects the new plant to emit about 100 tons of pollutants a year. At the present time new plants in Houston may emit up to 100 tons. When the Clean Air Act goes into effect in November of 1992, annual emissions will be limited to 25 tons a year.

What are the 1990 Clean Air Act Amendments and what do they mean to a contractor? As the elements of the Amendments are reviewed, it is very important for consumers and businesses to remember that everyone will feel the effects of the implementation of the Clean Air Act Amendments. It has been estimated that the costs to execute the Amendments will run between $22 billion and $50 billion per year. When it is considered that the annual cost of all environmental regulations is $100 billion the magnitude of the costs and requirements of the Clean Air Act become clear.

In the following pages The Clean Air Act Amendments of 1990, the Florida State Implementation Plan directed by the Division of Air Resources Management, National Air Quality, Indoor Air Quality, the Environmental Industry, and the benefits that may be realized through the Prevention of Air Pollution will be examined.

7.1 1970 Clean Air Act

The 1970 Clean Air Act originally established deadlines for states to bring areas unable to fulfill the **National Ambient Air Quality Standards(NAAQS)** into compliance. It was determined that the goals had been very unrealistic when many areas of the nation were unable to achieve the deadline. Congress then enacted the 'Part D' non-attainment program in 1977.

Part D established rigid requirements for **existing sources** and **new sources** of pollution. It also established a new timetable for bringing areas not in compliance with the NAAQS into compliance. Ozone and carbon monoxide levels were supposed to be in full compliance by the end of 1987. At the end of the new deadline there were still large areas of the country that had not met federal requirements.

The result of noncompliance of the Clean Air Act regulations and the lack of enforcement capabilities spearheaded the 101st Congress to enact a new set of amendments. The Clean Air Act Amendments of 1990 (''CAA's'') are significantly more complete and intricate than the CAA's that preceded them.

7.2 Attainment and Maintenance of National Ambient Air Quality

Under Title I, ''Attainment and Maintenance of National Ambient Air Quality Standards'' (NAAQS) of the CAA, each state continues to be responsible for the realization of air quality standards within its own boundaries. Each state is required to produce its own **''State Implementation Plan'' (SIP)**. Each state is required to implement special measures in those areas that have not achieved the national air quality standards as prescribed for ozone, carbon monoxide and fine particulate matter.

The state of Florida Department of Environmental Regulation is presently charged with the elimination, prevention, and control of air pollution. The Department's plan to protect and enhance the air quality of Florida is spelled out in Volume 9, Chapter 17 of the Florida SIP. ''The policy inherent in the standards shall be to protect the air quality existing at the time the air quality standards were adopted or to upgrade or enhance the quality of the air of the State. In any event, where a new or increased source of air pollution poses a possibility of degrading existing high air quality or ambient air quality established by this chapter, such source or proposed source shall not be issued a Department permit until the Department has reasonable assurance that such source, construction or development will not violate this chapter.''(17-2.200)

Under Part III, Ambient Air Quality (17-2.300), the plan goes on to assert that "....no person shall build, erect, construct, or implant any new source; operate, modify, or rebuild any existing source; or by any other means release or take action which would result in the release of an air pollutant into the atmosphere which would cause or contribute to a violation to a violation of an ambient air quality standard established under Rule 17-2.300(3).

7.3 Ozone Non-Attainment

More than 100 million people live in "ozone **non-attainment areas**" in regions in the United States that violate the National Ambient Air Quality Standards (NAAQS) for these gases. According to Alan Robock of the University of Maryland, "very slight changes in the balances of gases within the atmosphere can cause significant changes in the climate. The changes in the climate may in turn produce a dramatic effect on the environment and the way that people live. The greenhouse effect is the accumulation in the atmosphere of certain transparent gases, including CO_2, that prevents or retards the escape of the solar heat that radiates back from the earth's surface. The accumulation of gases causes a buildup of heat that can eventually lead to gradual but steady warming. Many models now predict an average temperature increase of 2 to 6 degrees by 2060. Models have demonstrated that the effects caused by this warming might range from melting of the polar ice caps, with a resulting increase in sea level that could submerge coastal cities, to the creation of dust bowls in fertile plains." (IR News, May-June 1990, Robert E. Paaswell)

Congress, in addressing the non-attainment issue has allotted more time for compliance to areas of the country with the more serious ozone problem. Areas are classified for ozone non-attainment in the following list.**(Table 7.1)**

Area classification	**Design value (parts per million)**
Marginal	0.121-0.138
Moderate	0.138-0.160
Serious	0.160-0.180
Severe	0.180-0.280
Extreme	0.280 and above

TABLE 7.1 Ozone Non-Attainment Classifications

The attainment deadline for the ozone NAAQS should be accomplished as "expeditiously as practicable," but no later than November 15, of the year provided below.**(Table 7.2)**

Area classification	**Primary standards attainment date**
Marginal	3 years after enactment
Moderate	6 years after enactment
Serious	9 years after enactment
Severe	15 years after enactment
Severe (with 1988 design value between 0.190 and 0.280)	17 years after enactment
Extreme	20 years after enactment

TABLE 7.2 Attainment Deadline

Until the U.S. Environmental Protection Agency decides to redesignate the area as attainment, each of the following areas is designated as a non-attainment area for the air pollutant, ozone:(17-2.410)**(Table 7.3)**

Ozone Non-attainment AREA	**New Source Allowance Tons per Year of Volatile Organic Compounds**
(a) Duval County	1,400
(b) Broward County	875
(c) Dade County	4,000
(d) Palm Beach County	1,350
(e) Hillsborough County	700
(f) Pinellas County	400

TABLE 7.3 Florida Ozone Non-Attainment Areas

7.4 Failure to Meet the Ozone Deadlines

Should a Marginal, Moderate, or Serious area fail to meet the ozone standards by their respected deadline, they will automatically be reclassified to the next higher classification. The area failing to comply will be subject to all state implementation plan requirements applying to the new category. Major stationary air pollution sources may be subject to excess fee penalties. Fees will equal $5000 for each ton of **volatile organic compound (VOC)** emitted by the source during the year in excess of 80 percent of a baseline amount as set forth by the EPA.

7.5 Provisions Relating to Mobile Sources

Title II of the CAA's significantly tighten mobile source standards by emphasizing fuel composition and by requiring automobile producers to reduce tailpipe emissions. Tailpipe emissions must be reduced by 35% for hydrocarbons and 60% for oxides of nitrogen. The emissions reduction will effect 40% of the vehicles sold in 1994 and increased to 100% in 1996. Similar reductions are going to be required for light-duty trucks. By the early 2000's there will be additional cuts if the EPA determines that they are necessary.

Under this title, the EPA is required to study emissions from non-road engines and non-road vehicles to determine whether such emissions endanger public health or welfare. If it is found that this variety of vehicles provide adverse health impact, the EPA must produce standards that will insure the maximum achievable emission reduction. Consideration will be given to the cost of applying the required technology as well as to noise, energy and safety factors associated with the application of such technology.

Chapter 17-243 of the Florida SIP establishes procedures to determine compliance with rules pertaining to the tampering with of air pollution control devices on vehicles. Penalties range from a noncriminal traffic infraction to a misdemeanor of the first degree.

7.6 Carbon Monoxide Non-Attainment

Carbon monoxide (CO) levels are exceeded during the winter in some 40 U.S. cities and thus are a current concern in Congress. Most CO emissions come from motor vehicles, mobile or stationary.

CO non-attainment areas are classified as Moderate or Serious, based upon the design value for the area.**(Table 7.4)**

Area classification	**Design value (parts per million)**
Moderate	9.1-16.4
Serious	16.5 and above

TABLE 7.4 CO Non-Attainment Classification

The deadline for primary standards is "as expeditiously as practicable," but not later than the dates listed in Table 7.5.

Area classification	Attainment date
Moderate	December 31, 1995
Serious	December 31, 2000

Table 7.5 CO Non-Attainment Deadlines

The EPA may grant two one-year extensions beyond the deadline if the state has complied with all SIP requirements with no prior CO limit violations.

7.7 Particulate Matter Non-Attainment Issues

Provisions for **particulate matter (PM_{10})** are also covered by the new Amendments. The EPA is required to issue technical guidance concerning reasonable methods of control for fugitive dust, wood burning, agricultural burning and other sources of particulate matter. Open burning and frost protection fires are extensively covered in Chapter 17-256 of the State Plan. The plan states in 17-256.100:

> (2) It is the intent of the Department to require that open burning be conducted in a manner, under conditions, and within certain periods that will reduce or eliminate the deleterious and offensive defect of air pollution caused by open burning.
>
> (5) The Department finds that there are several alternative disposal methods for pesticide containers that are environmentally preferable to open burning.

All areas will be designated as Moderate initially. If an area cannot attain PM_{10} NAAQS by the end of the sixth calendar year after they have been designated an area of non-attainment, they may be reclassified as Serious. To avoid being classified as a non-attainment area, attainment must be reached not later than December 31, 1994.

Construction bans that were enforced under the 1977 version of the Clean Air Act, due to failure to submit a non-attainment area new source review permit program or failure to submit an acceptable SIP, will remain in effect until such time that the EPA approves a plan correcting those deficiencies. The EPA may choose to cut off federal highway funds until the state complies.

7.8 Hazardous Air Pollutants

Title III of the 1990 CAA's initiated a new process for controlling air toxics. The existing plan is a risk-based program to control the emission of hazardous air pollutants. It is considered by many to be a failure because the EPA has only issued eight standards over the past 20 years.

According to industry estimates, more than 2.4 billion pounds of toxic pollutants were emitted into the atmosphere in 1988. These emissions may result in a variety of adverse health effects including cancer, reproductive effects, birth defects, and respiratory illness. Only seven hazardous air pollutants were regulated under the previous Clean Air Act.

The new process includes a listing of 189 substances. This list is provided in Appendix 7.1 of this chapter. It includes organic chemicals, pesticides, metals, coke oven emissions, fine mineral fibers, and radionuclides (including radon).

The list provided is an initial list and may have substances added or removed. If a substance is shown to be present, through inhalation, or routes of exposure, a threat of adverse human health effects or adverse environmental effects, it will be added to the list by the EPA.

Any person may petition the EPA to modify the list of hazardous air pollutants by adding or deleting a substance. The EPA must either grant or deny the petition within 18 months of receipt provided the petition contains adequate supporting data on the health and environmental effects of the pollutant.

Each state may develop and submit to the EPA for approval a program for the implementation and enforcement of emission standards and other requirements for hazardous air pollutants or requirements for the prevention and mitigation of accidental releases of hazardous substances. A state may receive partial or complete delegation of the EPA's authority and responsibility to implement and enforce emissions standards and prevention requirements. This shall not include the authority to set standards less stringent than those promulgated by the EPA.

Within 12 months of enactment of the Clean Air Act, the EPA must publish guidance for the states to use in developing their hazardous air pollutants programs. In addition, the EPA is required to establish and maintain an air toxics clearinghouse and center to provide technical information and assistance on control technology, health and ecological risk assessment, risk analysis, ambient monitoring and modeling, and emissions measurement and monitoring to state and local agencies.

The EPA must approve or disapprove a state program within 180 days after receipt and after notice and opportunity for public comment. The EPA must disapprove a state program if they determine that:

(1) The state program authorities cannot assure compliance by all sources;

(2) The state program lacks adequate authority or adequate resources to implement the program;

(3) The state program schedule for implementation and compliance is not sufficiently expeditious; and

(4) The state program is otherwise not in compliance with EPA guidance.

If a state program is disapproved, the state may revise its program and resubmit the program to EPA for approval. A local air pollution control agency may also develop and submit to the EPA a program to undertake any action authorized to be performed by the state.

Title III of the Clean Air Act also directs the Secretary of Labor, in coordination with the EPA, to announce, in accordance with the Occupational Safety and Health Act, a chemical process safety standard designed to protect employees from hazards associated with accidental releases of highly hazardous chemicals in the work place.

The chemical process safety standard must impose the following requirements on employers:

(1) develop and maintain written safety information, identifying work place chemical and process hazards, equipment and technology used in the processes;

(2) perform a work place hazard assessment, including, as appropriate, identification of potential sources of accidental releases, identification of any previous release within the facility which had a likely potential for catastrophic consequences in the work place, estimation of work place effects of a range of releases, estimation of the health and safety effects of such range on employees;

(3) consult with employees and their representatives on the development and conduct of hazard assessments and the development of chemical processes required under the Standard;

(4) establish a system to respond to the work place hazard assessment findings, which shall address prevention, mitigation, and emergency responses;

(5) periodically review the work place hazard assessment and response system;

(6) develop and implement written operating procedures for the chemical process, including procedures for each operating phase, operating limitations, and safety and health considerations;

(7) provide written safety and operating information to employees, and train employees in operating procedures, emphasizing hazards and safe practices;

(8) provide appropriate information and training to contractors and contract employees;

(9) train and educate employees and contractors in emergency response in a manner as comprehensive and effective as that required by the regulation promulgated pursuant to the Superfund Amendments and Reauthorization Act;

(10) establish a quality assurance program to ensure that initial process related equipment,maintenance materials, and spare parts are fabricated and installed consistent with design specifications;

(11) establish maintenance systems for critical process related equipment, including written procedure, employee training, appropriate inspections, and testing of such equipment to ensure ongoing mechanical integrity;

(12) conduct pre-start-up safety reviews of all newly installed or modified equipment;

(13) establish and implement written procedures to manage change to process chemicals, technology, equipment and facilities; and

(14) investigate every incident which results in, or could have resulted in, a major accident in the work place, with any findings to be reviewed by operating personnel and notifications made, if appropriate.

7.9 Acid Rain Deposition Control

Title IV of the Clean Air Act Amendments of 1990 will address the control of the pollutants associated with acid rain. The goal is to realize a 10 million ton reduction of sulfur dioxide (SO_2) and an approximately two million ton reduction in nitrogen oxides (NO_x), relative to 1980 levels. The focus of the acid rain program is an innovative market-based emission allowance program which will provide affected sources flexibility in meeting the mandated emission reductions. The new law allows utilities to trade allowances within their systems and/or buy or sell allowances to and from other affected sources. Each source must have sufficient emissions fees and must offset the excess emissions in the following year. The EPA will promulgate regulations for the allowance system within 18 months of enactment.

In early July 1991, the Chicago Board of Trade voted to allow trading in credits for air emissions of sulfur dioxide to meet the new lowered pollution levels under the Clean Air Act. Utility companies unable to meet the 1995 pollution levels will be required to obtain additional pollution allowances that will be issued by the EPA. The plants that can meet the new pollution levels will be allowed to sell their excess credits to those that find it less expensive to purchase the credits than to comply with the new law. The concept of reward for compliance should be an important motivating factor in the success of the Clean Air Act. It should be remembered that compliance results in the initiation of major construction projects. The plan requires approval by The Commodity Futures Trading Commission and the EPA.

7.10 Permits Required

Title V of the Clean Air Act Amendments of 1990 established a comprehensive operating permit program for air emissions. The purpose of the operating program is to put in one place all of the requirements concerning air emissions that apply to affected sources. When fully in place, these permits will ensure that sources are not being subjected to conflicting requirements and that all parties have a clear picture of those requirements.

Under Chapter 17-2.210 the State of Florida will require "....the **owner or operator** of any source which emits or can reasonably be expected to emit any air pollutant shall obtain an appropriate permit from the Department prior to beginning construction, modification, or initial or continued operation of the source unless exempted pursuant to Department rule or statute. Issuance of a permit does not relieve the owner or operator of any source from complying with applicable emission limiting standards or other requirements of Chapter 17-2, or any other requirements under federal, state, or local law.

(1) Air **Construction Permits** - An air construction permit shall be obtained by the owner or operator for any proposed new or modified source prior to the beginning of construction or modification, in accordance with all applicable provisions of Chapter 17-2, Part V, and Chapter 17-4, F.A.C.

(2) Air **Operation Permits** - Upon expiration of the air operation permit for an existing source or subsequent to construction or modification and compliance testing of a new or modified source, the owner or operator of such source shall obtain an air operation permit in accordance with Chapter 17-2 and Chapter 17-4, Florida Administrative Code."

7.11 Stratospheric Ozone Protection

Title VI of the Clean Air Act Amendments require complete phase-out of chlorofluorocarbons (CFC's) and halons with interim reductions. Ozone depleting substances will be grouped into two classes. Class I chemicals (CFCs, halons, and carbon tetrachloride, and methyl chloroform) will be phased out by 2000, with the exception of a methyl chloroform phaseout by 2002. Class II chemicals (hydrochlorofluorocarbons (HCFCs)) will be phased out by 2030.

Regulations are required to reduce the use and emissions of Class I and Class II substances to the "lowest achievable level" and to maximize the recapture and recycling of these chemicals. The EPA will develop a regulation for the use and disposal of Class I chemicals during the service, repair, or disposal of appliances and industrial process refrigeration.

7.12 Enforcement

The Clean Air Act incorporates enforcement features of other recent environmental statutes, including felony penalties for knowing violations of the Act and misdemeanor penalties for negligent releases of hazardous pollutants. The EPA will be able to issue administrative enforcement penalties orders of up to $200,000, and to issue administrative orders with compliance schedules of up to 12 months. Additionally, the EPA has the authority to establish, through regulation, a field citation program for minor violations. These field citations for minor violations may be issued on site during an inspection, for up to $5000 per day of violation.

7.13 Air Pollution: A National Problem

In recent years it has not been uncommon to turn on the television and hear about life threatening toxic spills. In October 1987 an accident occurred at the Marathon Petroleum Co. plant in Texas City, Texas. An 80-ton piece of equipment fell from a crane onto a hydrofluoric acid tank.

Although the amounts are unknown, the companies involved have made partial settlements with most of the approximately 1200 residents who filed suits. The acid cloud force residents within 50-blocks to evacuate. Approximately 1200 people were treated at hospitals for eye and skin irritation and breathing difficulties. The claimants claimed that the injuries they incurred were long-term or permanent.(ENR, JULY 12,1990)

In January 1992 another acid spill occurred on Interstate 75 near Gainesville, Florida. As reported by The Gainesville Sun, two trucks were hauling acids on I-75 when one of the drivers noticed something leaking from the other truck. The trucks were pulled off the highway into a truck-stop where the truck eventually exploded. The different acids were stored in separate compartments. Official believe that the leak may have been the cause of an explosive chemical reaction.

There were several service stations, restaurants, hotels and convenience stores located at the interchange near the accident. Two people were injured and 11 others were taken to the hospital for eye and skin irritation resulting from the released vapors.

These types of accidents are costly to all involved. Costly to the victim in inconvenience and suffering, and costly to the contractor in a monetary sense. Great care should always be exercised when working around any substance that can be transmitted by the air. There is little that can be done to contain the vapors released into the atmosphere.

"Taiwan's EPA now has 19 major environmental construction projects under way, says John Rasile, Vice president of the Fluor division. One of these projects is its "Blue Sky" project to clean up notoriously bad air pollution in Taipei and Daohsiung." The article goes on to quote W. Dennis Moran, President of Camp Dresser & McKee International Inc. "EPA is coming out with projects at the rate of four or five a week." (ENR, September 13,1990)

The environmental service markets topped $59 million dollars in 1990 and are expected to grow 15 to 20% per year for the next 5 years. Environmental projects will more than likely be dominated by larger service companies, largely due to a lack of resources necessary to land the larger Federal Government environmental cleanup projects. Larger firms are better able to offer all of the services a waste generating concern might expect when soliciting bids. Foreign competition will offer stiff competition to domestic Environmental Service Companies in the future due to a globalization of the industry.

According to Frost & Sullivan Ltd., a London Market research firm, the European Community will spend nearly $4 billion for air emission control and filtration equipment by 1994, up from $2.9 billion in 1989. Germany will be the largest market, spending about $974 million by 1994. France is next at $560 million and Great Britain at $555 million while Spain is considered to have the least stringent enforcement of air pollution control measures, it will invest $332 million in equipment by 1994, the firm projects. Investment in emission control equipment in Western Europe is expected to total $2.7 billion by 1994, up from $1.9 billion in 1989. (ENR February 11, 1991)

The opportunities for construction companies generated by the Clean Air Act are enormous. In 1990 spending on stationary control systems reached approximately $2 billion, with 30% annual growth predicted for five years. The emphasis on control of air toxics will affect companies of all sizes. The road to clean air emissions can only be accomplished through massive construction efforts.

New clean-coal technology has caught on in the last 10 years. Many Eastern European countries are being introduced to the circulating-fluidized-bed(CFB) combustion boiler technology by Ahlstrom Pyropower Inc., San Diego, and a Polish firm called Fabryka Kotlow Prqemyslowych. The new technology allows a plant to burn low-grade coal cleanly. There are approximately 90 CFB boilers either in production or being built.

7.14 Indoor Air Quality

The understanding of Indoor Air Quality(IAQ) is very important today because the population of the United States usually spends up to 90% of their lives indoors. Studies have shown that in many cases the collection of indoor contaminants are higher than corresponding outdoor values. It is for this reason that exposure to indoor contaminants may be more detrimental to a persons well being than the pollutants that are present outdoors.

In early efforts to combat our dependence on fossil fuels, our nation initiated the concept of building energy management. The significance of its practice is credited as a means to control the depletion of the earth's natural resources and the associated dependency on foreign energy sources. Energy Conservation measures were imposed to conserve energy in structures. Unfortunately, these measures presented serious

compromises to occupant comfort, health, and productivity within the structures. The floundering condition of the health and well being of people was further aggravated when the costs of energy resources continued to soar at an astounding rate. The negative results of these measures were eventually considered a necessary effect of energy conservation.

Occupants of office buildings and other structures can experience unhealthy symptoms as a result of exposure to irritants. The complaints may include itching or burning eyes, watery eyes, dry nose and throat, sore throat, sneezing, coughing, and tightness of the chest. Paints, adhesives, sealants, office furniture, carpeting, and vinyl wall coverings are sources of compounds that produce gasses which lead to unhealthy symptoms in building occupants. Ozone, an irritant of the mucous membranes and the lungs, can be produced indoors by photocopiers and electrostatic air cleaners and other high-voltage electrical equipment. Solvents used in the cleaning of building are also known contributors to indoor air pollution. HVAC system intakes located near heavy traffic, parking garages, or loading docks can result in contamination of a building space with motor vehicle exhaust. Over fifty percent of the "sick buildings" have an outdoor air ventilation deficiency problem.

Other common sources of indoor air pollutant are asbestos and radon. Common building uses for asbestos have included fire-proofing, thermal insulation, and as part of pipes, in floor tiles and coverings, and as insulation cladding for structural members. Exposure to asbestos is normally negligible for most occupants except where asbestos surfaces are disintegrating or being worn away, releasing asbestos fibers. Contractors should be very cautious when working in areas that contain old asbestos. The removal of asbestos is a specialized area of the construction industry and should be left to companies with the proper equipment and expertise.

Radon occurs in structures mostly through diffusion from the underlying subsoil. The concentration can vary considerably. If the foundation of a building is tight, very little or no radon will enter, and very little radon will normally be found in spaces more than two stories above the foundation. It is estimated that in the United States that 5000 to 15000 cases of lung cancer can be ascribed to radon exposure each year. These subjects are dealt with more completely in Chapter 9.

Formaldehyde is a colorless gas found in thousands of products ranging from carpeting and drapes to particleboard and foam insulation. It is known to cause nose, eye and upper respiratory tract irritation, as well as headaches and nausea.

Energy conservation and acceptable environmental quality are not incompatible. By connecting a piece of ductwork from the outside of a structure to the return air intake on the furnace, a contractor can dilute indoor pollution. Using fiberglass insulation or other less hazardous material in conjunction with a vapor barrier

can guard against contaminants emitted by insulation. Paints, sealers, stains and other nontoxic products are available to replace their toxic counterparts. The use of pine in place of plywood will eliminate a large source of formaldehyde emissions.

Some of the aforementioned suggestions will definitely create added expense to the construction of a home or building, but many customers will be willing to pay the price to protect their health. The time may be ripe for the construction industry to examine its methods and practices concerning the utilization of known toxic materials. Perhaps a unified drive for the research and development of environmentally safe building products will be the catalyst to expel the myth that contractors are anti-environmental.

7.15 Conclusion

As the world expands and the desire to adopt the Western World's standards increase, economic expansion will continue at an alarming rate. Along with this expansion will travel the inevitable trail of waste that is presently posing serious threats to our environment. The ignorance of past generations as to the consequences of uncontrolled growth is no longer an acceptable excuse. Environmental studies have shown the finite nature of the atmosphere and that the implications of continued dumping of noxious dusts, fumes and toxins are far too important to ignore.

As a result of these far reaching environmental concerns a whole range of political movements and pressure groups have evolved to try to force National Governments to control and contain the air pollution problem. The success of preserving the quality of life on earth is ultimately the responsibility of each individual on this planet.

Contractors are in a very opportunistic position. They have the means and power to do their part in controlling air pollution and in reaping the benefits in more ways than insuring clean air. The very nature of the problem breeds solutions that can only be implemented through massive construction efforts. Understanding the problem and following the necessary steps to contain air pollutants is an important key to preserving the present quality of life for generations to come.

7.16 Definitions

National Ambient Air Quality Standards(NAAQS)

a)Primary
Maximum air pollutant levels set by the EPA, which if attained, allow an adequate margin of safety to protect human health.
b)Secondary
Maximum air quality levels requisite to protect the public welfare from known or anticipated adverse effects associated with the presence of particular air pollutants.

Existing Source	Any stationary source other than a new source.
New Source	A stationary source which commenced construction or reconstruction after the EPA fist proposes regulations establishing an emission standard under Title III.
State Implementation Plan (SIP)	State plans submitted to the EPA which provide for implementation, maintenance and enforcement of secondary NAAQS in each of the State's AQCR's.
Volatile Organic Compound	Hydrocarbon air pollutants that react in sunlight with NOx to form ozone.
Particulate Matter (PM_{10})	Particulate matter of 10 microns or less in length.
Non-Attainment Area	An area shown by monitored data or modeling to exceed NAAQS for a particular air pollutant.
Department	The State of Florida Department of Environmental Regulation.
Owner or Operator	Any person who owns, leases, operates, controls or supervises a stationary source.
Construction Permit	The legal authorization granted by the Department to construct, expand, modify, or make alterations to any installation and to temporarily operate and test such new or modified installations.
Operation Permit	The legal authorization granted by the Department to operate or maintain any installation for a specified period of time.

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APPENDIX 7.1
Clean Air Act Title III
List of Hazardous Air Pollutants

CAS NUMBER	*CHEMICAL NAME*
75070	Acetaldehyde
60355	Acetamide
75058	Acetonitrile
98862	Acetophenone
53963	2-Acetylaminofluorene
107028	Acrolein
79061	Acrylamide
79107	Acrylic acid
107131	Acrylonitrile
107051	Allyl chloride
92671	4-Aminobiphenyl
62533	Aniline
90040	o-Anisidine
1332214	Asbestos
71432	Benzene (including benzene from gasoline)
92875	Benzidine
98077	Benzotrichloride
100447	Benzyl chloride
92524	Biphenyl
117817	Bis(2-ethylhexyl)phthalate (DEHP)
542881	Bis(chloromethyl)ether
75252	Bromoform
106990	1,3-Butadiene
156627	Calcium cyanamide
105602	Caprolactam
133062	Captan
63252	Carbaryl
75150	Carbon disulfide
56235	Carbon tetrachloride
463581	Carbonyl sulfide
120809	Catechol

CAS NUMBER	*CHEMICAL NAME*
133904	Chloramben
57749	Chlordane
7782505	chlorine
79118	Chloroacetic acid
532274	2-Chloroacetophenone
108907	Chlorobenzene
510156	Chlorobenzilate
67663	Chlorlform
107302	Chloromethyl methyl ether
126998	Chloroprene
1319773	Cresols/Cresylic acid (isoners and mixture)
95487	o-Cresol
108394	m-Cresol
10644	p-Cresol
98828	Cumene
94757	2,4-D, salts and esters
3547044	DDE
334883	Diazomethane
132649	Dibenzofurans
96128	1,2-Dibromo 3-chloropropane
84742	Dibutylphthalate
106467	1,4-Dichlorlbenzene(p)
91941	3,3-Dichlorlbenzidene
111444	Dichloroethyl ether (Bis(2-chloroethyl)ether)
542756	1,3-Dichloroproopene
62737	Dichlorvos
111422	Diethanolamine
121697	N,N-Diethyl aniline (N,N-Dimethylaniline)
64657	Diethyl sulfate
119904	3,3-Dimethoxybenzidine
60117	Dimethyl aminoazobenzene
119937	3,3'-Dimethyl benzidine
79447	Dimethyl carbamoyl chloride
68122	Dimethyl formamide
57147	1,1-Dimethyl hydrazine
131113	Dimethyl phthalate
7781	Dimethyl sulfate

CAS NUMBER	*CHEMICAL NAME*
534521	4,6-Dinitro-o-cresol, and salts
51285	2,4-Dinitrophenol
121142	2,4-Dinitrotoluene
123911	1,4-Dioxane (1,4-Diethyleneoxide)
122667	1,2-Diphenylhydrazine
106898	Epichlorohydrin (1-Chloro-2,3-epoxypropane)
106887	1,2-Epoxybutane
140885	Ethyl acrylate
100414	Ethyl benzene
51796	Ethyl carbamate (Urethane)
75003	Ethyl chloride (Chloethane)
106934	Ethylene dibromide (Dibromoethane)
107062	Ethylene dichloride (1,2-Dichloroethane)
107211	Ethylene glycol
151564	Ethylene imine (Aziridine)
75218	Ethylene oxide
96457	Ethylene thiourea
75343	Ethylidene dichloride (1,2-Dichloroethane)
50000	Formaldehyde
76448	Heptachlor
118741	Hexachlorobenzene
87683	Hexachlorobutadiene
77474	Hexachlorocyclopentadiene
67721	Hexachloroethane
822060	Hexamethylene-1,6-diisocyanate
680319	Hexamethylphosphoramide
110543	Hexane
302012	Hydrazine
7647010	Hydrochloric acid
7664393	Hydrogen fluoride (Hydrofluoric acid)
7783064	Hydrogen sulfide
123319	Hydroquinone
78591	Isophorone
58899	Lindane (all isomers)
108316	Maleic anhydride
67561	Methanol

CAS NUMBER	*CHEMICAL NAME*
72435	Methoxychlor
74839	Methyl bromide (Bromomethane)
74873	Methyl chloride (Chloromethane)
71556	Methyl chloroform (1,1,1-Trichloroethane)
78933	Methyl ethyl ketone (2-Butanone)
60344	Methyl hydrazine
74884	Methyl iodide (Iodomethane)
108101	Methyl isobutyl ketone (Hexone)
624839	Methyl isocyanate
80626	Methyl methacrylate
1634044	Methyl tert butyl ether
101144	4,4-Methylene bis(2-Chloroaniline)
75092	Methylene chloride (Dichloromethane)
101688	Methylene diphenyl diisocyanate (MDI)
101779	4,,4'-Methylenedianiline
91203	Naphthalene
98953	Nitrobenzene
92933	4-Nitrobiphenyl
100027	4-Nitrophenol
79469	2-Nitropropane
684935	N-Nitroso-N-methylurea
62759	N-Nitrosodimethylamine
59892	N-Nitrosomorpholine
56382	Pentachloronitrobenzene (Quintobenzene)
87865	Pentachlorophenol
108952	Phenol
106503	p-Phenylenediamine
75445	Phosgene
7803512	Phosphine
7723140	Phosphorus
85449	Phthalic anhydride
1336363	Polychlorinated byphenyls (Arochlors)
1120714	1,3-Propane sultone
57578	beta-Propiolactone
123386	Propionaldehyde

CAS NUMBER	*CHEMICAL NAME*
114261	Propoxur (Baygon)
78875	Propylene dichloride (1,2-Dichloropropane)
75569	Propylene oxide
75558	1,2-Propylenimine (2-Methyl aziridine)
91225	Quinoline
106514	Quinone
100425	Styrene
96093	Styrene oxide
1746016	2,3,7,8-Tetrachlorodibenzo-p-dioxin
79345	1,1,2,2-Tetrachloroethane
127184	Tetrachloroethylene (Perchloroethylene)
7550450	Titanium tetrachloride
108883	Toluene
95807	2,4-Toluene diamine
584849	2,4-Toluene diisocyanate
95534	o-Toluidine
8001352	Toxaphene (chlorinated camphene)
120821	1,2,4-Trichlorobenzene
79005	1,1,2-Trichloroethane
79016	Triethylamine
95954	2,4,5-Trichlorophenol
88062	2,4,6-Trichlorophenol
121448	Triethylamine
1582098	Trifulralin
540841	2,2,4-Trimethylpentane
108054	Vinyl acetate
593602	Vinyl bromide
75014	Binyl chloride
75354	Vinylidene chloride (1,1-Dichloroethylene)
1330207	Xylenes (isomers and mixture)
95476	o-Xylenes
108383	m-Xylenes
106423	p-Xylenes
0	Antimony Compounds
0	Arsenic Compounds (inorganic including arsine)
0	Beryllium Compounds

CAS NUMBER	*CHEMICAL NAME*
0	Cadmium Compounds
0	Chromium Compounds
0	Cobalt Compounds
0	Coke Oven Emissions
0	Cyanide Compounds[1]
0	Glycol ethers[2]
0	Lead Compounds
0	Manganese Compounds
0	Mercury Compounds
0	Fine mineral fibers[3]
0	Nickel Compounds
0	Polycyclic Organic Matter[4]

CHAPTER 8
NOISE CONTROL

8.0 Introduction

Noise becomes a problem, especially when it is "unwanted noise." Too much of it at high levels can affect humans in a number of ways including, hearing, ability to communicate, and behavior problems. Consequently, **noise control** has become tremendously important from both an economic and environmental standpoints.

Noise in the environment is a unique situation. It is possible to purify air and water and to remove all solid waste from the landscape (**Table 8.1**). However, sound can only be eliminated by creating a vacuum, in which of course, humans cannot survive. Sound is and will always be part of the environment.

As more people are exposed to high levels of noise, economic losses due to reduced physical and intellectual working capacity have increased. Compensation cases involving claims for millions of dollars as a result of permanent hearing damage are now in the courts.

This chapter will cover physical problems caused by noise, discuss regulations on noise control, provide suggestions on noise control, and furnish a list of agencies to contact if further information is desired.

8.1 Hearing Damage Risk

Any noise greater than 85 **decibels** can damage hearing if the human ear is exposed to it over an extended period. Repeated noise exposures at high noise levels, over a long period of time, may cause temporary or permanent damage to the inner ear. Consequently, depending on its severity, noise exposure can lead to permanent hearing damage.

Threshold shift, which is expressed in decibels, is the difference between the lowest levels of **sound intensity** measured before and after noise exposure. There are two types of threshold shifts: temporary and permanent. **Noise-induced temporary threshold shift** results in a loss of hearing sensitivity following noise exposure. In noise-induced temporary threshold shift the hearing loss is reversible. In **noise-induced permanent threshold shift**, the hearing loss in nonreversible and it remains throughout the lifetime of the affected individual. Current standards permit permanent threshold shifts

up to 10 dB at frequencies below 1000 Hz, 15dB at 2000 Hz, and up to 20 dB above 3000 Hz. A United States

Environmental Protection Agency (EPA) study determined that the threshold of hearing-damage risk is between 70 dB and 90 dB, with 70 dB being cautionary and 90 dB a serious risk.

8.2 Noise Control Technique

There are three methods by which noise control problems can be minimized: (1) noise control at the "source," (2) noise control of the "transmission" path, and (3) the use of protective measures at the receiver. Economic feasibility, operational considerations, and the amount of noise reduction required, will determine which method, or combinations of methods will be adopted (Harris, 1979).

8.2.1 Noise Control at the Source

There are at least three primary areas in which control of noise generated by a source may be initiated: (1) proper design, (2) proper equipment operation, and (3) equipment maintenance.

(1) Proper Design

Proper design of equipment to minimize noise generation is a complex engineering problem. Because of its complexity, it is in the province of the equipment designers, and is beyond the scope of this handbook.

(2) Proper Operation

The following are several areas relating to proper operations:

(a) If acoustic guards, covers, or enclosures are used, make certain that they are in place and that all openings are acoustically sealed. Noise is a lot like water--it will rush out through any cracks or openings.

(b) If the equipment is equipped with a muffler system, make sure that it is performing according to design.

(c) Install machinery on adequate mountings and foundations to reduce structure-borne sound and vibrations. There are many good, commercially available isolation pads.

(d) Provide good support for tool-bits and workpieces to reduce vibrations.

(e) Apply additional sound control devices. Inlet and discharge silencers or mufflers can often be added for a small investment.

In general, the manner in which a piece of machinery is operated can greatly influence the amount of noise generated.

(3) Equipment Maintenance

Some maintenance techniques that can affect noise are:

(a) improving lubrication

(b) installing bearing correctly

(c) reducing mechanical runout of shafts.

Furthermore, the operation of equipment during the peak hours of the day when **ambient noise** levels are high, is an effective noise control technique. This ambient noise will cover up some of the equipment noise, thus, making it less noticeable (Milligan, 1978).

8.2.2 Noise Control of the Transmission Path

It is possible to obtain significant noise reduction by controlling the transmission path through the reduction of energy that is communicated to the receiver. The following are possible ways of accomplishing this noise reduction:

(1) Location of Buildings on Sites

The noise entering a complex of buildings or originating within the complex, should not be "trapped" in the area by bouncing back and forth from surrounding walls. Some examples of good and poor building layouts are shown in **Figure 8.1**.

(2) Enclosures and Barriers

Barriers in the open air can be effective when they are large in size compared with the wavelength of the sound to be deflected. Enclosures can also be effective in controlling construction noise. For example, enclosing a large rock drill can provide a reduction of 20 dBA. A barrier often can be constructed without major additional cost. For example:

(a) a fence that normally surrounds a construction site can be designed to act as an effective sound barrier

(b) material stockpiles or unused equipment can be placed around the operating equipment

(c) earth berms can be constructed using dirt which normally is hauled away from the site Some other examples of barriers include the use of natural shielding of rolling terrain, shielding walls, thick growth of trees, or shielding by existing high buildings (**Figure 8.2**). The effectiveness of the barrier depends on its dimensions and location relative to the source and receiver position (Leasure, 1979).

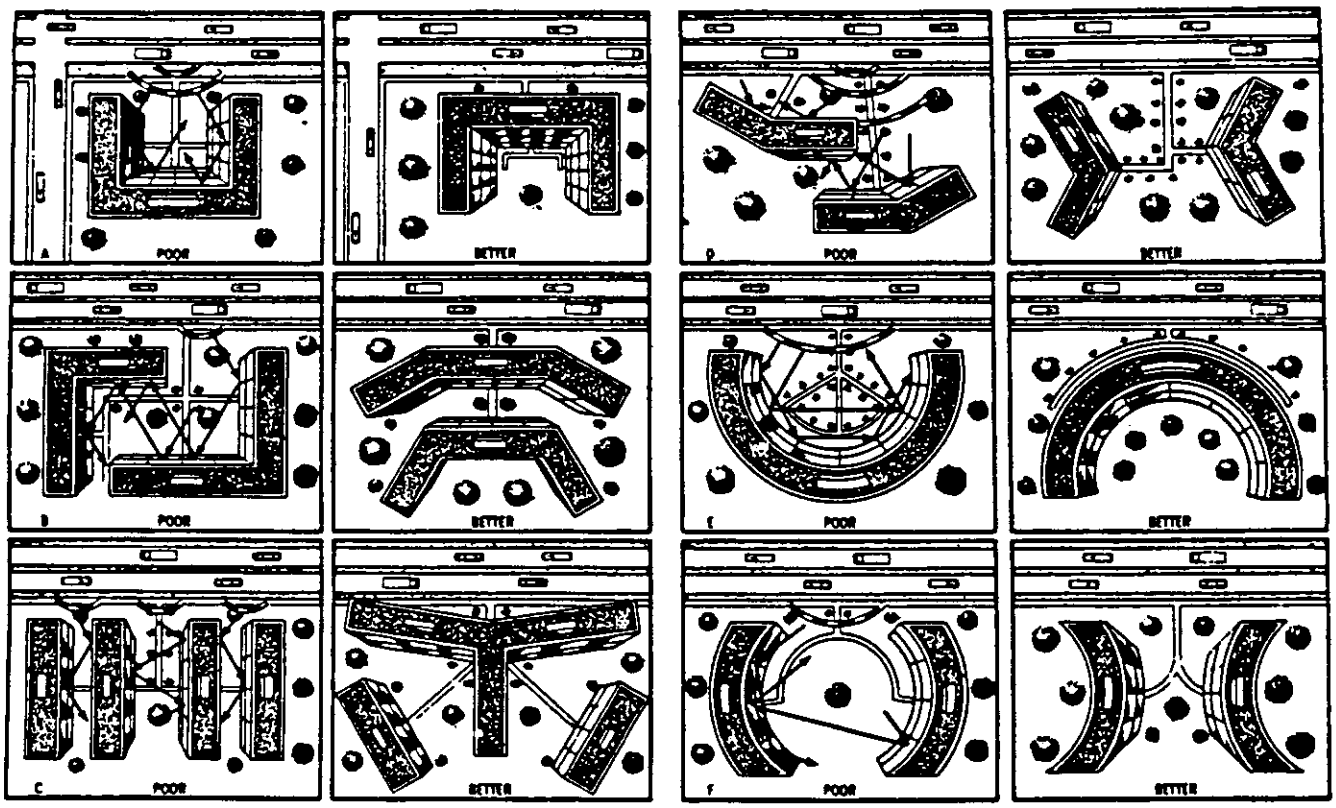

Figure 8.1: Building Orientation for Noise Control

8.2.3 Protective Measures at the Receiver

There is little opportunity for noise control at the receiver and sometimes it is impractical to reduce harmful noise at the source. Therefore, personal hearing protection is used instead. The following are methods for protection against high levels of noise:

(1) Hearing Protection Devices

Current **OSHA (Occupational Safety & Health Administration) 29 CFR 1926.52-53** standards require that hearing protective devices be provided and used if the given levels in **Table 8.2** are exceeded.

OSHA 29 CFR 1926.101 requires the use of ear protective devices wherever it is not feasible to reduce the noise level.

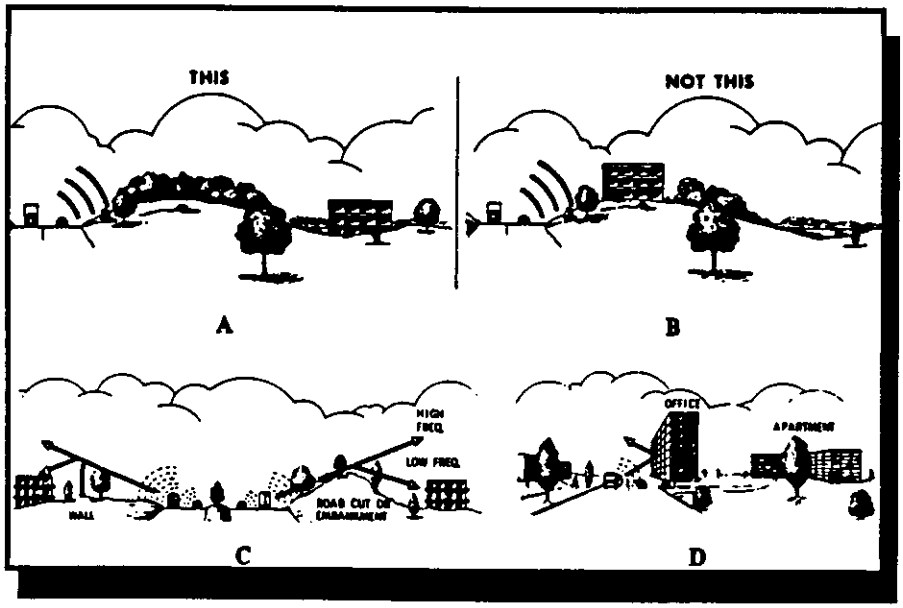

Figure 8.2: Noise Shielding

Table 8.2 Permissible Noise Exposure (a)

Duration Per Day, Hours:	Sound Level dB(A) Slow Response (b)
8	90
6	92
4	95
3	97
2	100
1.5	102
1.0	105
0.5	110
0.25	115

NOTE: (a) when the daily noise exposure is composed of two or more periods of different levels, the combined effect should be considered, rather than the individual effect of each. That is, if the sum of the following fractions exceeds unity (1), then the mixed exposure is considered to exceed the limit value.

(b) slow response refers to the speed with which the metering circuit and meter respond. There are two different averaging times: (1) "fast," which has a time constant of about 1/8 sec, and (2) "slow," which has a time constant of about 1 second.

Some types of ear protectors are earplugs, earmuffs, communication headsets, and helmets **(Figure 8.3)**.

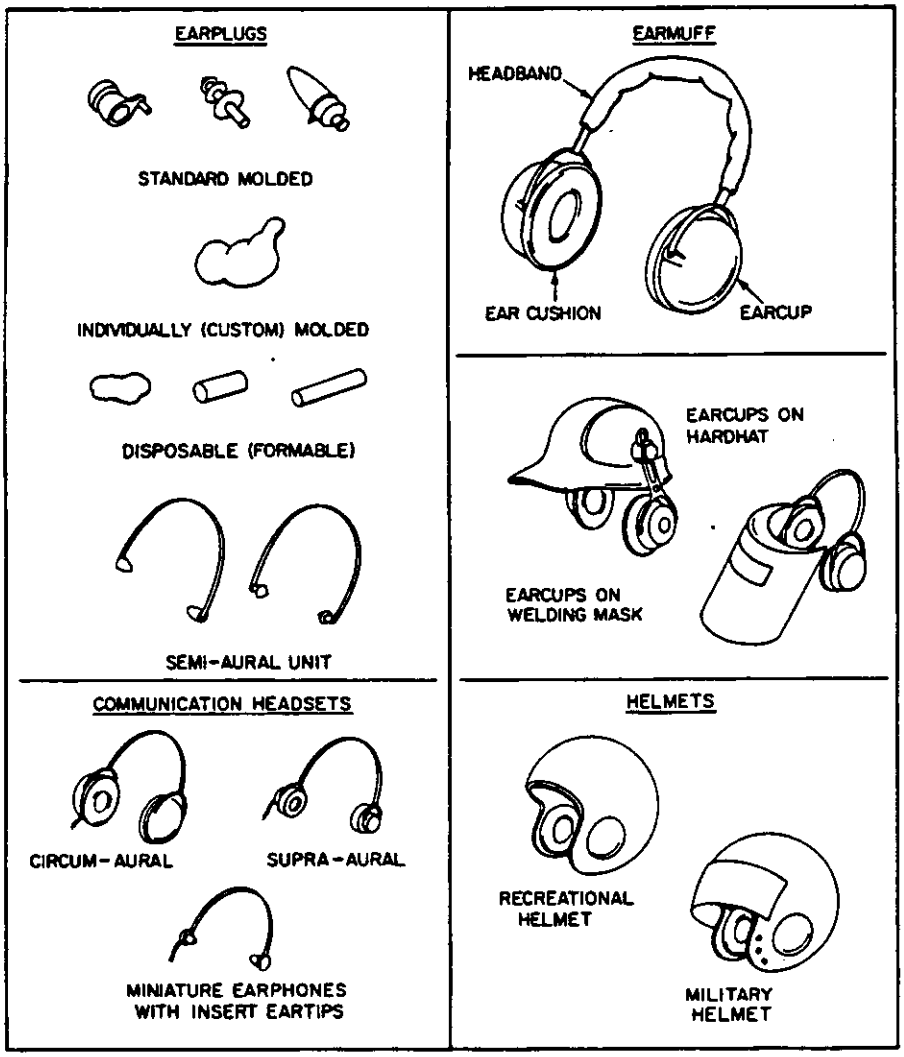

Figure 8.3: Hearing Protection Devices

(2) Booths

Partial enclosure and isolation of the receiver in a booth will help protect the worker from exposure to harmful noise.

(3) Hearing Conservation Programs

This program is designed to protect the hearing of employees from the effects of high levels of noise exposure at their place of work. Its major components are:

(a) Noise analyses to determine the possible need for a program.

(b) Engineering controls to reduce noise at the source

(c) Administrative or scheduling controls to keep the employee's noise exposure within safe limits

(d) The issuance and supervised use of hearing protective devices

(e) Initial and follow-up audiometric testing

(f) Evaluation of the audiometric test results and appropriate referral of employees with significant hearing problems and with ear complaints

(g) An employee education program

(4) Administrative Controls

If reduction of noise level cannot be achieved because it is unavoidable, workers should be rotated in order to reduce exposure time to harmful noise environments.

8.3 Noise Induced Disorders

8.3.1 Sleep Interference

Construction activity and sleep do not commonly occur during the same hours, however, according to the EPA there are still an estimated 3 million adults and about 2.5 million children 4 years old and under affected by construction noise sleep interference. The time required to go to sleep increased by as much as 1 to 1.5 hours at noise levels of 50 to 60 dB(A) according to a study performed by the Russian Government on apartment residents near major Moscow traffic arteries. It was found that the depth of sleep decreased by 60%, and that people felt tired and had headaches after they awoke. Normal sleep was found to occur at noise levels not exceeding 30 to 35 dB(A) [6]. Levels of construction noise ranging near 50 dB(A) are apparent even at great distances from construction sites. According to the EPA, sleep interference occurs at a moderate level of 40 dB(A) and an appreciable level of 70 dB(A).

8.3.2 Speech Interference

Satisfactory communication (95% of sentences understood) is capable at a distance of five meters (16 ft) with 50 dB of noise. For noise above 50 dB it will be necessary to raise the voice level at least 3 dB for every 10 dB increase in noise level. According to the EPA, adequate verbal communication in the home is considered to be 98% of all sentences comprehended or 85% of the words. Nominal vocal effort is approximately 65 dB at a distance of 1 meter. This level of speech is capable at a speaker-listener distance of approximately five meters at 45 dB. Five meters is the maximum distance a normal level of conversation in a quiet outdoor environment can be held. Speech is affected the most by construction site noise. Noise levels in all phases of construction are capable of interfering with speech. According to the EPA, approximately 34 million people suffer as a result of exposure to construction site noise in the United States.

8.4 Laws Governing Noise Pollution

8.4.1 Noise Control Act of 1972 (P.L. 92-574, 86 Stat. 1234)

This act established a national policy "to promote an environment for all Americans free from noise that jeopardizes their health and welfare." Through the act, Congress required the EPA to compile and publish a report or series of reports "(1) identifying products which in its judgment are major sources of noise, and (2) to give information on techniques for control of noise from such products, including available data on the technology, costs, and alternative methods of noise control."

8.4.2 OSHA 1926.52 - Occupational Noise Exposure

As mentioned earlier in section **8.2.3(1)**, personal protective equipment must be provided and worn by employees exposed to sound levels exceeding those listed in **Table 8.2.**

This regulation also states that no worker should be exposed to steady sound levels which exceed 115 dB(A). In addition, impulsive or impact sounds to which workers are exposed should not exceed a peak sound pressure level of 140 dB.

8.4.3 National Environmental Policy Act of 1969 (P.L. 91-190) Environmental Impact Statements

Section 102(2)(c) of the National Environmental Policy Act (NEPA) requires that an environmental impact statement (EIS) be prepared for all "major federal actions signficantly affecting the quality of the human environment."

The goal of an EIS and the subsequent environmental impact review process is to achieve desired objectives with the minimum expenditure of irreversible resources and social costs through a long-range cost-benefit analysis.

Noise is an important factor to be included in the planning process and to be analyzed in an EIS. It should be considered with factors such as air pollution, water pollution, thermal pollution, and chemical hazards.

The goals of an environmental impact statement related to noise are:

(1) To determine the change in the noise environment that may occur as a result of a proposed action.

(2) To discuss the change in terms of its effects on the population or the land exposed.

The following types of actions and projects may require detailed noise analysis and reporting in the EIS:

(1) Regulations and administrative actions to abate noise

(2) Regulations and administrative actions not aimed at noise but that could lead to significant changes in either ambient noise levels or shift in population densities

(3) Construction projects involving highways, airports, or mass transit systems

(4) Urban and commercial developments

(5) Construction of power plants and erection of power transmission lines

The steps taken in the preparation of such a statement are shown in **figure 8.4** (Gierke, Yaniv, Blackwood, 1979).

8.4.4 Department of Housing and Urban Development Act of 1965 (24 CFR 51)

The purposes of the Housing and Urban Development (HUD) noise policy is to:

(1) Call attention to the adverse psychological and physiological effects of noise

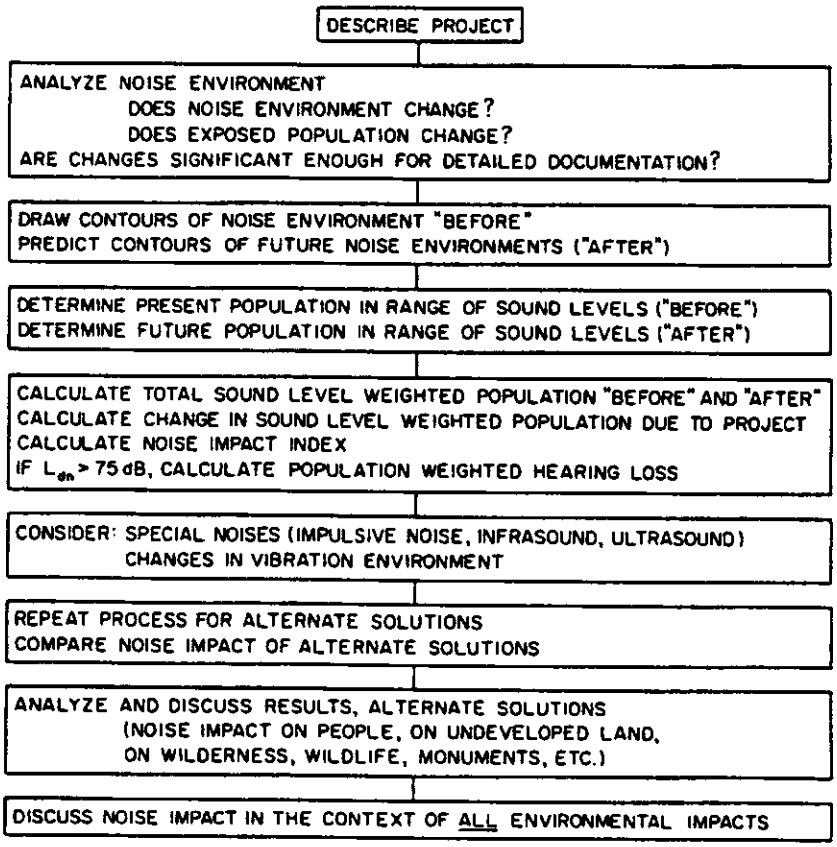

Figure 8.4: Preparation of noise Statement

(2) Call attention to the economic losses which may be caused by noise

(3) Encourage the control of noise at its source in cooperation with other federal departments and agencies

(4) Encourage land use patterns for housing and other municipal needs that will separate uncontrollable noise sources from residential and other areas sensitive to noise

(5) Prohibit HUD financial support for new construction on sites which have unacceptable noise exposure

HUD recognizes noise as a major source of environmental pollution and in its efforts to provide suitable living environments, has developed guidelines for the construction of new buildings. The guidelines

divide sites into the following noise zone categories: **Acceptable, Normally Acceptable, Normally Unacceptable,** and **Unacceptable. (See Table 8.3)**

Table 8.3 External noise exposure standards for new construction sites (From U.S. Department of Housing and Urban Development, 1971.)

No.	Noise Level	Category
1	Exceeds 80 dB(A) for 60 min/24 hr or 75 dB(A) for 8 hr/24 hr	Unacceptable
2	Exceeds 65 dB(A) for 8 hr/24 hr	Normally Unacceptable
3	Does not exceed 65 dB(A) for more than 8 hr/24 hr	Normally acceptable
4	Does not exceed 45 dB(A) for more than 30 min/24 hr	Acceptable

Table 8.3: Acceptable Decibel Levels

In the Acceptable and the Normally Unacceptable noise zones there are no special requirements since sites in these zones are not considered to have a noise problem.

There are special requirements and approvals necessary for Normally Unacceptable and Unacceptable noise zones in order to meet site acceptability standards.

Approvals in a Normally Unacceptable noise zone require:

(1) That housing be provided with special noise attenuation measures
(2) The concurrence of the HUD Regional Administration in whose jurisdiction the project lies
(3) The preparation of an Environmental Impact Statement

Approvals in an Unacceptable noise zone are strongly discouraged since only the Secretary of HUD can approve such sites after an EIS has been filed (Miller, 1979).

8.5 Construction Site Noise

Construction equipment is one of the categories specifically identified as a major noise source in

the Federal Noise Control Act of 1972. Two types of noise control standards must be met by all users of construction equipment:

(1) Product noise emission standards which place limits on the amount of noise the equipment may produce

(2) Construction site noise standards which establish maximum values of sound level permissible at the boundaries of a construction site

According to the General Services Administration:

"Equipment to be employed at sites of Federal Government structures under contract with the General Services Administration shall not produce A-weighted sound level exceeding the following limits at a distance of 50 feet (15.2 m) from the equipment under test" **(see Table 8.4).**

"The Contractor shall comply with all applicable state and local laws, ordinances, and regulations relative to noise control.

Stationary equipment may be provided with acoustical enclosures to provide the required sound attenuation subject to continued maintenance of such enclosures to assure that maximum sound levels are not exceeded.

Where field sound measurements indicate sound levels exceeding those listed above, Contractor shall cease operating such equipment and repair or replace it with equipment complying with these sound levels."

NOTE: Contractors are permitted to use current equipment which is capable of exceeding those limits specified above as long as they are operated in such a manner as not to exceed those limits.

According to the EPA, construction site noise can be reduced by:

(1) Replacing the noisy operations with less noisy ones

(2) Selecting the quietest among alternative equipment

(3) Scheduling noisiest operations to keep average levels low and to have noisiest operations coincide with times of highest ambient levels

(4) Keeping noisy equipment as far as possible from site boundaries

(5) Providing enclosures for stationary items of equipment and barriers around particularly noisy areas on the site or around the entire site

Table 8.4 Maximum Equipment Noise at sites of Federal Government Structures

EQUIPMENT	A-Weighted Sound Level, dB(A)
Earthmoving:	
Front Loader	75
Backhoes	75
Dozers	75
Tractors	75
Scrapers	80
Grader	75
Truck	75
Paver	80
Materials Handling:	
Concrete Mixer	75
Concrete Pump	75
Crane	75
Stationary	
Pumps	75
Generators	75
Compressors	75
Impact	
Pile drivers	95
Jackhammers	75
Rock drills	80
Pneumatic tools	80
Other	
Saws	75
Vibrators	75

A combination of the above methods is the most economical way of reducing noise. Proper maintenance and operation is also important in reducing the noise from construction equipment (Leasure, 1979).

8.5.1 Federal Noise Emission Standard For Construction Equipment Subpart B - Portable Air Compressors (40 CFR 204)

In 1974, the EPA formally identified portable air compressors as a major source of noise. The reason for choosing this equipment is shown by their total sound energy per day contributed to construction site noise. This standard went into effect January 1, 1978, for air compressors with maximum rated capacity of less than or equal to 250 cubic feet/minute (cfm). The emission standard for this air compressor is 76 dB(A). On July 1, 1978, for units with maximum rated capacity greater than 250 cfm, the emission standard became 76 dB(A).

8.6 Employer's Responsibility

Noise will always be part of the environment. It will especially exist in a construction site environment, ranging from residential to industrial. It becomes the responsibility of the employer to become aware of the hazards of exposure to harmful noise. The employer should be knowledgeable in noise control for the sake of workers and the environment.

According to the code developed by a group of experts for the International Labour Office, the employer has three duties:

(1) The employer should be responsible for action to reduce by all appropriate means the exposure of workers to noise and vibration.

(2) The employer should be responsible for the organizational arrangements required to prevent the risks due to noise and vibration in the undertaking.

(3) The employer should establish and publish (preferably in writing) a general policy emphasizing the importance of prevention, and should take the decisions and the practical steps required to give effect to national regulations and to this code of practice.

8.7 Federal Agencies

The federal agencies having jurisdiction with respect to noise are as follows:

Department of Commerce -- National Bureau of Standards

Department of Health, Education, and Welfare

Department of Housing and Urban Development (land use and building materials aspect)

Table 8.1 Comparison of Noise and Air Pollution

	Air Pollution	Noise
Characteristics	Composed of potentially toxic chemicals which are both cumulative and residual. Subject to meteorological dispersion/ diffusion laws.	Made up of physical energy with wide variation in brief periods of time. The sound energy is additive. Sound decays over distance and ceases as soon as the sound source is stilled.
Measurement in the Environment	Time-concentration dose levels are easily assessed since variation does not occur rapidly.	Rapid changes in sound level preclude time-concentration assessment except with the use of cumulative measures, which are then related to an equivalent steady-state sound energy.
Measurement in the Human Body	Presence of toxicants in the body can be directly related to measurable reference concentrations and is often immediately identified by overt physiological reaction (e.g., respiratory attacks during high ambient chemical concentrations).	Observed in some instances as hearing impairment. No other readily identifiable physiological changes directly attributable to noise exposure. Annoyance cannot be correlated with noise levels alone since human reaction to noise varies greatly within and between persons.
Geographical Control	Air quality regions have been established to monitor and control ambient air pollutants traveling great distances and crossing geographical and political boundaries.	Noise travels only a relatively short distance from its source and, in most cases, within existing political and geographical entities.

Department of Labor -- Occupational Safety and Health Administration

Department of Transportation -- Assistant for Systems Development and Technology, Federal Aviation Administration Office of Noise Abatement

Environmental Protection Agency

National Aeronautics and Space Administration

8.8 Definitions

Noise Control — the technology of obtaining an acceptable noise environment, consistent with economic and operational considerations

Decibels	a unit for measuring the relative loudness of sounds
Sound Intensity	the average rate of flow of sound energy through a unit area in a sound field
Ambient Noise	all-encompassing noise associated with a given environment

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CHAPTER 9

RADON IN NEW CONSTRUCTION

9.0 Introduction

Radon is a gaseous element present to varying degrees in all soils and is constantly being released into the atmosphere. Radium, the immediate parent element of radon, decays from a solid to radon gas. Radon then decays into several short-lived solid elements called daughters or progeny that can be inhaled and lodge in the lungs. Recent reports in the scientific literature indicate that long-term exposure to this process even at relatively low radon levels can lead to health problems. The primary health problem associated with exposure to radon is an increased risk of lung cancer. The U.S. Environmental Protection Agency (EPA), based on studies by the National Academy of Sciences, estimates between 5,000 and 20,000 lung cancer deaths each year are attributable to radon.

9.1 Radon Source and Transport

Building materials, groundwater, and soils have all been identified as potential sources of radon. Building materials commonly used for residential construction in the United States are not believed to be major sources. However, groundwater can be a significant source in some areas. In areas where radon content is suspected to be high in local groundwater and where homes are served by well water, an investigation of the water supply can save unnecessary costs and effort that may otherwise be spent trying to reduce soil gas entry into the home. Measurement of radon levels in household water supplies should be considered when indoor test results indicate elevated radon levels that cannot be readily attributed to other sources, or if high levels of radon or radium have been identified in local groundwater.

Although present in all soils, the total radon content of a soil is not necessarily indicative of the amount of radon available for transport into a home. Radon is transported by two mechanisms: (1) convective flow, which is the movement of a gas driven by a pressure or temperature differential; and (2) diffusion, which is a random scattering of a gas from an area of high concentration to an area of lower concentration. Convective flow is thought to be the dominant mechanism of transport into most homes. As soil-gas radon moves through the soil, it can enter homes through cracks and openings in the foundation.

9.2Pre-Construction Planning

Although reliable methods for measuring radon concentrations in soil gas are available, the ability to determine radon risk prior to construction at a given site is not yet practical. This makes planning for radon-resistant construction difficult. Therefore, at this time builders are advised to consider some simple radon-resistant construction measures rather than spend money on inconclusive soil testing. The

EPA has recognized the difficulty of evaluating sites prior to construction and recommends that the following factors be considered when determining whether radon-resistant construction is necessary (EP-87):

·Have existing homes in the same geological area experienced elevated radon levels?

·Is the soil derived from underlying rock, such as granite, black shale, or phosphate-bearing ore, that normally contains above-average concentrations of uranium or radium?

·Is the soil relatively permeable or the rock structure fractured to permit radon to easily move toward the surface?

If the answer to any of these questions is yes, particularly to the first question, then builders are advised to consider incorporating some form of radon resistance into their construction.

9.3 Measuring Indoor Radon

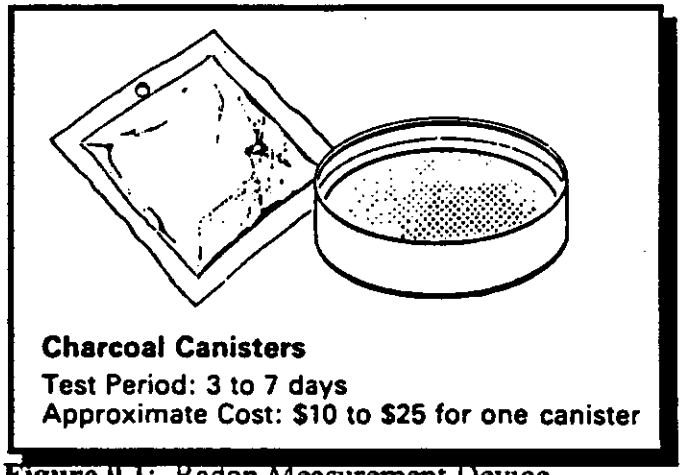
Radon is measured in **pico Curies** per liter of air (pCi/l), or alternatively in **Working Levels**. Pico is a prefix meaning one trillionth and Curie is a measure of radioactivity. A Working Level is a measure of the potential alpha energy associated with the decay process. Generally, pCi/l is used by the EPA in its literature describing radon risk, and is also preferred by most measurement laboratories.

Radon can be measured with a number of different devices, some passive (i.e. they have no moving parts) and others active. Active devices generally require trained operators and are much more costly to use than passive devices. Their application is usually limited to research or detailed building diagnostics. Passive devices are relatively inexpensive and easy to use, and therefore of more interest to the building industry. The most common passive devices are charcoal monitors, alpha track detectors (ATDs), and Electret Ion Chambers (EICs), which are explained below:

Charcoal monitors contain a measured amount of activated charcoal in a canister or sealed packet. When these monitors are exposed, radon is adsorbed onto the charcoal where it decays into its short-lived progeny. The radon level is then determined by measuring gamma radiation in the charcoal with a gamma detector (See Figure 9.1).

·Alpha-track detectors consist of a thin piece of alpha-sensitive plastic. Alpha energy from the decay of radon and radon daughters leaves scratches or "tracks" on the plastic. The number of scratches is proportional to the radon level. At the conclusion of the test, the tracks are counted, electronically or manually, under a microscope (See Figure 9.2).

·Electret Ion Chambers consist of an electronically-charged teflon disc within a small air-tight chamber. When opened, the disc's voltage is reduced in proportion to the radon decay process in the surrounding air. The drop in voltage is then measured and a corresponding radon level is calculated.



Charcoal Canisters
Test Period: 3 to 7 days
Approximate Cost: $10 to $25 for one canister

Figure 9.1: Radon Measurement Device

Alpha Track Detectors
Minimum Test Period: 2 to 4 weeks
Approximate Cost: $20 to $50 for one detector; discounts for multiple detectors

Figure 9.2: Radon Measurement Device

Although all three devices provide a time integrated average radon level, they can be used for different purposes. Charcoal monitors are typically deployed as screening measurements for a period of 3 to 7 days. ATDs are used for longer-term tests lasting from one month up to one year. Both of these devices require analysis in a laboratory. EICs can be used for short or long-term tests, and can be read in the field using a special voltage meter.

9.4 Interpreting Indoor Measurements

Indoor radon levels can vary significantly with seasonal changes, from day to day, and even from hour to hour. These variations severely limit the usefulness of short-term screening measurements in

predicting long-term exposures. Long-term tests of several months to a year in duration or the average result from a series of short-term measurements conducted at different times of the year can provide a more reliable estimate of annual radon exposure.

Contingencies based on results of radon screening tests are not considered appropriate in a sales contract for a home, since short-term screening measurements cannot be used to predict annual radon levels accurately. However, all homeowners are advised by the EPA to test their homes in accordance with accepted protocols. In order to reflect worst-case conditions, the EPA recommends conducting initial screening measurements in the basement or in the lowest living area of a home. All windows and doors should be closed for at least 12 hours prior to the start of the test, and should remain closed throughout the test except for normal ingress/egress.

Builders may wish to provide buyers with additional information on when, where, and how to test for radon. This information can be found in the EPA's A Citizen's Guide to Radon (EP-86), published in 1986 and available from the regional EPA offices and also from the "Radon Handbook for the Building Industry" by the NAHB National Research Center. A summary of EPA recommendations for evaluating results of screening tests is provided in Table 1.

The Indoor Radon Abatement Act of 1988 (the Act) adopts a goal of reducing indoor radon levels to or below ambient outdoor levels. Since the technology to achieve this goal does not yet exist, it is unclear how provisions of the Act will affect future EPA recommendations.

9.5 Radon Resistant Construction

The number of homes that may require radon mitigation is relatively small compared to the number of homes built each year. Since accurate identification of problem sites before construction is not yet possible, the EPA and the building industry have proposed an approach to minimize radon exposure by constructing homes to limit radon entry, and to provide for features that permit easy and inexpensive installation of additional measures, if needed, at a later date.

Experience gained through mitigation of existing houses is presented in the EPA publication Radon Reduction Techniques for Detached Houses, Technical Guidance, Second Edition (EP-88). In existing homes where no radon control measures were used at the time of construction, hidden entry routes and unknown conditions of sub-slab permeability can make effective radon mitigation difficult or prohibitively expensive. Application of radon-resistant techniques during construction offers an opportunity for greater control that will enhance the effectiveness of these techniques and will cost substantially less than post-construction mitigation. The following excerpt from this publication summarizes state-of-the-art practices for reducing radon risk:

·The first step includes "efforts to reduce soil-gas entry routes, including, for example, steps to avoid cracks in the concrete floor slab, sealing around utility penetrations through the slab and foundation walls, and sealing the top of sumps...".

·The second step includes provisions "during construction that will enable effective subslab suction after the house is built, if radon levels turn out to be elevated despite the preventive steps mentioned above.... These provisions include a 4-in. deep layer of clean crushed rock under the slab, with an interior or exterior drain tile loop which drains into a sump or which is stubbed-up or capped outside the house or through the slab. Alternatively, one or more 1-ft. lengths of PVC pipe can be embedded into the aggregate through the slab and capped at the top. These standpipes can later be uncapped and connected to a fan in suction (or to a passive convective stack) if needed."

·Another option often discussed is to reduce the "stack effect" that is believed to be an important factor influencing radon entry into heated buildings. The stack effect results from warm air rising within a building and escaping through openings in the upper portion of the building. The result of the stack effect is a depressurization of the lowest level of the building relative to the surrounding soil, which tends to draw radon in through any cracks, joints, or other openings. Methods to reduce the stack effect include the elimination of openings between floors and sealing the superstructure of the home. Reduction of the stack effect is not recommended as a stand-alone technique since there is insufficient data to predict its performance confidently.

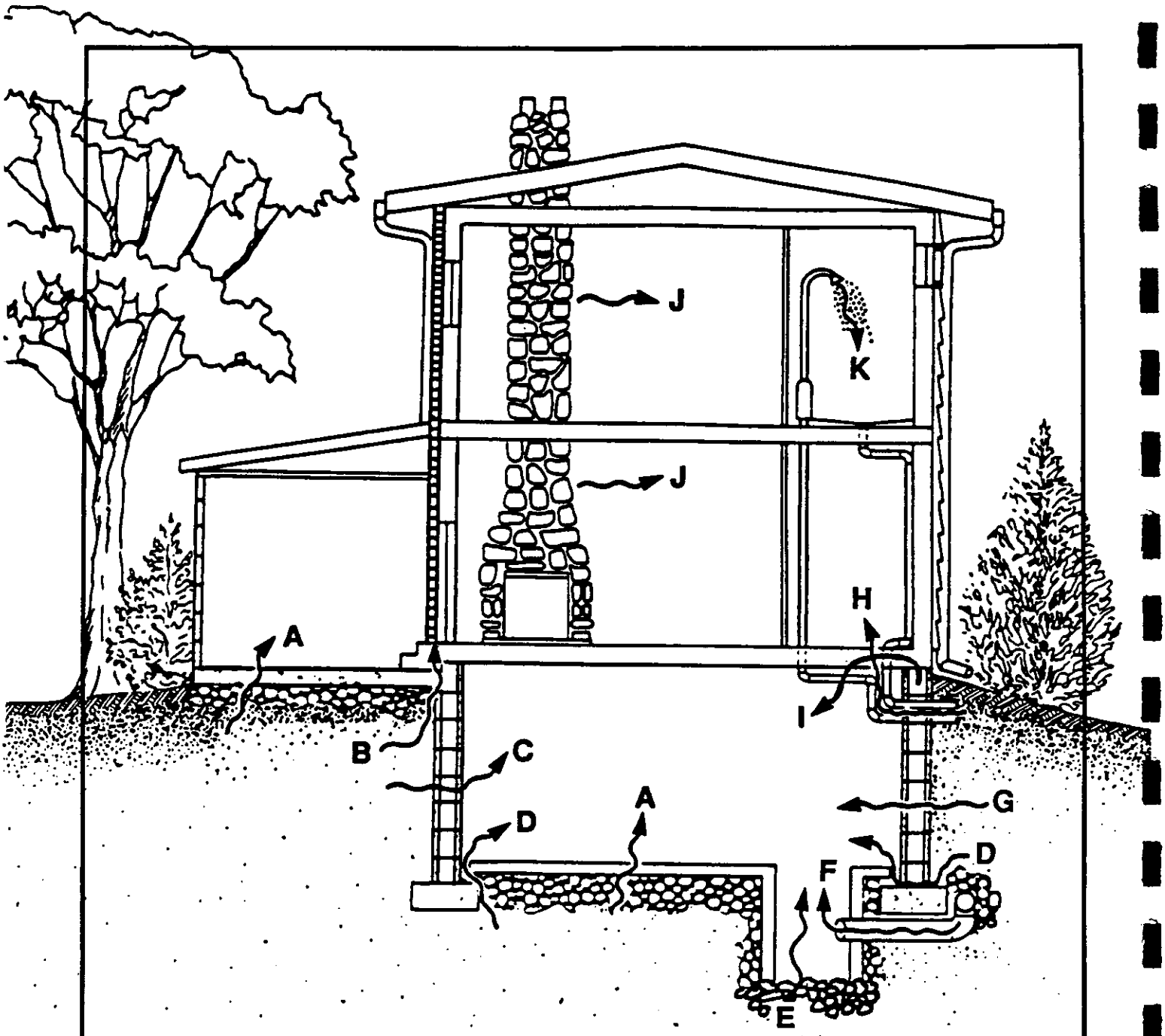
The preceding list should not be considered all-inclusive; rather it focuses on techniques that have demonstrated high success rates, are the most cost-effective, and offer practical solutions for new construction. Although these techniques represent the best available technology, they do not guarantee reduction of radon levels below a prescribed standard (See Figure 3 and 4).

Recommendations for reducing radon are provided according to the type of foundation. In homes with basement and slab-on-grade foundations, radon-resistant construction includes minimizing radon entry and providing for inexpensive post-construction installation of a subslab depressurization system. For homes built on a crawl space, options include limiting radon entry into the crawl space, venting the crawl space to the exterior with passive foundation vents or a fan-driven system, limiting radon entry into the home through floor openings and heating and cooling system duct work, and depressurization under a barrier installed over the crawl space floor. In homes constructed on a combination of foundation types, each area should be treated according to its particular foundation type.

Specific techniques for both pre- and post-construction mitigation are identified in the NAHB/NRC handbook.

Table 1 - Summary of EPA Recommendations for Follow-Up Actions

Screening Level (pCi/l)	Recommended Action
Less than 4	Follow-up measurements are probably not required.
Between 4 and 20	Perform follow-up measurements over a one year period, or obtain an average from a series of short-term measurements conducted at different times of the year, e.g. expose detectors for a one week duration during each of the four seasons.
Between 20 and 200	Perform follow-up measurements At these levels it is important to obtain readings that are as accurate as possible in a short period of time. Expose detectors for no more than three months.
Greater than 200	Perform follow-up measurements as soon as possible. Expose detectors for no more than one week. The homeowner/occupant should also consider taking immediate actions to reduce radon levels in the home.



MAJOR RADON ENTRY ROUTES

A. Cracks in concrete slabs
B. Spaces behind brick veneer walls that rest on uncapped hollow-block foundation
C. Pores and cracks in concrete blocks
D. Floor-wall joints
E. Exposed soil, as in a sump
F. Weeping (drain) tile, if drained to open sump
G. Mortar joints
H. Loose fitting pipe penetrations
I. Open tops of block walls
J. Building materials such as some rock
K. Water (from some wells)

Figure 9.3: Radon Entry Routes

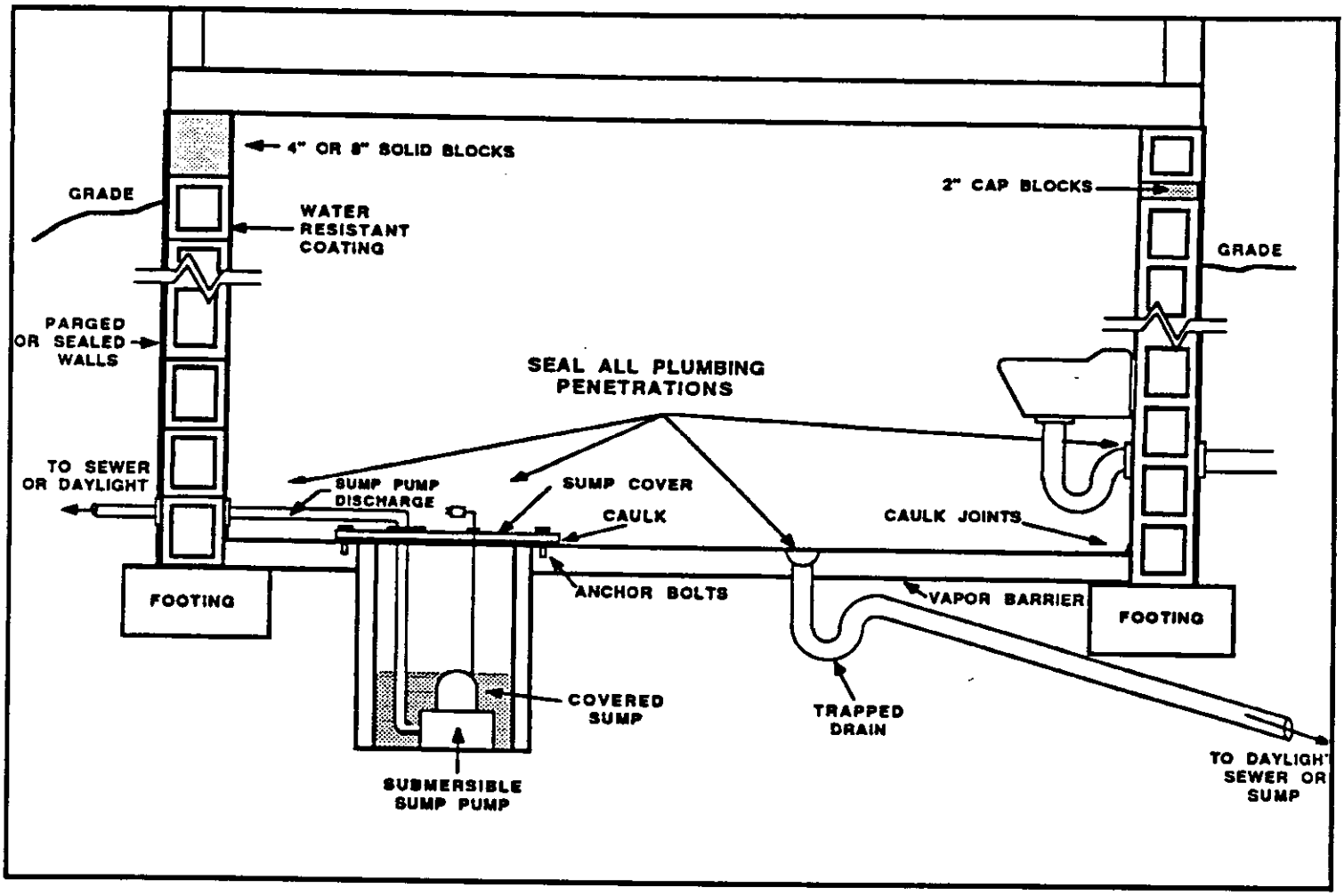


Figure 9.4: Methods to Reduce Pathways for Radon Entry

9.6 Radon Liability Provisions

Concerns over legal responsibilities of builders and homeowners is a natural by product of the radon issue. As with any transaction, clear and concise contract language is important. Home buyers should be fully aware of what is being purchased, who is responsible for specific conditions, and where that responsibility ends. From the builder's perspective, the best intentions to build safe, quality housing do not always guarantee protection against legal action. Builders and prospective home buyers should familiarize themselves with the laws of their state, since each state has its own set of laws governing liability.

Although understanding the dynamics of radon contamination is the first step in reducing health and legal risks, there are a number of other actions that can benefit both the builder and the home buyer. The following is a summary of these actions:

·Homes should be constructed using widely-recognized techniques that help prevent radon infiltration. Builders and buyers should know, however, that no radon-resistant construction technique is foolproof, that radon-resistant techniques will add to the price of a home, and that most techniques require homeowner maintenance.

·A specific language regarding radon or indoor air quality should be included in the contract. The primary objective is to educate, inform and warn potential buyers as much as possible with accurate information.

·Home sales should not be contingent upon the results of a short-term radon test. EPA's discussion of radon levels and associated health risks are based on the average annual level of radon in a home and lifetime exposures to those levels. Short-term tests are not reliable measures of the average annual level, nor do they accurately assess the health risks faced by exposure to radon. Until technology progresses to the point where long-term exposures can be estimated from short-term tests, contract contingencies based upon the results of a short-term test should be avoided.

A sales contract should not create any contractual responsibility for indoor radon levels on the part of the seller. Given its natural cause and the wide hourly, daily, and seasonal fluctuations of radon levels (see Figure 20), a builder or seller should not be expected to warrant any specific radon levels. Any express warranties should be very specific, enumerating each item or condition to be covered. General or broad terms should be avoided. Warranties on workmanship should be referenced to the standards of construction in the jurisdiction in which the home is located.

·A contract should disclaim or waive all warranties, expressed or implied, that are not specifically enumerated in a limited express warranty. While some states will not enforce this disclaimer as to implied warranties, about twenty have specifically allowed the disclaimer and the trend is increasing. The disclaimer language should be simple, clear and conspicuous (for example, putting it in all capital letters). The important point is to specify exactly what is and is not warranteed. The contract should not leave any room for interpretation by either party to the contract. A disclaimer of implied warranties should also be accompanied by a limited express warranty.

·Builders should consider the importance of selecting subcontractors who are informed on radon and understand the impact that their work can have on the radon-resistance of a home. As a final measure, builders should negotiate an "indemnification and hold harmless" clause in their contracts with foundation and ventilation subcontractors, and with design professionals.

9.7 Definitions

Pico Curies	A prefix meaning one trillionth and Curie is a measure of radioactivity.
Working Levels	A measure of the potential alpha energy associated with the decay process.

9.8 Work Cited

A Citizen's Guide to Radon: What It Is and What to Do About It. (August 1986). U.S. Environmental Protection Agency.

Radon Handbook for the Building Industry, NAHB National Research Center

CHAPTER 10

PROTECTION OF PLANTS AND WILDLIFE

10.0 Introduction

With a population approaching 14 million, citizens, land developers and the construction industry must be well informed concerning environmental issues if Florida's fragile ecosystems are to survive into the twenty-first century. Florida's habitat contains many complex animal and plant communities. Florida has the second highest number of endemic (restricted to a region) species in the continental United States. The state of Florida is home to 425 species of birds, 3500 plants, and 65 snakes. Only California has greater diversity. Due to this complexity, it becomes each individual's responsibility to understand how he or she affects Florida's environment. Ecology (from the Greek **oikos**, "home") is the study of how organisms interact with their environments. An environment is described by factors such as climate, light, topography, soil, availability of water, and other interaction with other organisms. Environments tend to exist on vast scales whereas communities are an assemblage of species living close enough together for potential interaction. Since extinction occurs one species at a time, the effects will involve will involve the entire community. A drastic decrease in the number of a particular species often leads to a disruption in the balance of nature within that ecosystem. Therefore, the primary concern, whenever a habitat is effected or engaged, must be to account for the community as a whole.

10.1 Species Stability

In the basic sense, species diversity is the richness of number of species which make up an individual community. Some species may be quite rare in a community, whereas other species may be plentiful (Campbell, 1987). The more plentiful species tends to dominate or have a major impact on a community. A shift, positive or negative, in the number of a dominant species will often cause a shift in the balance of other species in the system. The ability of a community to bounce back to its original composition in the wake of some disturbance if often referred to as the community stability (Campbell, 1987). Common disturbances include fire, disease, and human interference. Often, human interference tends to be greater than nature's ability to regenerate and continue within that system. Each species has a geographical range, within which individuals are not spread out evenly, but are usually concentrated in several localized populations. In the unfortunate event that several of these populations become depleted, extinction often occurs.

10.2 Habitat and Extinction

Two species cannot continuously occupy the same niche in society. When two species coexist, eventually one dominates the other which leads to the demise of the less fortunate species. When a person walks

through a forest and views various species of small seed-eating birds, they must be utilizing the habitat in different ways. "It should be clear that the processes of life are complex, interactive and responsive. Because life is such an interactive process, it is important to keep in mind that if one part changes, the effect can ripple through other parts, sometimes in unexpected ways." (Wallace, 1987). For instance, suppose the only deciduous (with leaves) trees in the system were oaks and construction or disease wiped out all oaks in the area. What would be the effect on other life forms in this area? Large shrubs would be unprotected and possibly die out leaving only ground-level grasses and shrubs. The number of herbivores (plant-eaters), such as rabbits, squirrels, mice, and birds, might increase due to this ideal shelter. The carnivore (meat-eating) populations may begin to decrease due to a lack of shelter. This may in turn place new pressure on plant life to feed an increasing herbivore population. Therefore, competition may destroy several species of plants, reducing the number of seed-eating birds. A decrease in predator birds, such as hawks and owls may lead to an increase in frogs and insects. What will then happen to insect-eating birds? What might happen to the number of snakes? The possibilities are endless, yet this example shows the complex nature and often fragile state of an ecosystem. What can be learned from this example? Should we be concerned that over 150 major species of animals have been eliminated in the last 50 years? Should we start worrying about the thousands of endangered species - many of which are the result of our activities?

10.3 Endangered and Threatened Species Protection

Federal and state government may create legislation for the protection of plant and animal species of special concern and threatened or endangered species.

10.3.1 Federal Statutes

Section 9 of the Endangered Species Act of 1973, as amended, states that it is unlawful for any person subject to the jurisdiction of the United States to take (defined as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct.) any listed species anywhere within the United States. Persons violating the provisions of Section 9 of the ESA may be fined up to $20,000 or imprisoned for up to 1 year or both.

The Migratory Bird Act (16 U.S.C. 703-711) makes it unlawful to "pursue, hunt, take, attempt to take, capture, kill, possess, offer for sale, sell any migratory bird or any part, nest or eggs of any such bird." Persons violating any part of the MBTA may be fined up to $2,000 or imprisoned for up to 2 years or both.

The Bald Eagle Protection Act (16 U.S.C. 668-668d), and the regulations derived from (50 CFR 22), state, in part, that no person "shall take (defined as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb.") any bald eagle or any golden eagle, alive or dead, or any part, nest, or egg thereof." Persons violating any part of the BEPA may be fined up to $10,000 or imprisoned for up to 2 years or both. **(Figure 10.1)**

10.3.2 State Statutes

Rule 39-27.011 of the State of Florida Wildlife Code (Chapter 39, Florida Administrative Code) states "No person shall kill, attempt to kill, or would any endangered or threatened species." Rule 39-27.002 states, in part "No person shall pursue, molest, harm, harass, capture, or possess any endangered or threatened species or parts thereof of their nests or eggs." Persons violating this rule may be convicted of a second degree misdemeanor punishable by a $500 fine or up to 60 days in jail or both.

The bald eagle, wood stork, Florida jay scrub (**Figure 10.2**), least tern, and the gopher tortoise are listed as threatened species by the State of Florida according to the "Official Lists of Endangered and Potentially Endangered Fauna and Flora in Florida" dated 1 April 1991.

Figure 10.1: Bald Eagle

10.4 Florida Ecosystems

Pine flatwoods may be the most wide-ranging ecosystem in Florida. This system may also be the ecosystem which has been most influenced by humans. The characteristics which best describe a pine flatwood include low, flat topography, relatively poorly drained, acidic, sandy soil sometimes underlain by an organic horizon (Abrahamson, 1990). Pine flatwoods are generally made up of an open over story of pines, extensive low shrubs, and a grassy layer. Forest fires play an important part in the survival of

Figure 10.2a: Scrubjay

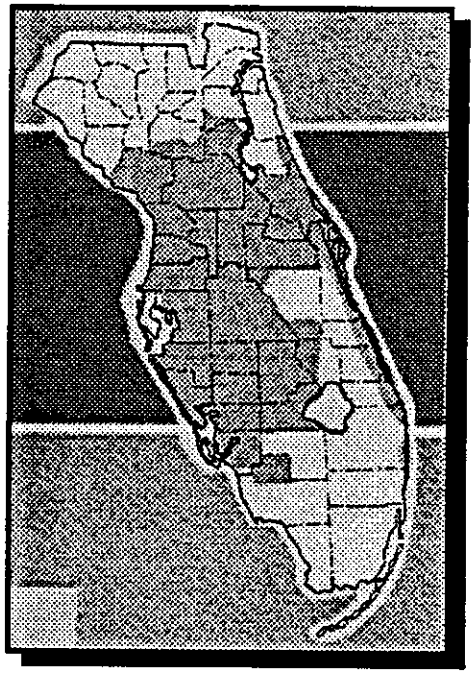


Figure 10.2b: Scrubjay Nesting Places

the pine flat wood ecosystem. Due to human interference such as roads, housing communities, commercial development, reductions in fire frequencies and average area burned per fire event have led to a decrease in the natural renewal process. Approximately fifty percent of the land area in Florida is pine flatwoods (**Figure 10.3**). A large share of plant species which are endemic to Florida are found within this particular ecosystem. This habitat maintains vast populations of birds, small and large mammals, amphibians, and reptiles. The white-tailed deer, black bear, and the Florida panther are three native large mammals which use pine flatwoods. The pine flat wood habitat supports many endangered, threatened, and rare animal species including the fox squirrel, southeastern kestrel, red-cockaded woodpecker, mole snake, Miami black headed snake, and the striped newt. Due to increasing protection of poorly drained wet land ecosystems, the most extensive alterations of Florida's ecosystems will occur in flatwoods.

Florida's dry prairies are open, grassy expanses which provide the primary habitat for several distinctive bird species, including the threatened crested caracara, burrowing owl, grasshopper sparrow, white-tailed kite, least shrew, Florida scrub jay and the Florida sandhill crane. Dry prairies and flatwoods often occur in close proximity and share similar characteristics.

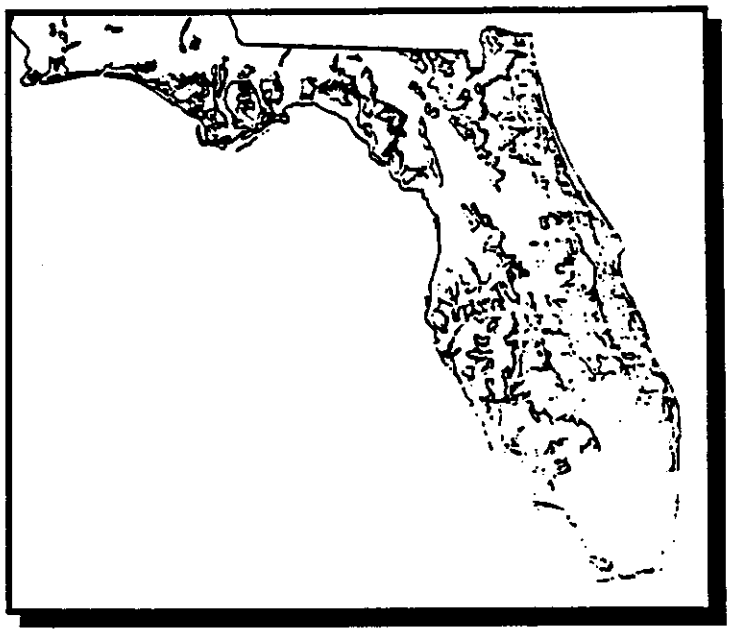


Figure 10.3: Pine Flatwoods and Dry Praries

The rockland ecosystem exists primarily on marine limestone outcrops. Rock lands make up a very small percentage of Florida's ecosystems (**Figure 10.4**) and they continue to shrink in size due to the pressure of economic development. Much of the land cleared in Miami and the Florida Keys has cut away at the rocklands. Rock lands are an endemic home to many threatened and endangered species including the Big Pine partridge pea, wedge spurge, Small's milk pea, Everglades peperomia, Key tree cactus, Key Largo wood rat, silver rice rat, Key Vaca raccoon, Key deer, Big Pine Key ring neck snake, Florida Keys mole skunk, and the Key mud turtle. Many of these species do not cross into other ecosystems. Therefore, as rocklands decrease in size, the populations of these endemic species decrease in size respectively.

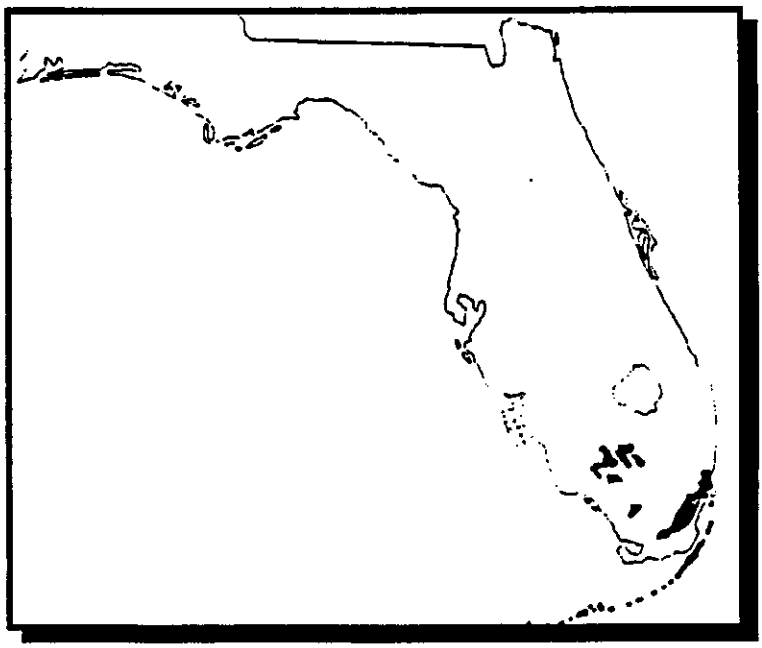


Figure 10.4: South Florida Rockland

Wetlands are comprised of marshes and swamps. More than half of the state was originally made up of wetlands. Today, only 10 percent of Florida's landscape is made up of wetlands. This decrease is due to drainage and filling of swamps and mosquito control in marshes. Swamps provide many ideal necessities for a wide variety of animals including food, shelter, nesting sites, and hibernating places. Left intact, wetlands provide many services which are valuable to society. Many species breed in wetland areas and species types are diverse. Foodplain forests serve as flood control areas without dams or other water level regulators. Stillwater swamps proved ideal wastewater treatment systems and retention areas for stormwater management systems. Wetlands provide a natural means for water to percolate into aquifers rather than evaporate. Due to the richness and complexity of wetlands, they have become the most regulated and protected ecosystem in the state of Florida. The Warren S. Henderson Wetland Protection Act of 1984(FS 403.918) provides criteria for permit issuance, enforcement, consideration of cumulative impacts, and establishes regulatory criteria for using wetlands for wastewater disposal (see Chapter 3).

Marshes make up approximately one-third of Florida's wetlands (**Figure 10.5**). Marsh ecosystems include bogs, fens, mires, prairies, savannas, wet savannas, reed swamps, and swamps. The term **swamp**, however, is more appropriately restricted to forested or wooded wetlands. The objective of marshland conservation in the state of Florida is the purchase and reflooding of drained marshes.

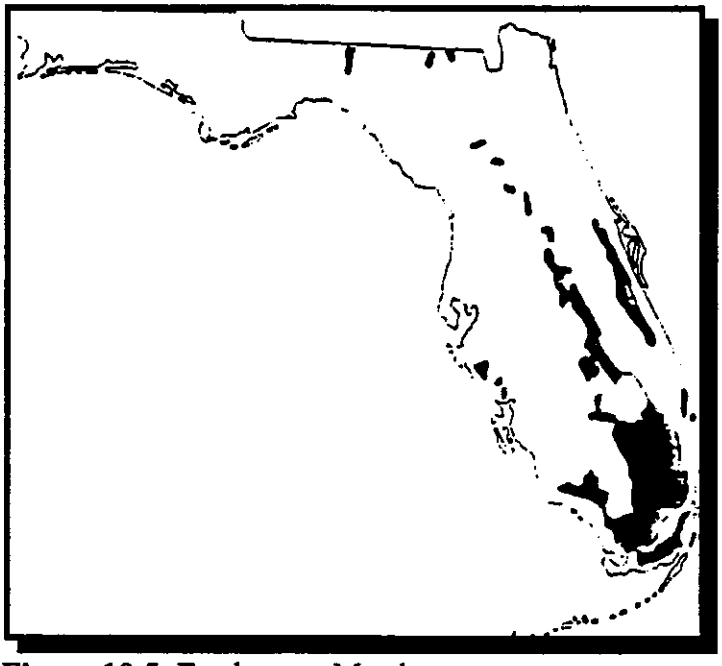


Figure 10.5: Freshwater Marshes

Mangroves are an important ecosystem which help to stabilize sediment along parts of Florida's coastline (**Figure 10.6**). Until approximately 25 years ago, mangrove forests were given little protection from alteration and development. Thousands of acres were destroyed and replaced with filled and developed land. The role of a mangrove forest is to stabilize sediments deposited by physical processes so that

mangroves may act as positive land stabilizers (Odum and McIvor, 1990). Florida mangrove ecosystems provide habitat for 220 species of fishes, 24 species of reptiles, 18 species of mammals and 181 species of birds.

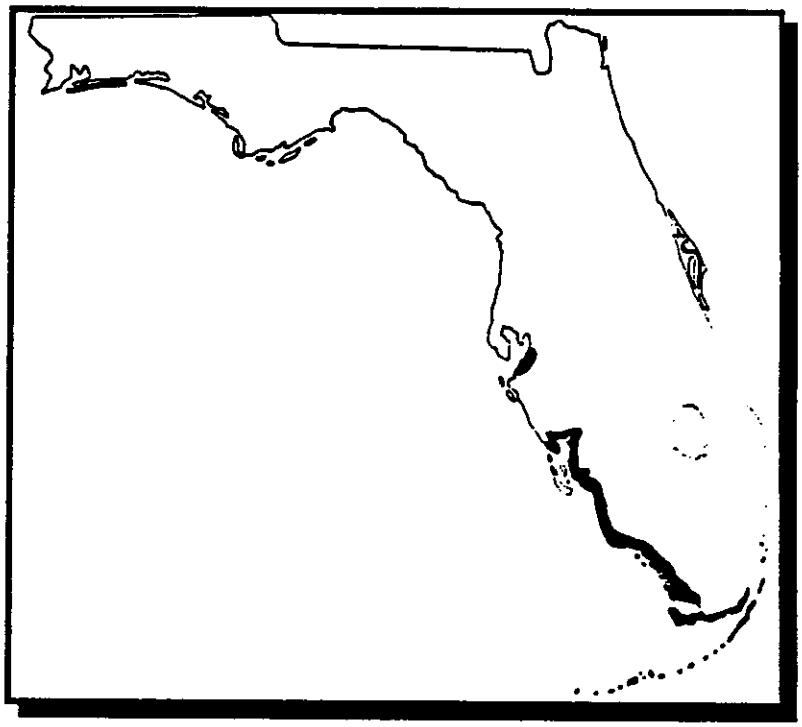


Figure 10.6: Mangrove Areas

10.5 Contractor's Obligations

Florida has the longest coastline in the continental United States. Sea turtles depend on beaches for nesting sites. Of the seven turtle species, five have worldwide distributions in tropical and subtropical seas, including the waters off the Florida coast (Johnson and Barbour, 1990). The most important nesting sites of the loggerhead in its New World range are along Florida's beaches (**Figure 10.7**). It has been widely assumed that female loggerheads return to their natal beaches. Tagging has shown that female sea turtles return to the same beaches to nest. The total population of nesting females along the east coast of the United States is estimated to be about 14,000 (Hopkins and Richardson, 1984). Major threats to the sea turtles in Florida are destruction of suitable habitat above high tide by the building of seawalls; predation of eggs by raccoons; and lights, which disorient the hatchlings and cause them to head toward the lights instead of toward the sea (Carr, 1984). Nesting is most concentrated along the middle-eastern coast of Florida. The highest densities occur from Cape Canaveral to Sebastian Inlet. Along the highly developed coasts of Palm Beach and Broward counties, high nest densities are encountered. In Broward County, about 60 percent of the nests must be dug up and the eggs either reburied in more suitable sites or hatched artificially and then released in order for them to survive threats from human activities (Fletemeyer, 1985).

The gopher tortoise is one of the most at risk species in the state of Florida. Gopher tortoises dig deep, long lasting burrows which may be also used as shelter by many other animals. More than 80 species of wildlife are known to use gopher tortoise burrows (Franz, 1986). Many experts agree that the major threat to gopher tortoise population, in Florida, is the extensive land alterations that accompany rapid human populations (Diemer, 1986). Auffenberg and Franz (1982) predict that gopher tortoise populations, in Florida, will fall to threatening low levels and be eliminated from all unprotected lands by the year 2025. The Florida Game and Fresh Water Fish Commission has classified the gopher tortoise as a Species of Special Concern (Wood, 1986). Care must be taken when altering lands inhabited by gopher tortoises. For the purposes of law enforcement and permitting, "taking" includes the entombment or killing of gopher tortoises as a result of bulldozing, grading, paving, or building construction.

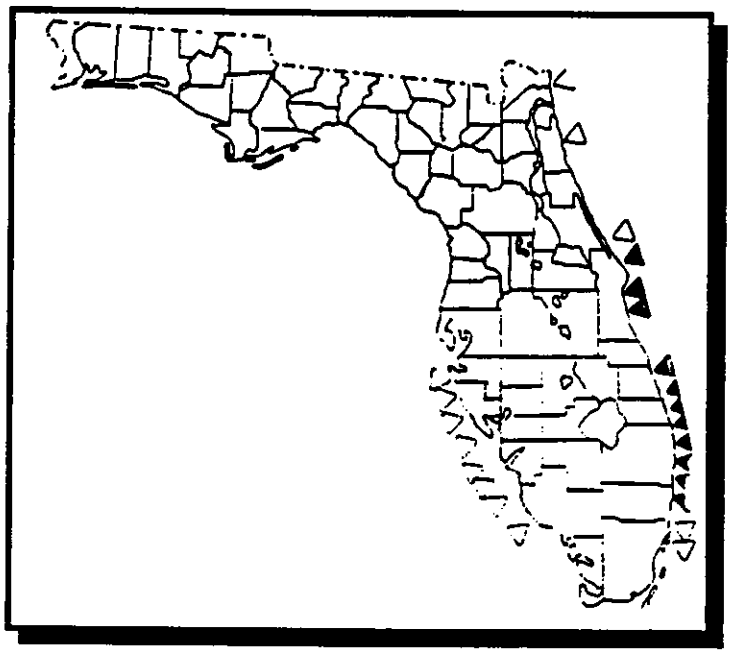


Figure 10.7: Nesting Sites of Loggerhead Turtles

Information about the populations, importance, and guidelines for permitting when interacting with protected species may be obtained from the local Office of Environmental Services (OES). The literature concerns the gopher tortoise, Florida scrub jay, wood stork, burrowing owl, osprey, least tern, bald eagle, and many other protected species.

10.6 Permitting

The Florida burrowing owl is listed by the State of Florida Game and Fresh Water Fish Commission (FGFWFC) as a Species of Special Concern (FAC 39-27.005). FGFWFC's policy is to issue permits to destroy burrowing owl nest burrows only as a last resort, after all reasonable alternatives have been shown to be impractical. When such permits are issued, they apply only to burrows containing no eggs

or flightless young. Burrowing owl nests can generally be considered inactive from 10 July to 15 February. Between 15 February and 10 July, burrows are considered active nests unless information is available to suggest otherwise. Burrowing owls often nest on vacant lots in rapidly developing suburban areas. In these areas, home construction is the major cause of burrow destruction. A FGFWFC permit is not necessary to build a home on a lot when a safe distance (at least a 10-ft. radius circle) can be provided around the borrow, but cautionary measures must be taken to guard against accidental destruction of the nest. The burrow entrance must be left open and may not be plugged or impeded in any way. To request a permit to take a burrowing owl nest, submit an application packet to the Nongame Wildlife Section Supervisor, Florida Game and Fresh Water Fish Commission, 620 S. Meridian Street, Tallahassee, FL 32399-1600. The packet must contain: (1) a letter stating the location of the burrow(s), (2) a statement as to why the borrow(s) must be destroyed, (3) a site plan or scaled diagram of the property that shows the location of the burrow(s) relative to the proposed construction, and (4) a statement of mitigation measures that will be enacted to offset the loss of nesting habitat for the species. If approved, a permit will be issued, usually within 30 days. Federal permits are issued by the Special Law Enforcement Agent in Charge, U.S. Fish and Wildlife Service, 75 Spring Street S.W., Atlanta, GA 30303. State permits are only valid when accompanied by a Federal permit (Office of Environmental Services, 1991).

This is an example of the guidelines for removal of a species of special concern, threatened or endangered species. Similar permits must be obtained for a removal of any of the protected species including the gopher tortoise, wood stork, least tern, osprey, and the bald eagle (Refer to Chapter 18). Each process and permit criteria is different depending upon the species concerned.

Where do you go when all the fair places have been ruined? Where do you go from Florida?

Raymond F. Dasmann, No Further Retreat

10.7 Recommendations to Contractors

Florida has a rich diversity of ecosystems. Most of these ecosystems are vulnerable and many are in danger. In order to take control of this problem, an aggressive growth management program must be undertaken and accepted as a necessary action. Management of environmentally sensitive lands must be created on a statewide basis. In 1972, the Florida legislature established the Environmentally Endangered Lands (EEL) Program to acquire lands containing relatively unaltered ecosystems or providing critical habitat for endangered species. In 1979, The EEL Program was merged into the Conservation and Recreation Lands (CARL) Program. Protecting individual ecosystems in small patches does not ensure sufficient habitat for all species. Large tracts of land which encompass several ecosystems are necessary to allow many endangered species roaming habitat. Habitat size is one of the major threats to species such as the Florida panther, black bear, and several endangered bird species.

ecosystems are necessary to allow many endangered species roaming habitat. Habitat size is one of the major threats to species such as the Florida panther, black bear, and several endangered bird species.

The future of environmental awareness lies in the understanding of the environment's past. Vital Florida ecosystems have been drained, filled, polluted, mismanaged, logged, excavated, and laid waste. Many of these activities have led to short-term losses. Understanding of how ecosystems have been affected by alteration and a close examination of those practices can lead to better management guidelines. In the past, Florida's natural ecosystems were altered by conversion to agriculture and tree plantations. The present and future trend will change the natural communities to housing developments; commercial and industrial developments, city growth, and new roads. Deforestation for agriculture or forestry is reversible, whereas concrete and asphalt are relatively permanent structures. The future of Florida's environment lies in the hands of developers, contractors, government, and the citizens of this state. The solution to these problems does not entail the cessation of progress but in the education of individuals as to their influence on important ecological systems and issues. Because inexpensive yet effective planning and management procedures have been neglected before the resource problems appear, serious environmental problems have occurred that often defy immediate solution. The development of progressive management programs is needed now if Florida's complex ecosystems are to remain viable (Livingston, 1990). Individuals and government must carefully take the time necessary to consider their influence on the environment and take measures to provide for each ecosystem's future.

10.8 Definitions

Coterminous having the same boundaries.

Community an interacting population of various kinds of species in a common location.

Ecology pattern of relations between organisms and their environment.

Ecosystem the complex of a community and its environment functioning as an ecological unit.

Endemic restricted or peculiar to a locality or region.

Environment an aggregate of social and cultural conditions that influence the life of an individual or community.

Extinct no longer existing.

Native living or growing naturally in a particular region.

Species a class or individuals having common attributes and designated by a common name.

Table 10.0

Protected Florida Native Animal Species

Invertebrates	7
Freshwater Fish	16
Reptiles and Amphibians	28
Birds	34
Mammals	32
TOTAL	117
	(17% of Florida wildlife)

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Pamphlets detailing the permitting procedures may be obtained from the Office of Environmental Services:

620 S. Meridian Street
Tallahassee, FL 32399-1600
904-488-6661

29200 Tuckers Grade
Punta Gorda, FL 33955
813-639-3515

SC 278-6661
P.O. Box 3407
Marathon Shores, FL 33052
305-743-9312
SC 451-5002

3900 Drane Field Road
Lakeland, FL 33803
813-648-3206
SC 595-3210

SC 721-7570
110 43rd Avenue S.W.
Vero Beach, FL 32968
407-778-5094
SC 788-5094

CHAPTER 11
COASTAL AREAS

11.0 Introduction

The nation's largest cities are located on the coasts of the oceans and Great Lakes. Population growth in **coastal zones** is twice as much as the rest of the country. By the year 2000, 80 percent of the United States population will live within 50 miles of a coast. The vital natural system of the coast has been threatened by increasing population growth and the commercial, recreational, and residential development that is associated with it. Coastal areas are one of the nation's most valuable resources and must be protected. It is to the advantage of everyone to protect this natural resource by using appropriate construction techniques to ensure the stability of the beach-dune system, decrease erosion, protect adjacent structures, save endangered salt-water species, and prevent interference with public access and interest. It is clear that unless future growth is better managed the beaches may be lost forever and with this loss may come the loss of human lives as well.

Research on coastal systems has established not only their economic importance but also their vulnerability, interdependence, and accelerating deterioration. Certain physical processes are extremely important to coastal ecosystems. If one of them is altered, a chain reaction can occur that disrupts the entire cycle. For example, human activities which involve changing the natural drainage pattern, such as dredging, digging channels, flood control or the removal of vegetation will disrupt natural circulation of the water which serves to disperse and dilute pollutants, transport nutrients, and maintain the level of salt concentration in the water. The Florida State Legislature, through the Beaches and Shores division of the Department of Natural Resources, has set forth guidelines for these and other activities in coastal areas.

This chapter will discuss a broad overview of lawful due process as it pertains to construction on the coastal areas of Florida, and give a basic background of beach/dune systems, beach/shore retaining walls, and seawall design on the open coast. Beach/dune walkway standards, and geological and ecological concerns will also be discussed.

11.2 Beach and Dune System

The beach is always changing and always moving in accordance with the earth's natural laws. Whether the shorelines are sandy beach, marsh, or rock, they respond to nature's forces of wind, waves, currents, and tides. These changes are part of a natural process that has been occurring since shorelines were first

created. One must keep in mind that the visible part of the beach is only the very upper part of the whole shore system. This beach system extends from the seaward toe of the **dune** to a depth of 40 to 50 feet, which may be miles offshore. This area incorporates the area of sand transportation. Grains of sand or earth are carried from or parallel to the shoreline. Winter storms usually wash sand off the beaches and dunes causing erosion. Milder summer weather is a period when sand washes toward the beach, replenishing and rebuilding the shoreline. A stable beach is one that maintains a balance between periods of erosion and replenishment. Sand grains are also carried parallel to the beach by a process called **littoral drift (Figure 11.1)**.

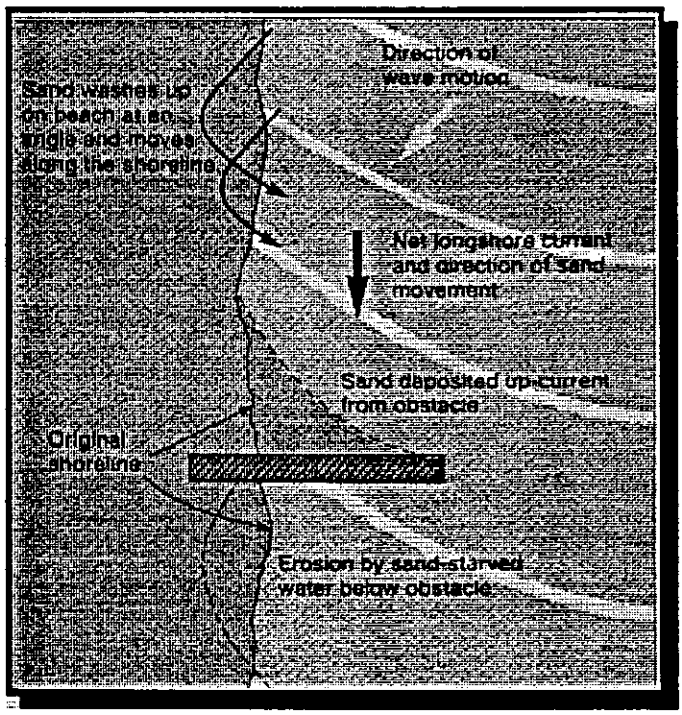

Figure 11.1 Interference with Littoral Drift

A number of forces affect shoreline stability. Most of the natural changes are slow and require a long period of time before erosion becomes noticeable. Erosion threatens the developed areas. Man's response to this threat is to create structures near the shore. These structures usually increase erosion and interfere with the natural processes. During periods of heavy weather, the beaches respond by flattening out to expend the storm's energy over a greater distance. When a steeper surface is encountered, a seawall, for example, the storm-wave energy is absorbed on a smaller surface causing greater damage.

11.3 Establishment of Coastal Construction Control Lines

Legislation through the Division of Beaches and Shores of the Department of Natural Resources(DNR) has dictated that **Coastal Construction Control Lines (CCCL)** be initiated in counties fronting the Atlantic Ocean, Gulf of Mexico, and the Straits of Florida. This law also provides that the established

CCCL shall be subject to review at the discretion of the DNR or at the written request of officials of affected counties or municipalities.

Establishment of CCCL's must be given the following considerations:

(1) Ground elevations in relation to historical storm and hurricane tides
(2) Predicted maximum wave approach
(3) Erosion trends
(4) Vegetation line
(5) Beach and ground contours
(6) Dune line
(7) Established development

Authority and guidelines for the establishment of these control lines are found in subsections 161.053(1) and (2), Florida Statutes and Chapter 16B-33, Division Beaches and Shores, Rules and Procedures for Coastal Construction and Excavation. The Department may establish a particular or several sections of the CCCL further landward than the impact zone of a **100-year storm surge**. Zones must be made to not extend beyond the landward toe of the dune structures that intercept the 100-year storm surge line.

Any individual owner who feels that a CCCL has been unjust and prevents appropriate usage of the property is qualified to a review of the location of the line according to subsection 161.053, in the Florida Statutes. Procedure for requesting this review is stated in Rule 16B-33.010, Florida Acts and Committees. This procedure involves a written request along with papers of ownership and shall be given consideration and an opinion within 30 days of receipt of the request.

It cannot be emphasized too strongly that future development should be carefully planned and engineered to minimize risks as much as possible. A study was made to show the effects after Hurricane 'Eloise' in 1975 (**Figure 11.2**). The damage per structure increases greatly for structures located seaward of the control line, levels off at the control line, and reduces gradually landward.

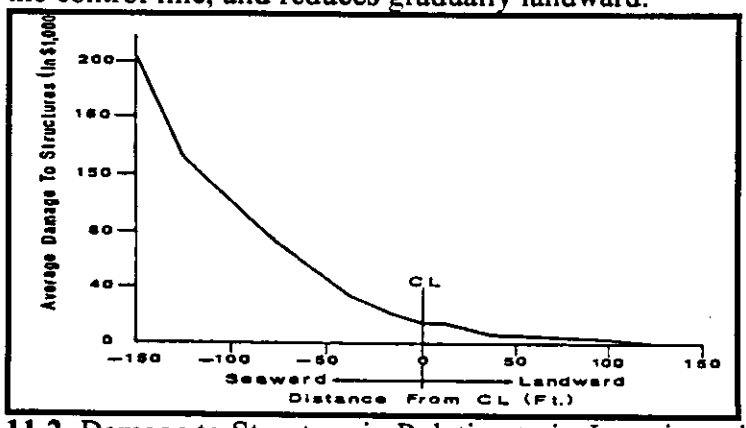

Figure 11.2 Damage to Structure in Relation to its Location with CCCL

11.4 Coastal Construction Permits

Activities requiring a coastal construction permit include, but are not limited to, piers; wharfs; docks; dolphins; mooring piling; excavation; commercial sand and gravel dredging; filling; disposal of dredge material; riprap and revetments; retaining walls; groins; breakwaters; jetties; beach restoration; levees; wires or cable over the water; pipes, cables and tunnels under the water; fishing reefs; clearing; channel and upland canal construction; intake and outfall pipes and/or structures; navigational aids; platforms; ramps; signs; fences and the transportation/deposition of dredged material for open water dumping. A complete description of permit application requirements and procedures are found in Chapter 16B-33.007 to .008 of the DNR/ Division of Beaches and Shores-Rules and Procedures. The permitting authority for DNR's Beaches and Shores program is found in subsection 161.053(2), and is as follows:

> Upon the establishment, approval, and recordation of such control line or lines, no person, or firm, corporation, or governmental agency shall construct any structure whatsoever seaward thereof; make any excavation, remove any beach material, or otherwise alter existing ground elevations; drive any vehicle on, over, or across any sand dune; or damage or cause to be damaged such sand dune or the vegetation growing thereon seaward thereof, except as hereinafter provided.

The above legal jargon only states that it is illegal to perform any type of excavation, construction, or removal of vegetation seaward of a CCCL without a permit from the Department.

Requirements for permits that must be met before approval by the Governor and Cabinet, Executive Director or Division Director:

(1) All proposed structures shall be located and designed and engineered sufficiently to allow for natural beach dune fluctuations and natural resistance and recovery from 100-year storm surges.

(2) Major structures shall conform to all minimum building code requirements, (Florida Building Codes Act, Florida Statutes, Sections 553.70-553.895) as well as, designed to resist predicted forces associated with the 100-year storm. Additional assistance for design for minimal impact can be found in editions of Shore Protection Manual, Department of the U.S. Army Coastal Engineering Research Center Papers and Reports, and Division Technical and Design Memoranda.

(a) Engineering certifications for assuring structural integrity may be required by DNR. (161.053(d),F.S.)

(b) DNR shall make limitations to construction for structures that interfere with public access along the beach, making provisions when interference is unavoidable.

(3) Nature, timing and sequence of construction may be conditioned to protect sea turtle habitat and endangered plant communities, both native and salt water vegetation.

(4) Grandfathered activities according to subsection 161.053(9), F.S., "...existing or under construction prior to the establishment of costal construction control line...", do not pertain to current permitting requirements.

11.4.1 Permitting Procedures

Permitting under chapter 161 of the Florida Statutes is a licensing activity subject to the provisions of Section 120.60, F.S.

Upon receiving an application (**Figure 11.3**) DER will forward one copy of the application along with the appropriate drawings to the Corps District Office within 24 hours. Applications for groin or jetty construction, beach restoration, or other activities permitted pursuant to Chapter 161, F.S., must also be submitted concurrently to the Bureau of Beaches and Shores (DNR). Within the first 30 days after receipt of the application the DNR must notify the applicant of any errors and omissions, and make a request for any additional information the agency is permitted by law to require for completion. Unless DER or DNR has notified the applicant within 30 days, failure to correct errors or omissions or to supply additional information shall not be grounds for denial.

When the application has been determined to be in proper order, a joint public notice is issued to all known interested individuals, groups, and governmental agencies. Any comments received in response to the public notice are furnished to the applicant to give them an opportunity to comment on or rebut the objections. Every state application must be approved or denied within 90 days after receipt of the original application. Any application for permit not approved or denied within the 90-day period shall be deemed approved and the permit shall be issued. If a public hearing was requested during the processing of an application it usually takes longer than 90 days before the final action can be taken by the state. In this situation the DER and DNR must issue or deny the permit application within 15 days after the conclusion of a public hearing or the permit is deemed approved and shall be issued.

11.5 Seawall Design

Seawalls are typically designed to meet one or more of the following objectives:

(a) Protect artificially filled land areas that extend seaward from the existing shoreline.

(b) Save an eroding shoreline or protect one that is subject to erosion under adverse weather conditions.

(c) Maintain a boat landing or stable shore next to deep water, as at a dock or at a ship channel traversed by a short bridge.

The seawall typically only protects the land directly behind it. It usually does not protect the shore in areas up or down the shoreline or the beach seaward of them. When the structure is built on a shoreline with existing erosion problems, erosion will usually continue on adjoining shores. Also the loss of materials immediately in front of the seawall usually increases because the structure tends to concentrate the energy in a more confined area. Seawalls have a detrimental effect on the natural beach profile through a number of related effects, all of which produce scour at the front of the seawall. Scour is defined as the lowering of the beach profile due to the effects of the seawall only. During storms a beach without

JOINT APPLICATION
DEPARTMENT OF THE ARMY/FLORIDA DEPARTMENT OF ENVIRONMENTAL REGULATION
FOR
ACTIVITIES IN WATERS OF THE STATE OF FLORIDA

Refer to Instruction Pamphlet for explanation of numbered items and attachments required.

1. Application number (To be assigned)	2. Date Day Mo. Yr.	3. For official use only

4. Name, address and zip code of applicant

Billy G. Wells
1641 S. Hampton Boulevard
Jacksonville, Florida 32211

Telephone Number 904/725-8386

5. Name, address, zip code and title of applicant's authorized agent for permit application coordination

N/A

Telephone Number _____

6. Describe the proposed activity, its purpose and intended use, including a description of the type of structures, if any to be erected on fills, or pipe or float-supported platforms, and the type, composition and quantity of materials to be discharged or dumped and means of conveyance.

Bulkhead and backfill with 880 cubic yards of clean sand obtained from upland areas. Construct pier for mooring private sailboat. No fuel pumps or toilet facilities to be constructed on pier. No structures are to be erected on fill.

Volume of Material:	Dredged/Excavated		Filled/Deposited	
	_____ CY Waterward of O.H.W. or M.H.W.	880 CY Landward of O.H.W. or M.H.W.	_____ CY Waterward of O.H.W. or M.H.W.	_____ CY Landward of O.H.W. or M.H.W.

7. Proposed use
Private [X] Public [ ] Commercial [ ] Other [ ] (Explain in remarks)

8. Name and address including zip code of adjoining property owners whose property also adjoins the waterway.

Robert L. Hampton
12467 Ridge Road
Jacksonville, Florida 32227

Cedric L. Clark
12571 Ridge Road
Jacksonville, Florida 32227

9. Location where proposed activity exists or will occur
Street address
Longitude _____ Latitude _____ (If known)
Sec. 31 Twp. 27S Rge. 41E

Florida	Duval	Jacksonville	
State	County	In City or Town	Near City or Town

10. Name of waterway at location of the activity Big Haw Creek

Figure 11.3 Coastal Construction Permit Application

11. Date activity is proposed to commence: 30 days after receipt of permit
Date activity is expected to be completed: 6 months after receipt of permit

12. Is any portion of the activity for which authorization is sought now complete? Yes [ ] No [x]
If answer is "Yes" give reasons in the remarks section. Month and year the activity was completed _____
_____. Indicate the existing work on the drawings.

13. List all approvals or certifications required by other Federal interstate, state or local agencies for any structures, construction, discharges, deposits or other activities described in this application, including whether the project is a Development of Regional impact.

Issuing Agency	Type of Approval	Identification No.	Date of Application	Date of Aporoval
DNR	Confirmation DF Title		29 Feb 75	———
City of Jacksonville	Permit	7J123	15 Jan 75	31 Jan 75

14. Has any agency denied approval for the activity described herein or for any activity directly related to the activity described herein?
Yes [ ] No [x] (If "Yes" explain in remarks)

15. Remarks (see Instruction Pamphlet for additional information required for certain activities)

16. Application is hereby made for a permit or permits to authorize the activities described herein. I agree to provide any additional information/data that may be necessary to provide reasonable assurance or evidence to show that the proposed project will comply with the applicable State Water Quality Standards or other environmental protection standards both during construction and after the project is completed. I also agree to provide entry to the project site for inspectors from the environmental protection agencies for the purpose of making preliminary analyses of the site and monitoring permitted works, if permit is granted. I certify that I am familiar with the information contained in this application, and that to the best of my knowledge and belief such information is true, complete, and accurate. I further certify that I possess the authority to undertake the proposed activities.

Billy G. Wells — Signature of Applicant
6-20-77 — Date

18 U.S.C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals, or covers up by any trick, scheme, or device a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statement or entry, shall be fined not more than $10,000 or imprisoned not more than five years, or both.

The application must be signed by the person who desires to undertake the proposed activity; however, the application may be signed by a duly authorized agent if accompanied by a statement by that person designating the agent and agreeing to furnish upon request, supplemental information in support of the application.

FEE: Attach Checks/Money Orders on front
Payable to Department of Environmental Regulation
$200 Standard form projects
$20 Short forms and Chapter 403 projects only

Figure 11.3 Coastal Construction Permit Application

a seawall protects itself by building its own submarine bar of shore that trips the larger waves. The high wave action along with high tides wash up on shore then drag the surface sand down to the submarine bar building it higher.

Seawalls disrupt the waves from a complete washup, therefore not allowing as much surface sand to be washed down to build up the bar. Design failures in seawalls are primarily due to improper backfill support. If the seawall cannot transmit the large hydrodynamic forces to the backfill it will fail in bending/ inward moment. Backfill can be lost through the joints or perhaps draining out from the sides of the wall from continuous wave action. One preventative measure for the seepage through the joints is to place filter material between the wall and backfill (**Figure 11.4**). Backfill lost around the sides can be prevented by the use and construction of return walls or "wing walls" long enough as to not be flanked by storm or high tide waves. The safety factor for determining an extra distance "x" from the face of the wall is determined by the height and length. Seawall construction data obtained after Hurricane 'Eloise', in Panama City, determined that the return length for a 7 x 300 foot seawall can be conservatively estimated at 45 feet.

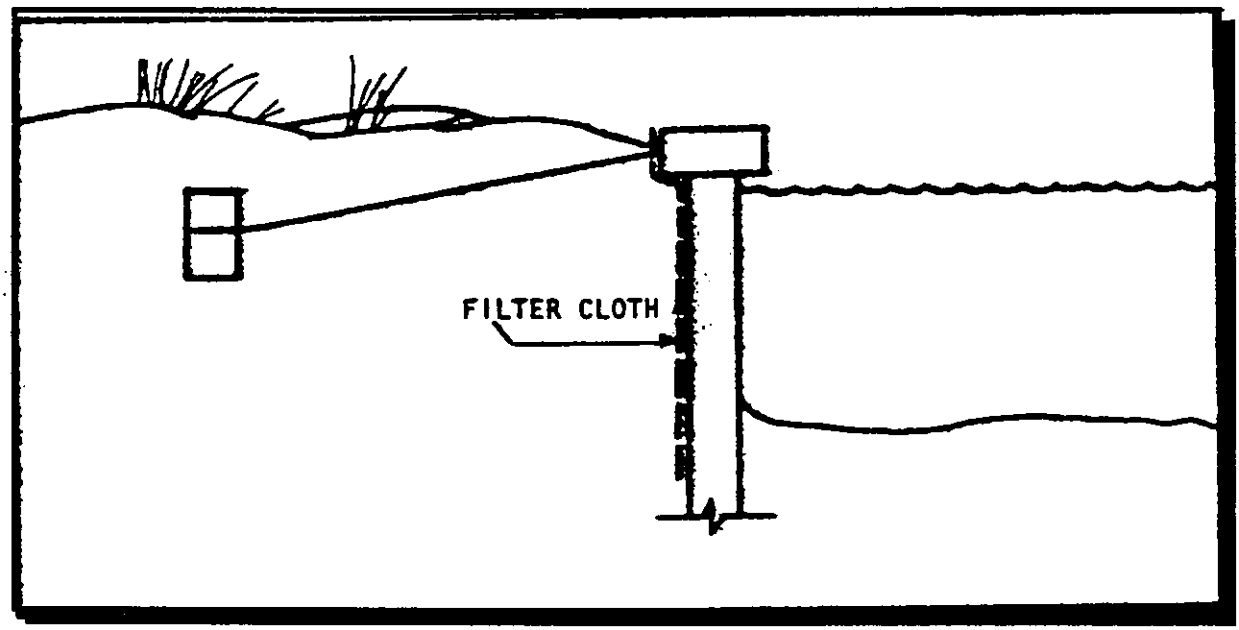

Figure 11.4 Filter Material Behind Seawall

After designing the seawall for proper length and return, a system for anchorage must be calculated, the most common of which are variations of the sheetpiles or "deadman" anchor system. A number of adequate design methods exist for different classifications of soils. Care must be taken to see that settlement of the anchor does not occur after construction. Specifications for compaction often exceed 90% of maximum density as a precaution against settlement.

The Division of Beaches and Shores requires a permit to be granted based on (1) a substantiated need and (2) seawall plans that have been designed by an engineer.

There are two basic types of seawalls. The most widely used consists of a vertical face of either precast concrete slabs or steel piles driven into the sea bottom to secure the toe. The top is secures by tie-backs connecting the wall to anchors placed back a safe distance inland (**Figure 11.5**). This helps to prevent the wall from tipping seaward. Wave energy breaking against the vertical face is deflected both upward and downward. Presently,

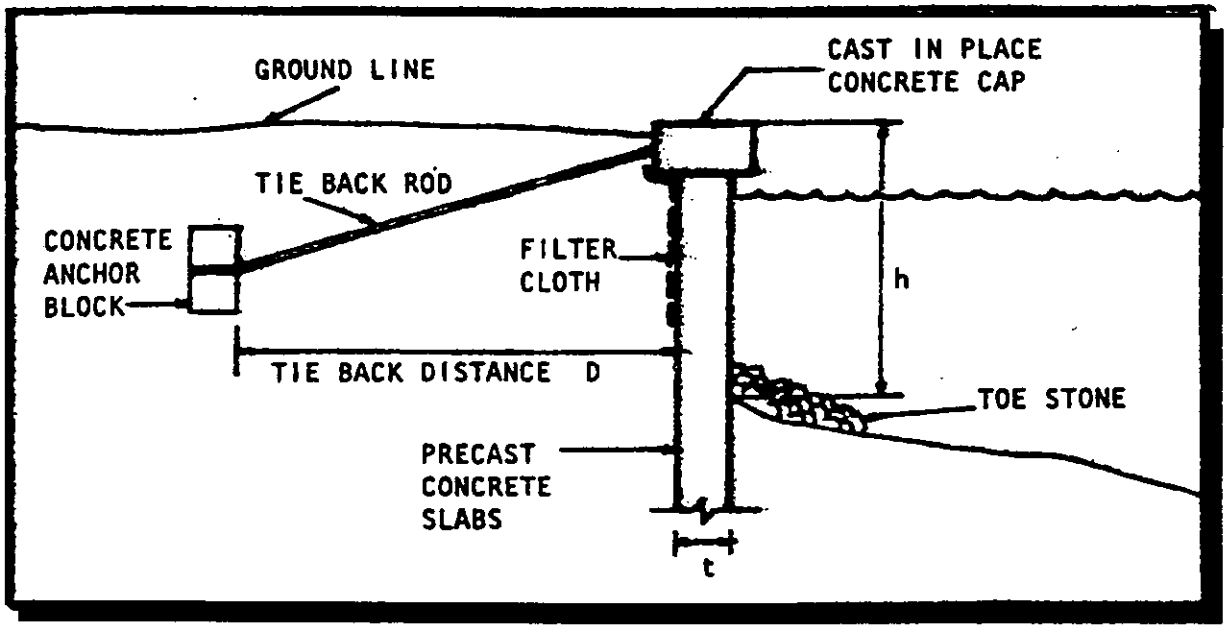

Figure 11.5 Typical Seawall Design

seawalls designed for the open coast are approximately $250 - $450 per lineal foot. The importance of any specific design used must take into consideration the consequences of seawall failure as well as the initial cost of seawalls. Unfortunately, in past practice, seawall design has been governed by the amount of money the upland owner was willing to pay, with little thought as to whether the structure would endure the critical environment in which it was placed.

When selecting materials for seawalls and other protection structures the moist marine atmosphere should be taken into consideration. The following materials are commonly used:

(a) Concrete. A stiff mix properly placed and vibrated at the time of placement will produce a structure almost impermeable to water. The Portland Cement Association recommends a water/cement ratio of 0.44 to 0.40. A minimum of three inches of cover over reinforcing steel provides protection against corrosion.

(b) Steel. Steel corrodes and gradually looses its strength when exposed to the warm moist

atmosphere. The greatest loss occurs in the splash zone between the mean high tide and the upper limit of wave contact. Coatings of plastic, bitumen, or concrete are recommended from the bottom line to the top of the structure to prevent corrosion.

(c) Timber. If properly designed and installed timber can be very resistant to the marine environment. Timber is subject to attack by decay, insects, and marine borers (Figure 11.6).

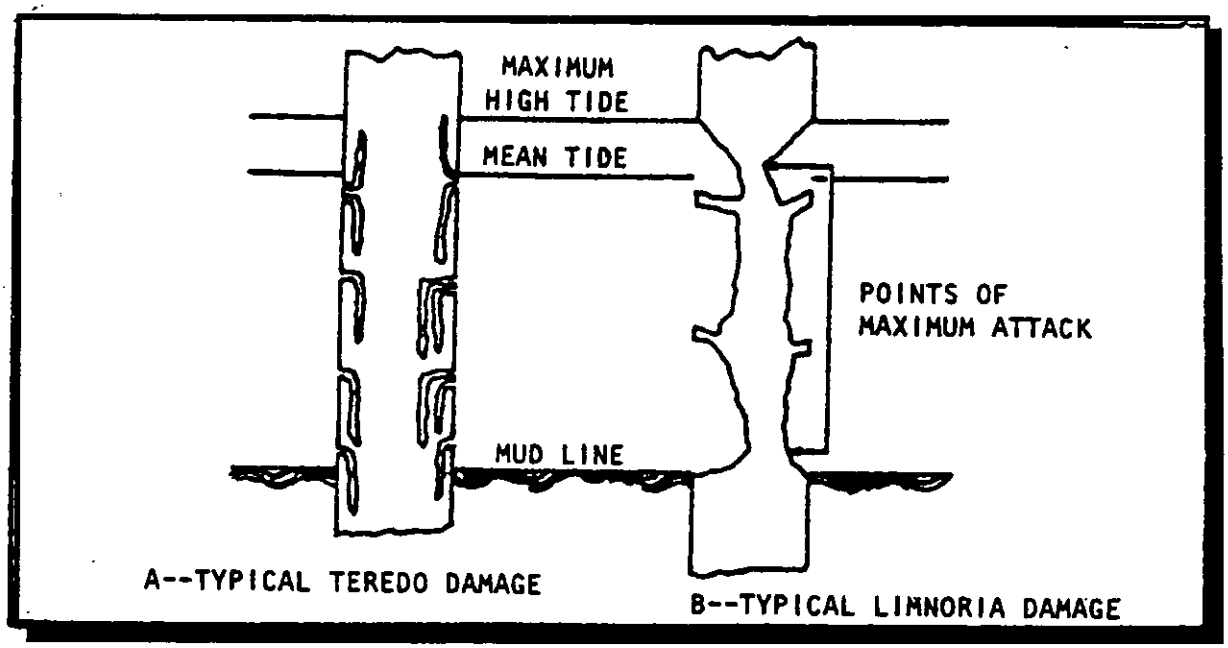

Figure 11.6 Pile Damage by Marine Borers

(d) Combinations. Since timber is more durable below the sea bottom, some structures have used combinations of wood below the bottom with concrete tops to form a combination piling.

(e) Stone. Stones used in structures usually resist weathering under normal conditions. Angular stones are more stable than round stones. Repairs are simply made by adding or replacing rocks. Several types of native rock are available in Florida: Coquina and Limestone.

11.6 Beach and Dune Walkover Structures

In areas of high human traffic in unrestricted access areas, extensive loss of dune system vegetation has occurred. This loss leaves the dune unprotected from the wind. In these areas a beach walkover is needed. Typical design considerations and allowances must be done by an engineer. Two basic structure designs are discussed below.

The first structure is for heavy foot traffic. The depth of piles are a function of the beach profile, as well as, maintaining structural integrity. The following must be taken into consideration:

(1) All wood is to be pressure treated in accordance with AWPA Standard C-2. Preservative shall be of waterborne type B or C, as covered in Federal Specification TT-W-535 and AWPA Standard P5, C2 and C14. A suitable inexpensive wood for construction is pressure treated Southern Pine. Higher grade and more expensive woods would be the heartwood of Southern Cypress, Redwood, or Eastern Red Cedar. ''Rough cut'' is allowed in sub-structure, while surfaced lumber should be used for flooring and handrails.

(2) All bolts and additional hardware shall be hot, dipped galvanized.

(3) Galvanized nails shall be used.

The second type of beach/dune walkover is primarily used for light foot traffic. This is primarily designed for a dune system with no sharp drop-offs.

11.7 Basic Definitions

Applicant- the owner of record, leaseholder or holder of any legal instrument which gives the holder legal authority to undertake the activities for which a permit is sought, or the authorized agent of such person.

Barrier Islands-long, narrow strips of land separated from the mainland by lagoons.

Beach- the zone of unconsolidated material that extends landward from the mean water line to the place where there is marked change in material or to the line of permanent vegetation (usually the effective limit of storm waves). Unless otherwise specified, the seaward limit of a beach is the mean low water line. ''Beach'' is alternatively called shore.

Bureau- the Bureau of Coastal Engineering and Regulation of the Division of Beaches and Shores of the Department of Natural Resources.

Coastal Construction Control Line or Control Line-the line established pursuant to the provisions of Section 161.053, of the Florida State Statutes.

Coastal Zone-the area where land meets water, coined by the Commission on Marine Science, engineering, and Resources.

Dune- a mound or ridge of loose sediment usually sand-sized sediment, lying upland of the beach or shore, and deposited by any natural or artificial mechanism.

Erosion- the wearing away of land or the removal of beach or dune material by wave action, tidal currents,littoral currents of deflation. Erosion includes but is not limited to:

(a) Horizontal recession which occurs where the storm surge intersects but does not inundate the profile, and where horizontal littoral activity due to waves, currents and runup erodes the profile.

(b) Scour which occurs when the entire topography is completely inundated by the storm

surge, and where wave and current forces erode the profile in the vertical direction.

Groin- long, narrow obstacle set more or less perpendicular to the coastline or breakwaters parallel to the coastline.

Littoral Drift-sand movement along the length of a beach that occurs in the presence of longshore current.

Longshore Current-the net current parallel to the coastline caused when the waves approach the shore at an oblique angle.

One-hundred-year storm or 100-year storm-a shore-incident hurricane or any other storm with accompanying wind, wave, and storm surge intensity having a one-percent chance of being equaled or exceeded in any given year, during a 100-year interval.

Thirty-year erosion projection or 30-year erosion projection-the projection of long-term beach and coast recession occurring over a period of thirty years based on shoreline change rate information obtained from historical measurements.

Under construction-the continuous physical activity of placing the foundation or continuation of construction above the foundation of any structure seaward of the established coastal construction or setback line.

CHAPTER 12
GROWTH MANAGEMENT ISSUES

12.1 Introduction

The state of Florida has experienced rapid growth in the last decade resulting in a variety of benefits such as a low unemployment rate and a rather unprecedented building boom. The problems brought about by rapid growth have both plagued and benefitted the construction industry. Rapid growth means immediate demand upon infrastructure resulting in an increased need for roads, schools, fire and police protection facilities. When funding is available for these measures, the construction industry is healthy.

When, as in 1986-89, over 1000 people per day were moving to Florida, the housing industry experienced its most rapid increase in starts since post-war times. The reasons people were moving to Florida centered around the positive aspects of its prime geographical location in terms of climate and scenic beauty as well as its favorable potential for development in terms of available land and adequate infrastructure support. However, a massive influx of new people with immediate demand for existing services created a serious lag in time before taxes and business revenues contributed by the new population could catch up with the cost of adding immediate infrastructural support. The unique manner in which Florida's demographics have changed have presented the state with unusual growth management problems. As the quality of the environment and the condition of available infrastructure deteriorated, there was a growing consensus that in order to protect the Florida's attractive qualities which draw people to Florida and continue to have a healthy development and construction industry, something had to be done to protect Florida's resources. The result of the decision to attempt to manage growth in Florida in such a manner to extend the right kind of balance of quality of life issues affecting the success of all business ventures as well as Florida's general population culminated in the Florida Legislature enacting the 1985 Local

Government Comprehensive Planning and Land Development Regulation Act (Growth Management Act).

12.2 History of the Growth Management Act

Since the early 70's, Florida has had a nationally recognized growth management system to deal with growing population problems. By the early 1980's, however, it was clear that the system was inadequate to cope with the type of megagrowth Florida was experiencing. The 1985 Growth Management Act (Chapter 85-55) Laws of Florida) provides sweeping changes in the manner in which property can be developed in Florida. As a result of the Growth

Management Act and the legislation preceding it, Florida is recognized as one of the nation's leaders in establishing a comprehensive and coordinated statewide system of growth management. The manner in which legislation has evolved has established Florida as a prototype of state action in response to rapid development and population pressures. Many states across the country are now looking to learn from Florida's effort to implement the state's growth management policies. The background of the forces leading to the creation of the Growth Management Act can be summarized by brief review of its preceding legislation:

The Florida State Comprehensive Planning Acts (1972 and 1975, Florida Statutes Chapter 186)

The Florida Environmental Land and Water Management Act (1972, Florida Statutes Chapter 380) and

The Florida Water Resource Act (1972, Florida Statutes Chapter 373).

12.2.1 The Florida State Comprehensive Planning Acts

Along with the Florida Environmental Land and Water Management Act, the 1972 Florida State Comprehensive Planning Act was the first program to be adopted. The primary problems with the Act were the placement of too much responsibility for enforcement with state agencies and the directives being too detailed to implement. The 1975 Local Government Comprehensive Planning Act (LGCPA, Florida Statutes Chapter 163) required all local governments to prepare, adopt, and implement comprehensive plans for future development and growth of their respective communities. Furthermore, local governments were to establish, support, and maintain administrative instruments and procedures to carry out the purposes and intentions of the Act. Additionally, the LGCPA required that all action taken by local governments in regard to development be consistent with the adopted comprehensive plan.

The plan itself was highly contested due to lack of additional funding being provided by the state for the purpose of carrying out the program and strong opposition by local governments to state comprehensive planning. Under the State Planning Act, this plan was finally adopted by the legislature in 1978 with the provision that the plan be advisory only. This amendment so weakened the effects of the Act that the plan was essentially ignored by all regulating bodies. A 1980 Governor's Resource Management Task Force and A 1984 Environmental Land
Management Study Committee concluded in two final reports that the objectives of the Act had not been met.

The Florida Environmental Land and Water Management Act and the Florida Water Resource Act of 1972 (Florida Statutes Chapter 373) addressed significant land use issues and led to the state establishing

programs that identified areas of critical state concerns. One such program, was the state's Developments of Regional Impact (DRI) which was designed to protect Florida's water resource and natural environment from the adverse physical effects of urban development. The primary goal of the DRI program was to set up a review process for proposed developments that could have a major impact on a large geographical region.

Because of an increased concern by the Florida constituency about the adverse effects of having no viable growth management system, the legislature passed the State and Regional Planning Act of 1984 (SRP, Florida Statutes Chapter 186). This Act established the framework for comprehensive statewide planning primarily because it required the Executive Office of the Governor to submit to the Legislature a proposed state comprehensive plan which :

"...shall be composed of goals and policies briefly stated in plain, easily understood words that give specific policy direction to state and regional agencies." (1985 Florida Statute 186.007)

The statewide plan was to concentrate on policies dealing with land use, water resources, and transportation system development. By 1985, Florida residents and the legislature were ready for even bolder actions to set new directions for Florida in growth management. As a result, during the 1985 legislative session, the legislature adopted the State Comprehensive Plan and went even further in enacting the historic Local Government Comprehensive Planning and Land Development Regulation Act of 1985.

12.2.2 1985 Growth Management Act

The most important aspect of the 1985 Growth Management Act is the requirement that all local governments submit and adopt comprehensive plans for the purpose of guiding and controlling all future community growth. The local plan must also identify goals and objectives that must be met before any parcel of land may be developed. Local governments' comprehensive plans must be submitted to the Department of Community Affairs(DCA) for review and approval. A schedule of submission has been underway and recently finalized. Counties in coastal areas were the first to be required to submit plans. North Central Florida counties were among the last. All plans were to have been submitted by July 1, 1991. The DCA has final authority to determine if local plans are in compliance with the State

Comprehensive Plan as well as state planning goals and policies. The DCA has also proposed rules (rule 9j-5 Florida Administrative Code) setting forth minimum criteria to use in determining plan compliance. After 1992, building permits will not be issued by counties that have no approved comprehensive plan. Furthermore, if the DCA does not approve a local comprehensive plan, the Governor and Cabinet are authorized to withhold certain state funds.

The Comprehensive Planning Act has clearly established the "top down" approach for planning and managing future growth in Florida. The 1985 Act has amended, repealed, or added provisions to at least twelve chapters of the Florida Statutes, most importantly, Chapters 163,380, and 186. An additional bill, (Chapters 85-87) was adopted to provide a State Comprehensive Plan to fulfill the requirements of the State and Regional Planning Act of 1984. The requirements for local comprehensive plans were expanded and strengthened primarily through adopting and providing a manner for the implementation two major planning principals: Consistency and Concurrency. These two concepts are the cornerstones of the 1985 Growth Management Act.

Consistency

The provision set forth in the Local Government Comprehensive Planning and Land Development Regulation Act (Growth Management Act) requires all local governments' plans to be consistent with the appropriate comprehensive regional policy plan and the State Comprehensive Plan (Section 187.201 Florida Statutes). Local governments' comprehensive plans must be "compatible with " and "further" the policies and goals that are identified in the State Plan. The State Comprehensive Plan adopts specific goals and policies for twenty-five major state issues:

1. Education
2. Children
3. Families
4. The Elderly
5. Housing
6. Health
7. Public Safety
8. Water Resources
9. Coastal/Marine Resources
10. Natural Systems/Recreation Lands
11. Air Quality
12. Energy
13. Hazardous and Non-Hazardous Material and Waste
14. Mining
15. Property Rights
16. Land Use
17. Public Facilities
18. Cultural and Historic Resources
19. Transportation
20. Governmental Efficiency

21. The Economy
22. Agriculture
23. Tourism
24. Employment
25. Plan Implementation

No section of a local plan may be in conflict with the state plan or appropriate regional policy plan. Moreover, local governments must supply a list indicating the specific elements, subsections and page numbers that address the goals and policies as stated in the State Comprehensive Plan in accordance with rule 9j-5.021, Florida Administrative Code.

Another significant aspect of the Growth Management Act involves the relationship of zoning to the comprehensive plan. The comprehensive plan must identify different land use districts such as Low Density Residential, Regional Commercial and Light Industrial. Each land use district permits a range of acceptable zoning districts with specified associated density ranges. The density ranges and districts must be consistent with the local and state comprehensive plan. Prior to the adoption of new comprehensive plans, grandfathered zoning could allow land development even though the range of permitted uses did not conform to the site's land use designation. However, following the adoption of a local government's comprehensive plan, a building requiring zoning that is not consistent with the range of permitted uses under the site's land use designation will not be able to obtain a building permit.

The primary goal of consistency is to discourage strip or "leap-frog" development as well as large areas of low density development. Therefore, strong disincentives exist to prevent developers from building outside of unincorporated areas of cities. This means that it is no longer easy to by-pass the more expensive land which is usually closer to the urban core in favor of the less expensive land on the fringe in order to build.

Concurrency

The concept of concurrency prevents local governments from issuing development orders unless there are available concurrently with the proposed development, sufficient public facilities and services. The legislature requires that local governments adopt levels of service (LOS) standards for public facilities and entrusts the DCA with the authority to approve the minimum allowable service standards before the adoption of the local governments' comprehensive plans. The public facilities subject to concurrency include:

roads, potable water, sanitary sewer, recreational facilities, solid waste disposal
mass transit, drainage

A local government may issue a development order only if the necessary public facilities:

(1) are currently in place

(2) will be in place when the impact on the existing LOS for all infrastructure by the planned development occurs

(3) are under construction at the time of issuance of the development order or are the subject of a binding, executed contract.

Furthermore, a development order will be issued only if the necessary public facilities are subject to the requirements of a concurrency management system.

Concurrency must be determined before approval for an application for a development order or permit is issued. Local governments must develop guidelines to determine at what point in the application process the test for concurrency must be met by interpreting and applying levels of service standards.

Specifically, Florida Statute 163.3203 requires that land development regulations shall as a minimum provide:

> "...that public facilities and services meet or exceed the standard established in the capital improvements element...and are available when needed for the development, or that development orders and permits are conditioned on the availability of these public facilities and services necessary to serve the proposed development. No development order or permit may be issued which results in a reduction in level of services for the affected public facility below the level of services provided in the comprehensive plan."

These provisions have led to the question of whether a municipality is prohibited from approving new development until its existing backlog of inadequate levels of services has been met, and also, whether a locality may effectively prevent new development in an area by refusing to plan for or build new public facilities to raise the level of service toservice supports development.

12.3 Impacts of The Growth Management Act Upon Construction

The Growth Management legislation has made development very complex in the state of Florida. Developers are now having to hold their properties idle longer than they or their lenders would desire in order to prove concurrency. Some lenders in Dade and Broward Counties are requiring an opinion letter from an attorney concerning concurrency for particular sites. Once concurrency has been determined, lenders and developers still face other uncertainties. Loss of infrastructure capacity prior to completion is an ever present concern for all parties involved. This is especially true for phased projects whose first phase may be approved while subsequent phases may be denied because the levels of service for certain infrastructure may have been unacceptably degraded by interim development of surrounding property.

Another area of concern is the provision for objections by third parties by the Growth Management Act. Anyone affected by the proposed project's impact has a series of steps available to be taken to stop the project from reaching completion.

All of this leads to increased costs. The approval process consists of more numerous and stringent reviews which translates into more necessary front end capital for approval. Additional costs must be incurred int the form of consultants. Developers and lenders must rely more on legal advise from attorneys who understand the intricacies of the Growth Management Act. These costs have become necessary in order to insure a project's potential for completion. The most important thing for builders to understand is that it has become more important than ever to pay close attention to the evaluation of existing conditions in the pre-construction phase of any project.

CHAPTER 13
HISTORICAL AND ARCHAEOLOGICAL SITES

13.0 Introduction

Archaeological interests are becoming more important for developers to consider when planning a construction development. A developer may want to know what his or her responsibilities are when he or she suspects or uncovers an archaeological resource. Furthermore, the developer may want to be aware of all the laws that pertain to the protection of archaeological interests. Understanding the many archaeological laws and permitting procedures will help the developer to avoid construction delays or even complete stoppages of work.

13.1 Protection of Archaeological Interests

There are basically two ways in which legal protection is given to archaeological interest. The first way is local planning controls and the second protection is under the Archaeological Resources Protection Act of 1979.

Because it is necessary for a developer to receive permission before development, the local planning authority is in the position to ensure that archaeological interests are maintained before a construction permit is issued. Local planning bodies may vary significantly from one location to another; therefore, laws and restrictions will vary. A developer may encounter planning bodies in which no provisions are made to protect archaeological interests and he or she may encounter planning bodies which go as far as placing a condition that no development should take place until an archaeological study has been performed. The local planning body may also insist that the developer provide access to his or her site at any time for an archaeologist nominated by the planning body. The archaeologist would be able to observe excavations and record findings. While this stipulation does not require the developer to pay for the archaeological facilities, he or she may end up doing so in order to accelerate this delay. Of course, the developer may challenge the requirement by appealing to the Secretary of State; however, such an action may not be worthwhile because of the timely appeals process.

13.2 The Archaeological Resources Protection Act of 1979.

The United States Congress drafted the Archaeological Resources Protection Act to "secure for the present and future benefit of the American people, the protection of archaeological resources and sites which are on public lands and Indian lands"; however, the ARPA was created primarily because the Antiquities Act of 1906 was ruled unenforceable by United States vs. Diaz case, which held that the penalty provisions of the Act were unconstitutionally vague. The Archaeological Resources Protection Act made penalties for the disturbance or destruction of archaeological resources more severe and designed a structure for the protection of our nation's archaeological resources. The ARPA defines an

Archaeological Resource as "any material remains of past human life or activities which are of archaeological interest, as determined under uniform regulations promulgated pursuant to this act and which are at least 100 years old. Some important aspects of the ARPA that may be of concern to a developer are as follows:

* The act protects only public and Indian lands.
* No person may "excavate, remove, damage, or otherwise alter or deface any archaeological resource".
* The act prohibits the trafficking of artifacts obtained in federal, state, or local law.
* A person is required to obtain a permit from the federal land manager for excavation, removal and "associated activities". (A land manager will require the person to describe the time, scope, and specific purpose of the work.)
* A person is not required to obtain a permit for an archaeological survey alone.
* First offense violators face misdemeanor penalties up to a $10,000 fine or one year imprisonment, or both.
* When damage of an archaeological resource is less than $5,000, felony penalties up to $20,000 fine or two years imprisonment, or both.
* When damage to an archaeological resource is more than $5,000, felony penalties up to $100,000 fine or 5 years imprisonment, or both.
* Forfeiture - A court may order forfeiture to the United States all archaeological resource, vehicals, equipment that were involved in a violation of ARPA.

13.3 Florida Archaeology

Florida has an extremely rich historic past. Even early explorers to Florida noted how curious they were of the Indian inhabitants and their way of life. Particularly the artificial mounds which the explorers encountered were of interest. But even before the first Europeans came to Florida in 1513, the history of human populations dates back as far as 12000 B.C. Archaeologists have found enough evidence to follow the history of human occupation in Florida. The following outline is taken from the book Florida Archeology by Jerald Milanich and Charles H. Fairbanks:

* 12000 to 1000 B.C.-The state's earliest residents are nomadic hunters who follow big game herds.
* 7000 to 1000 B.C.-Archaic indians adapt to the extinction of big game by turning to plants, fish and deer for food and settling in areas where these are abundant.
* 1200 to 500 B.C.-The southern third of Florida remains in the Archaic stage, but people in other regions began to engage in agriculture and develop distinct formal, political and religious systems. Fired-clay pottery appears.
* 100 B.C.-Religious ceremonial life develops on the Gulf coast but will not take hold on the Atlantic

coast until A.D. 1000 or later.

* A.D. 200 to 1200-Populations spread inland from coasts. Regional cultures are distinguished mainly by different pottery styles.
* 1513-Europeans make first recorded venture to Florida, probably to Gulf coast.
* 1539-Spanish explorer Hernando De Soto arrives at Tampa Bay. Aboriginal population of 100,000 includes the Apalachee in the eastern Panhandle, the Timuca in the northern quadrant of the state and the Calusa in South Florida.
* 1564-The French establish a fort at the mouth of the St. Johns and the Spanish establish a garrison at St. Augustine, where Franciscan missionaries will come 20 years later to work among the Indians.
* 1710-The native population is almost destroyed by slaving raids and migrate south from Georgia and Alabama to the Everglades.
* 1763-The British occupy St. Augustine and the Spanish withdraw from Florida.

Potentially significant archeological finds and accelerated land development has prompted Florida and other states to pass laws and regulations dealing with the preservation of archeological sites. The particular concern of these laws are sites containing native American Indian and other historically significant burials.

13.4 Legislation

The State of Florida has passed a number of laws designed to protect historical and archeological sites. Over twenty Florida Statutes have provisions that pertain to cultural resources. The following is a synopsis taken from Louis Tesar's manuscript entitles "Listing of Florida's Historic Preservation Laws."

* Chapter 253, F.S. State Lands.
  -253.034 addresses the use of state-owned lands.
  -253.024(4) requires the preparation of state land management plans, which plans "shall specifically describe how the managing agency plans to identify, locate, protect and preserve, or otherwise use fragile nonrenewable resources, such as archaeological and historic sites..."
* Chapter 267, F.S. Florida Historical Resources Act.
  -267.061(1) declares state policy relative to historic properties.
  -267.12 makes the division (Division of Historical Resources) responsible for issuing permits for archaeological research on state-owned or controlled lands, and establishes the procedure for obtaining such permits. (NOTE: Chapter 1A-32, Florida Administrative Code, is the division's rule for implementing the terms of this section.)
  -267.13 makes it illegal to conduct archaeological research on state owned or controlled lands without a Chapter 1A-32 permit, or to otherwise deface, remove, destroy or alter archaeological sites or their

features and artifacts without division (Division of Historical Resources) authorization. If guilty, a misdemeanor punishable by a fine not exceeding $500.00 or by imprisonment in the county jail for a period not to exceed 6 months, or both, is possible. In addition, all material (including photographs and records) collected or excavated, shall be forfeited to the state. A fine of not more than $500.00 per day can be imposed on any person or business engaged in illegal activities through an administrative proceeding.

* Chapter 872, F.S. Offenses Concerning Dead Bodies and Graves.

-872.02 pertains to marked human burial sites and their contents, while 872.05 pertains to unmarked human burials. Both involve circumstances in which the Division of Historical Resources of the Department of State is a participating party. Indeed, 872.05 assigns specific authority to the State Archaeologist under specific circumstances, and is very explicit in the procedures to be followed when unmarked human burials are encountered. Upon encountering a human burial, a local law enforcement agency, and the district medical examiner shall be notified. If the individual has been buried for greater than 75 years the State Archaeologist shall be notified. Any person who willfully and knowingly disturbs a burial or burial site is guilty of a felony. Any person who has knowledge that an unmarked burial has been disturbed and fails to notify the local law enforcement agency is also guilty of violating the law as an accessory in the same way as any person who witnesses a crime and fails to report the activity.

13.5 Precautionary Actions

To help minimize the chance of an archaeological resource being damaged or destroyed due to a construction excavation or a construction related activity, there are some precautionary activities a developer can exercise. The Florida Master Site File lists known archaeological findings throughout the state. This reference will give the developer such information as the location of the site, type of site, historic content of the site and the method of site detection. With this information the developer can make an educated prediction about what he or she could expect on his or her site according to the known sites and the topography of the site to be developed. The developer can then make a judgement on what type of archaeological budget, if any, he or she should include in the estimated price of his or her project.

13.6 Florida Master Site File - Guidelines for Users

The Florida Master Site File is the state's clearinghouse for information on archaeological sites, historical structures, and field surveys for such sites. It is a system of several paper and computer files administered by the Bureau of Archaeological Research, Division of Historical Resources, under the Florida Department of State. The Master Site File needs the support of citizens and the general public, because most information is reported by outside individuals and organizations. About 52,000 sites (13,000 archaeological, 39,000 structural) are entered on the Master Site File as of May 1989. The large amount of work to be done can be seen from the fact that less than 10% of the area of most Florida counties has seen field survey by qualified professionals such as archaeologists or architectural historians. About

6,000 sites are being added every year.

The Master Site File is an archive and information source only. Inquiries related to state project reviews, permits, compliance procedures, state land use planning, or local government comprehensive planning should be directed to the Compliance and Review Section of the Bureau of Historic Preservation.

ENTRY OF SITES TO THE MASTER SITE FILE

Eligibility - Listing on the Master Site File does not require any minimal site age (although most sites entered are more than 50 years old) nor a preset level of site significance. Most sites reported with satisfactory documentation are accepted. However, paleontological or fossil sites with no evidence of human presence are not listed on the Site File.

Recording Sites - Two standard Master Site File forms are available, one for archaeological sites and one for historical structures. One or both, as applicable, will be required for entry of a site on the Site File. Supplementary documentation is normally required (site location on photostat of USGS topographic map for all sites; photograph and large scale street map for historical structures).

13.7 Conclusion

It is safe to conclude that many archaeological resources have already been destroyed due to construction, mining and other land development activities. It is the responsibility of everyone to help protect the remaining resources that provide clues to our ancestral heritage. Federal and State laws are becoming more stringent due to the realization of lost resources. With the cooperation of Federal, State and Local Planning Authorities, as well as citizens, we can protect our remaining archaeological resources.

CHAPTER 14

SOURCES OF ASSISTANCE

14.0 Introduction

This chapter lists many of the organizations and associations which can provide reference material and information in regard to various environmental issues in the construction industry which are described in each chapter of this handbook. Following sections provide the general description, address and office hours of the organizations and associations.

14.1 Center for Construction and Environment

The primary purpose of the Center as a research organization is to dedicate to the resolution of environmental problems associated with construction activities and the determination of the optimum materials and methods for use in minimizing environmental damage. A secondary mission is to serve as a resource center for the design and construction industries to utilize for assistance and information in adhering to the provisions of environmental laws and regulations. The Center would also conduct seminars, courses, and symposia on the subject of construction and environment.

Address, Office Hours, and Contacts.

FAC 101 M.E.Rinker, Sr.
School of Building Construction
University of Florida
Gainesville, Florida 32611
(904) 392-5965

Office hours are 9:00 a.m. until 5:00 p.m. each weekday
except holidays.

Dr. Charles J. Kibert
(904) 392-5965 ext. 22

Prof. Linda Waller
(904) 392-5965 ext. 40

14.2 Environmental Organizations

The environmental organization in the United States can be classified into federal, state, local groups. Following Figure 15.1 illustrates the interrelationship between the groups.

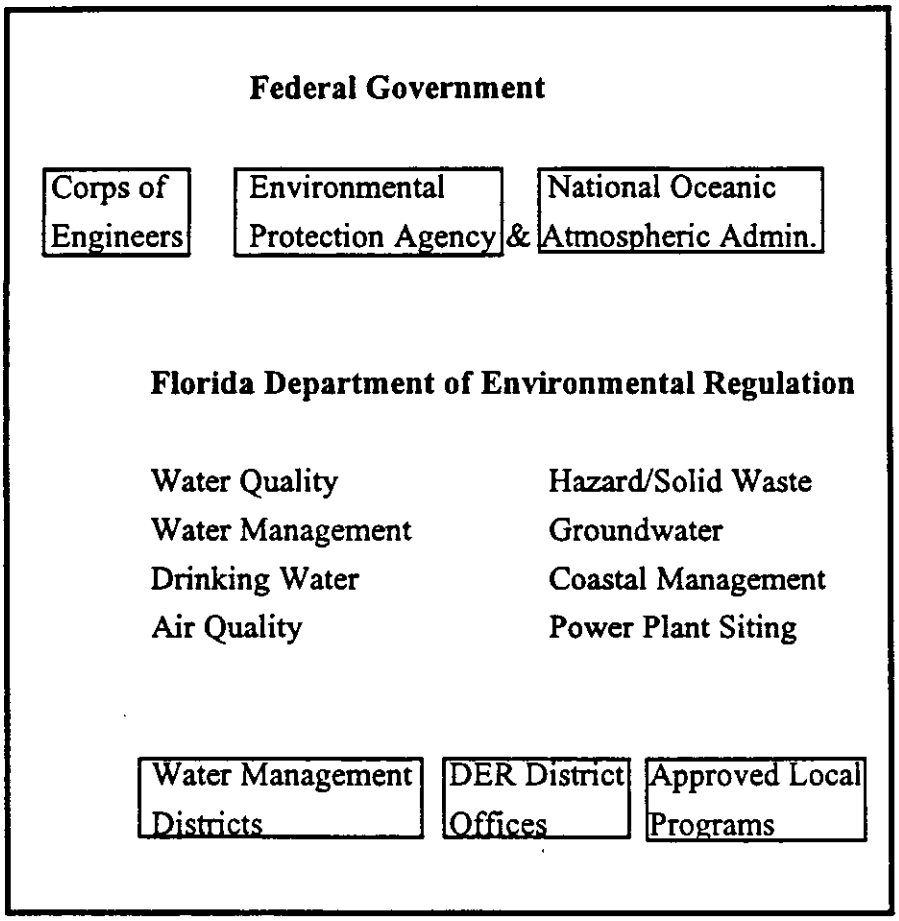

Figure 15.1 Federal Environmental Organizations and Department of Environmental Regulation in Florida

14.2.1 Program Divisions of Florida Department of Environmental Regulation

Following list gives the name and phone number of the program divisions of Florida Department of Environmental Regulation.

Waste Management
(904) 488-0190

Bureau of Waste Cleanup
(904) 488-0190

Petroleum Cleanup 487-3299
Hazardous Waste Cleanup 488-0190
Site Investigation 488-3601
Technical Support 487-3299

Bureau of Waste Planning & Regulation
(904) 488-0300

Hazardous Waste Reduction & Management 488-0300
Hazardous Waste Regulation 488-0300
Solid Waste 488-0300

Water Management
(904) 488-0130

Bureau of Wetland Resource Management
(904) 488-0130

Engineering Support 488-0130
Wetland Resource Regulation 488-0130

Bureau of Surface Water Management
(904) 488-6221

Standards & Monitoring 488-6221
Costal Zone Management 488-6221

Air Resources Management
(904) 488-1344

Bureau of Air Quality Management
(904) 488-1344

Central Air Permitting 48

14.2.2 Offices of Florida Department of Environmental Regulation

The Florida Environmental Regulation establishes environmental standards such as the department's stream classifications, and its air and water quality standards.

The district and branch offices throughout the state. The following list gives the address and telephone number of the Department's headquarters and district and branch offices.

Headquarters
2600 Blair Stone Road
Twin Towers Office Building
Tallahassee, Florida 32399-2400
(904) 488-4805

Northwest District
160 Governmental Center
Pensacola, Florida 32501
(904) 436-8300

Branch Office
340 W. 23rd Street, Suite E.,
Panama City, Florida 32399
(904) 872-4375

Branch Office
2600 Blair Stone Road
Tallahassee, Florida 32399
(904) 488-3704

Suwannee River Environmental District Center
Highway 90 E. & County Rd.
Rt. 3 Box 64
Live Oak, Florida 32060
(904) 362-1001

Northeast District
3426 Bills Rd.
Jacksonville, Florida 32608
(904) 821-5295

Branch Office
5700 S.W. 34th St., Suite 1204
Gainesville, Florida 32608
(904) 336-2095

Central District
3319 Maguire Blvd., Suite 232
Orlando, Florida 32803
(407) 894-7555

Dist. Satellite Office
4913 East Melbourne Ave.
Melbourne, Florida 32901
(407) 984-4800

Southwest District
4520 Oak Fair Boulevard
Tampa, Florida 33610
(813) 623-5561

Southeast District
1900 S. Congress Ave., Suite A
West Palm Beach, Florida 33406
(407) 964-9668

Dist. Satellite Office
970 e. Main Center
Suite A
Bartow, Florida 33830

Dist. Satellite Office
111 Corporation Way
Venica, Florida 34287

Branch Office
2745 S.E. Morningside Blvd.
Port St. Lucie, Florida 34952
(407) 878-3890/335-4310

South District
2269 Bay St.
Fort Myers, Florida 33901
(813) 332-2667

Branch Office
7451 Golf Course Blvd.
Punta Gorda, Florida 33982
(813) 639-4967

Branch Office
1140 Overseas Highway, Suite 123
Marathon, Florida 33050
(305) 743-5955/4337

14.2.3 Water Management District

The Water Management District of DER is composed of following five district offices located around the state.

Northwest Florida District
Rt. 1, Box 3100
Havana, FL 32333
(904) 487-1770

St. Johns River District
P.O. Box 1429
Palatka, Fl 32078-1429
(904) 328-8321

Suwannee River District
Rt. 3, Box 64
Live Oak, FL 32060
(904) 362-1001

South Florida District
P.O. Box V
West Palm Beach, FL 33402-9958
(305) 686-8800

Southwest Florida District
2379 Broad St.
Brooksville, FL 33512
(904) 796-7211

14.3 Division of Historic Resources

The Division of Historic Resources (DHR) under Florida Department of State has worked in developing a comprehensive Florida historic preservation planning program.

Division of Historic Resources
R.A. Gray Building
Tallahassee, Florida 32399-0250
(904) 488-1480

DHR is composed of following four executive branch offices.

Archaeological Research
(904) 487-2299

Florida Folklife Programs
(904) 397-2192

Historic Preservation
(904) 487-2333

Museum of Florida History
(904) 488-1483

14.4 Corps of Engineers Regulatory offices

Panama City Field Office
P.0. Office Box 151
Panama City, Florida 32402-0151
Telephone: (904)763-0717

Crystal River Regulatory Office
P.0. Box 387
Crystal River, Florida 32629-0387
Telephone: (904)795-1078

Pensacola Field Office
160 Governmental Center
Pensacola, Florida 32501
Telephone: (904)436-8428

Gulf Coast Area Office
P.O. Box 19247

Tampa, Florida 33686-9247
Telephone: (813)228-2578

Ft. Myers Regulatory Office
2180 W. First St.
CAN-AM Bldg Suite 312
Ft. Myers, Florida 33901-3217
Telephone: (813)332-7808

Field Monitoring Branch
Regulatory Division
P.O. Box 4970
Jacksonville, Florida 32232-0019
Telephone (904)791-2887

Palatka Regulatory Office
P.O. Box 1317
Palatka, Florida 32078-1317
Telephone: (904)325-2028

Merritt Island Regulatory Office
2460 N. Courtney Square Blvd.
Courtney Square Bldg., Suite 216
Merritt Island, Florida 32953-4101
Telephone: (305)453-7655

Stuart Regulatory Office
Suite 208 Arthur Dehon Bldg.
300 Colorado Avenue
Stuart, Florida 33494-2133
Telephone: (305)847-4525

South Florida Area Office
P.O. Box 1327
Clewiston, Florida 33440-1327
Telephone: (813)983-8101

Big Pine Key Regulatory Office
P.O. Box 633
Big Pine Key, Florida 33043-0633
Telephone: (305)872-3205
Kissimee Regulatory Office
P.O. Box 339
Kissimmee, Florida 32474-0339
Telephone: (305)847-4525

South Florida Area Miami Office
P.O. Box 520766
Miami, Florida 33152-0766
Telephone: (305)350-5041

14.5 Other Sources of Assistance

The following is a list of miscellaneous organizations that may be of assistance:

Hazardous Waste

Florida Department of Environmental Regulation Information Hotline, 1-800-342-0184, Monday - Friday, 8:00 a.m. - 5:00 p.m.

U.S. Environmental Protection Agency, RCRA/Superfund Hotline, 1-800-424-9346, Monday - Friday, 8:30 a.m. - 7:30 p.m.

U.S. Environmental Protection Agency, Small Business Hotline, 1-800-368-5888, Monday - Friday, 8:00 a.m. - 5:00 p.m.

U.S. Environmental Protection Agency, General Information, 1-800-241-1754, Monday - Friday, 8:30 a.m. - 5:00 p.m.

Governmental Refuse Collection and Disposal Association, Small Quantity Hazardous Waste Generator, Information and Assistance Clearing house Project, 1-800-458-5886.

Hazardous Waste Emergencies

Florida Department of Environmental Regulation, State Warning Point, 24 hours a day, 1-904-488-1320.

U.S. Environmental Protection Agency, National Response Center, 24 hours a day, 1-800-424-8802.

Asbestos

Florida Department of Environmental Regulation, Bureau of Air Quality Management, 1-904-488-1344, Monday - Friday, 8:00 a.m. - 5:00 p.m.

Florida Department of Health and Rehabilitative Services, asbestos in public schools, 1-904-487-1130, Monday - Friday,
8:00 a.m. - 5:00 p.m.

Florida Department of Labor and Employment Security, Asbestos Management Program, Gainesville, 1-904-336-2022.

Radon

Florida Department of Health and Rehabilitative Services, health effects, 1-904-488-2905, Monday - Friday, 8:00 a.m. - 5:00 p.m.

Florida Department of Health and Rehabilitative Services, Office of Radiation Control, 1-904-487-1004, Monday - Friday,
8:00 a.m. - 5:00 p.m.

Hazardous Materials: General

Florida Department of Environmental Regulation, State Warning Point, 1-904-488-1320, 24 hours a day.

U.S. Environmental Protection Agency, National Response Center,
1-800-424-8802, 24 hours a day.

Workplace Exposure to Hazardous Materials

Florida Department of Labor and Employment Security, Division of Workers' Compensation, Bureau of Industrial Safety and Health,
1-800-367-4378, Monday - Friday, 8:00 a.m. - 5:00 p.m.

U.S. Department of Labor, Occupational Safety and Health Administration (Jacksonville), 1-904-791-

2895, Monday - Friday,
8:00 a.m. - 5:00 p.m.

Air Pollution

Florida Department of Environmental Regulation, Northeast District Branch Office, Gainesville, 336-2095, 8:00 a.m. - 5:00 p.m., Northeast District, Jacksonville, 1-798-4200; Division of Air Resources Management, Tallahassee, 1-488-1344.

Drinking Water

U.S. Environmental Protection Agency, Safe Drinking Water Hotline, 1-800-426-4791, Monday - Friday, 8:30 a.m. - 4:30 p.m.