

2002

# Analyzing the education mandate of Title X: the Lead-based Paint Reduction Act of 1992

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**ANALYZING THE EDUCATION MANDATE OF  
TITLE X: THE LEAD-BASED PAINT REDUCTION ACT OF 1992**

A Thesis  
Submitted to the Graduate Faculty of the  
Louisiana State University and  
Agricultural and Mechanical College  
in partial fulfillment of the  
requirements for the degree of  
Master of Science

in

The Department of Environmental Studies

by  
William Troy Roussel  
B.S., Louisiana State University, 1995  
December 2002

## **Acknowledgements**

I would like to extend a sincere thank you to the members of my committee, Dr. Al Cunningham, Dr. Margaret Reams, Dr. Maude Walsh, and Dr. Michael Wascom. They allowed me to follow my interest and guided my research. I could not have completed this project with out their support and unlimited access to their resources and knowledge.

I also must thank Louisiana State University and the departments that provided an opportunity to continue my education by pursuing a master's degree in an environment that provided support through allocation of time and resources. The staffs in both departments lent their time and knowledge to assist me in anyway necessary.

I must thank my parents, family, and friend for all they gave of themselves during this project. I could not have dreamed this possible without their support and encouragement. Most of all I would like to thank my wife, Jenny, for helping to keep me focused on my goals and the goals of your family through the all events of our lives. She believed in me and sacrificed our time together so that I could better myself. The achievement of this goal would not be as special without her love and support.

## Table of Contents

Acknowledgements .....	ii
Abstract.....	v
Chapter 1 Introduction to Lead and the Lead Problem .....	1
1.1 What Is Lead?.....	2
1.2 What Is Lead Poisoning?.....	4
1.3 Lead in Paint.....	6
Chapter 2 Title X: Residential Lead-based Paint Hazard Reduction Act of 1992 .....	8
2.1 Regulatory History.....	8
2.2 Methods of Education as Mandated by Title X.....	10
Chapter 3 Evaluating the Title X Education Mandate.....	13
3.1 Goals and Objectives .....	13
3.2 Validity of Study.....	13
Chapter 4 Pre-Course Survey .....	17
4.1 Survey Overview .....	17
4.2 Honing the Instrument: Survey Pilot .....	18
4.3 Variables.....	18
4.4 Analysis of Statistical Data by Session.....	19
4.5 Analysis of Statistical Data for Survey Sample.....	24
Chapter 5 Post-Course Test .....	29
5.1 Test Overview.....	29
5.2 Analysis of Data .....	29
Chapter 6 Discussion.....	32
6.1 Summary of Findings.....	32
6.2 Policy Analysis .....	34
6.3 Political Issues .....	36
Chapter 7 Recommendations.....	40
7.1 Specialized Training for Contractors .....	40
7.2 Educate Parents.....	41
7.3 Additional Research.....	45
7.3.1 Delivery Methods.....	45
7.3.2 Infrastructure Analysis.....	46
7.4 Summary .....	47
References.....	50

Appendix A: Survey for Contractors .....	54
Appendix B: Case Summary .....	55
Appendix C: Post-Course Test.....	57
Appendix D: Post-Course Test Case Summary .....	61
Vita .....	62

## **Abstract**

The Environmental Protection Agency appropriates 400 million dollars in grant funding under the authority of Title X: Residential Lead-based Paint Hazard Reduction Act of 1992. The education mandate of Title X states that the federal government must build an infrastructure to educate the public, real estate professionals, and contractors, to name a few, on the hazards of lead-based paint. A survey was developed to assess the effectiveness of the Title X education mandate. Contractors in the City of New Orleans were surveyed to assess their knowledge of the act and the hazards of lead-based paint before attending an 8-hour training course used to training contractors in accordance with a city ordinance. The city's ordinance was passed to ensure that contractors performing remodeling or renovation activities in the city limits are properly trained on the hazards of lead-based paint and hazard control methods known as interim controls. It requires contractors to attend a minimum 8-hour course approved by the Department of Housing and Urban Development (HUD). The results of this study indicate that the contractors in the New Orleans area are not being educated on the hazards of lead-based paint and the requirements of Title X as mandated. The training course the contractors attended requires attendees to pass a post-course test in order to receive a notice of completion to prove certification. The scores from the test were also analyzed and assessed. The analysis demonstrated the contractors benefited from specialized training as average scores of the group increased by approximately 20% over the survey scores.

This study recommends policy mandating training and education with a need for additional research. Contractors should be required to attend specialized education

regarding lead-based paint. Policy to educate parents must be implemented with the help of pediatricians and other medical professionals. Additional research to identify the most effective training methods that can be used to educate contractors should be conducted. Also, research must be conducted to identify deficiencies in the national infrastructure mandated by Title X to educate contractors so that a model for an effective and efficient infrastructure can be implemented.

## **Chapter 1. Introduction to Lead and the Lead Problem**

One of the most common and preventable childhood health problems in the United States is lead poisoning. This problem spans all socioeconomic groups, ethnic groups, and geographical areas (Gerchifsky, 1994). According to the Agency for Toxic Substances and Disease Registry, lead is ranked first among the top 10 hazardous substances. Because lead is pervasive in the environment, children are at risk for lead exposure, and they are particularly vulnerable to the toxic effects of lead (Porter, 1997). Federal Law has been enacted to build an infrastructure for education of the public and trades selling, leasing, or performing remodeling or renovating residential property. However, has the education mandate of Title X: Residential Lead-based Paint Hazard Reduction Act of 1992, the law known simply as Title X, been effective in educating contractors of the requirements of the law and the hazards associated with lead-based paint?

Lead causes toxic effects on the human body, including behavioral changes, seizures, and even death. Due to potential cuts in federally funded programs that provide services to children, there is a great concern for the protection of children from lead poisoning (Tesman & Hills, 1994). Are contractors being educated on the hazards of lead-based paint and controls to protect residence or property owners as mandated by federal law? Cost-benefit analysis may indicate that the additional or re-appropriated funding is needed to educate the public and contractors performing remodeling and renovation in residential or child occupied facilities. Contractors are not being educated unless specialized training is required by city, state, or local mandates. This is important because parents must understand the hazards associated with remodeling, renovation, or rehabilitation of their property when lead-based paint is present. Contractors must help to

educate property owners so that children are protected from the hazards of this substance. Results of a descriptive study of factors associated with parental actions to reduce childhood lead exposure support this theory. Data provided by parents of 271 children whose blood lead levels (BLL) were at least 10 micrograms per deciliter (mg/dL). Parental reports of believing that the child's exposure was excessive and of having prior knowledge of lead's risks were both significantly associated with parental action to reduce lead exposure (Porter, 1997). This is significant because adverse health effects in children can occur as BLL reach an unsafe concentration which is 10 mg/dL or greater by law. With these facts in hand, it should not be assumed that parents are knowledgeable in building trade skills, but rather they should be able to rely on the expertise of remodeling or renovation contractors to inform them of possible lead-based paint hazards so that the parents can make informed decisions regarding the safety of their children.

### **1.1. What Is Lead?**

Elemental lead is a heavy, soft, malleable bluish metal. It generally occurs in nature in the form of ores, and was recovered in early times as a by-product in the smelting of silver. Once lead is mined, processed and introduced into man's environment, it is a potential problem forever. Nearly all of the lead in the human environment is there as a result of man's activities.

The history of lead use traces back through centuries past. Sustained use of large quantities of lead over many years has resulted in extensive environmental contamination. Although lead occurs naturally in small quantities in the earth's crust, by far the greatest risk of exposure to lead derives from man-made processes and products (Mielke, 1997). People have used lead in dishes, dyes, weights, and coins from the time of early

civilizations, such as the Greeks and Romans, to the present (Gilfillan, 1965). The oldest known lead object was a statue excavated in Turkey and circa 6500 B.C. Lead has been mined, smelted, and compounded for thousands of years. Lead objects have been found in Egyptian tombs. In ancient Syria, lead was used in rods and pieces as means of currency. World production of lead 4000 years ago has been estimated at 160 tons per year; 2700 years ago, it was 10,000 tons per year; and, during the Roman Empire, lead production increased to 80,000 tons per year.

During the Roman Empire, lead was used extensively in many aspects of life. It was used to line vessels that stored water and wine, in utensils, and, in combined form, as a glaze on pottery. It is hypothesized that the decline of the Roman Empire can be attributed, in part, to lowered birth rates and increased mental disturbances caused by lead poisoning among the populace (Gilfillan, 1965).

The ancient Greeks were the first to write about lead poisoning, but for most of its long history, lead had not been suspected as a hazard. In fact, doctors over the years utilized lead as a “treatment” for various diseases. A medical dictionary dated in 1745 suggests that lead dissolved in a mild acid such as vinegar might be used to cure sores or skin diseases. Others claimed that lead therapy could cure consumption, diabetes, dysentery, and epilepsy.

Bernardo Ramazzini, who described lead intoxication in potters working with glaze, first reported the occupational hazards of lead in 1713. Later In the 18th century, Benjamin Franklin (who was a printer and handled lead type) described the toxic effects of lead occurring in tradesmen who used lead in their occupations. These tradesmen included printers, plumbers, and painters. He lamented (in a now famous letter to his friend Ben

Vaughn) the fact that no one seemed to be doing anything to protect people from the known poisonous nature of lead.

Centuries of mining, smelting, and use have released millions of tons of lead into the environment. With the advent of the industrial age in the 1800s, the use of lead increased, and with it, the potential for occupational exposures also grew. Its versatility, as well as favorable physical and chemical properties, accounted for its extensive use. Much of its usefulness is due to its plasticity and softness. Lead can be rolled into sheets that can be made into rods and pipes. It can be molded into containers and mixed with other metallic elements. Lead was used in building construction, especially roofing, cornices, electrical conduits, and water and sewer pipes.

During the last 100 years, lead was added to many U.S. products including paint, gasoline, water pipes and health care supplies. About 330 million tons of lead were mined for these purposes. Even though lead's use is now restricted and regulated because of known health risks, the heavy metal is still mined and added to products (LinFu, 1992).

Because it does not break down, most of the lead ever produced remains in soil, dust and other environs. The odorless, colorless, tasteless metal (tasteless in the form of lead dust, but sweet as chips) so widely present in homes, yards and workplaces can only be detected through chemical analysis or by x-ray fluorescence analyzer (XRF).

## **1.2. What Is Lead Poisoning?**

Lead poisoning occurs when high amounts of lead are in the body. Lead accumulates in the body during a lifetime. Once stored, the heavy metal is released very slowly and is a continuous source of lead exposure. In the United States, data reveal that an estimated 1.4% of children, ages 6 months to 5 years, have blood lead levels of 25 mcg/dL or greater.

Adverse health and developmental effects of mild lead poisoning may include mild flu-like symptoms; sleep disturbances, headaches, and a metallic taste in the mouth. Bradycardia, neuropathy, ataxia, and papilledema are seen in severe lead poisoning. The evidence of adverse health effects associated with lead levels of 25 mcg/dL or greater demonstrates the magnitude of the problem, as these effects present enormous clinical, financial, public health, and societal dilemmas (Weitzman & Glotzer, 1992).

In the body, lead enters the bloodstream (99 percent is associated with red blood cells and 1 percent is in the plasma) where it is carried throughout the body. Lead meets one of two fates: 1) It can be excreted through the kidneys or intestines; or 2) It can be stored in soft tissue and bones and teeth where it is slowly released over decades. This is called lead burden.

More than 95 percent of total lead in the adult body is in bones and teeth. Throughout a lifetime, lead is mobilized back into the bloodstream in times of stress, chronic disease or pregnancy/lactation (a hazardous exposure source for unborn fetuses).

Even though single exposures are hazardous, it is chronic exposure that poses the biggest threat. Constant, long-term exposure from both the external environment and total body burden (all lead circulating or stored in a body) can cause adverse health effects. For instance, even if a person is removed from a lead source and blood-lead levels return to normal, the stored lead can be mobilized for decades, representing a continuous lead source that could cause lead poisoning (Mielke, 1997).

This entirely preventable disease is one of the most serious environmental health hazards U.S. children face. Almost 1 million children under the age of 6 have too much lead in their bodies (more than 10 µg/dl), according to the Centers for Disease Control and

Prevention (CDC), the federal agency responsible for tracking disease in the United States. A third of these youngsters had even higher and more unsafe levels (more than 15 µg/dl) (Goldman, 1997).

### **1.3. Lead in Paint**

The two biggest contributors of lead to the environment are leaded paint and gasoline. Lead-based paint use peaked in the 1920s and gradually fell off until its ban in 1978. Lead compounds (chemicals consisting of lead in combination with other elements such as oxygen or chromium) such as white lead and lead chromate were widely used pigments in paint. Lead is also commonly present in varnishes and primers. Although the use of lead-based paint, in particular on interior surfaces, has declined over the years, most housing units built before 1980 contain lead-based paint (Mielke, 1994).

The definition of Lead-based paint: as defined by the Department of Housing and Urban Development (HUD) is: “any paint, varnish, shellac, or other coating that contains lead equal to or in excess of 1.0 mg/cm<sup>2</sup> as measured by an x-ray fluorescence analyzer (XRF) or laboratory analysis or 0.5 percent by weight by laboratory analysis (HUD, 1997).”

The amount of lead-based paint in housing is significant: tens of millions of housing units contain at least some lead-based paint (see Table 1.1: Lead in Housing on following page). Children living in homes with lead-based paint become exposed to that lead directly by eating chips of lead-based paint or chewing on protruding surfaces painted with lead-based paint. The more common route of exposure, however, is the ingestion of lead-bearing dust that is generated by the paint when it deteriorates, chinks, or is disturbed

through renovation or even abrasion from the opening and closing of windows (Mielke, 1990).

Table 1.1: Lead in Housing

<b>How Widespread is Lead in Housing?</b>	
<b>Year House was Built</b>	<b>Percent of Homes with Lead-based Paint</b>
Before 1940	87 percent
1940 – 1959	69 percent
1960 – 1978	24 percent
All Housing	40 percent

*Source: HUD Report on the National Survey of Lead-based Paint in Housing, 2001*

A lead-based paint hazard is defined as a condition in which exposure to lead from lead-contaminated dust, lead-contaminated soil, deteriorated lead-based paint, or from lead-based paint present on accessible, friction, or impact surfaces would result in adverse human health effects (HUD, 1997).

## Chapter 2. Title X: Residential Lead-based Paint Hazard Reduction Act of 1992

### 2.1. Regulatory History

The first step in the development of any public policy is problem identification. In regard to the issue of lead poisoning, the issue has a long history (see Figure 2.1: Lead Regulation). As early as the 1890s, Australia was the first country to identify lead poisoning in children (Castiglia, 1995). It was not until the 1960s that lead poisoning was recognized by Medicare and both federal and state governments as a pediatric problem in the United States (Tesman & Hills, 1994). LinFu (1967), of the Department of Health, Education and Welfare, discovered lead poisoning in "slumdwelling" children as a serious threat to children's health. LinFu's discovery (1967) contributed to moving the issue of lead poisoning to the attention of government, making it a national issue in the United States. Her research launched subsequent education in the medical and pediatric settings and influenced public opinion. A groundswell of public opinion focused on children and lead and influenced the Congress to take action.

<b>A Regulatory History of Lead</b>	
Regulation	Year Enacted
HUD Interim Guidelines	1989
Resource Conservation and Recovery Act (RCRA)	1976
Hazardous and Solid Waste Amendments (HSWA)	1984
Lead Contamination Control Act (LCCA)	1988 (amended 1991)
Amended the Safe Drinking Water Act	
Residential Lead-based Paint Hazard Reduction Act of 1992 (Title X)	1992

Figure 2.1: Lead Regulation

Over the last two decades, the Federal Government has taken a number of key actions to reduce lead exposures. It has banned the use of lead in house paint and in the solder and pipes used in public drinking water systems. It has encouraged the phase-out of solder in food cans. EPA has contributed to these efforts by taking action to virtually

remove lead from gasoline and, most recently, by promulgating new standards for drinking water.

These actions have been very effective in reducing major sources of lead exposure. Deaths from lead poisoning, which were not uncommon 20 years ago, have been almost eliminated. However, old lead-based paint, and the associated contaminated dust and soil, remain largely untouched as environmental sources of lead. Moreover, continuing scientific research has demonstrated that harmful effects may occur at lead levels previously considered safe. Experts agree that a large number of children are still at an unacceptable level of risk (Mielke, 1990).

Congress passed the most comprehensive federal lead poisoning prevention legislation in 1992 as Title X of the Housing and Community Development Act (RESIDENTIAL LEAD-BASED PAINT HAZARD REDUCTION ACT OF 1992, PUBLIC LAW 102-550). The Act, commonly known as Title X, redefines the federal response to lead poisoning by directing several federal agencies to establish a coordinated effort to reduce lead hazards. The main agencies responsible for Title X are the Department of Housing and Urban Development (HUD), the Environmental Protection Agency (EPA), and the Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor. Title X amends the Toxic Substance Control Act (TSCA) by adding a fourth title: Lead Exposure Reduction. TSCA gives EPA the authority to address lead in residential housing, public and commercial buildings, and steel structures.

The danger posed by lead-based paint hazards can be reduced by abating lead-based paint or by taking interim measures to prevent paint deterioration and limit children's exposure to lead dust and chips. Despite the enactment of laws in the early

1970's requiring the Federal Government to eliminate as far as practicable lead-based paint hazards in federally owned, assisted, and insured housing, the Federal response to this national problem remained severely limited. Title X is very clear in stating the Federal Government must take a leadership role in building the infrastructure including an informed public, state and local delivery systems, certified inspectors, contractors, and laboratories, trained workers, and available financing and insurance -- necessary to ensure that the national goal of eliminating lead-based paint hazards in housing can be achieved as expeditiously as possible. EPA provides the State of Louisiana with the authority to oversee and enforce Title X with the Department of Environmental Quality designated as the lead agency.

To address these issues, Title X expands HUD's coverage of federally owned and assisted housing subject to lead-based paint reduction activities. Housing sold by other Federal agencies are subject to Title X's inspection and abatement requirements upon sale. States and local governments must evaluate and propose how to integrate lead-based paint hazards reduction into their housing policies and programs. HUD must also issue guidelines for the conduct of federally supported risk assessments, inspections, interim controls, and abatement of lead-based paint hazards (EPA, 1994).

## **2.2. Methods of Education as Mandated by Title X**

Recognizing the need for more public education, the EPA and HUD jointly issued a regulation in March 1996 providing for disclosure of possible hazards in lead-based paint at the time when homes are sold or rented. The rule implements section 1018 of the Residential Lead-Based Paint Hazard Reduction Act of 1992, designed to protect families from exposure to lead from paint, dust and soil.

Title X authorizes HUD to distribute approximately \$400 million in grants to states and local governments to reduce lead based paint hazards in priority housing that is not federally assisted or owned property. Funding under Title X is available for states to establish training, certification, and accreditation programs to meet the requirements of Section 402.

The purpose of these training, accreditation, and certification requirements and the work practice standards is to ensure that lead-based paint abatement contractors, including workers, supervisors, inspectors, risk assessors, and project designers, are educated in conducting lead-based paint activities in target housing and child occupied facilities. The rule also ensures, through the certification of professionals, that inspections for the identification of lead-based paint, risk assessments for the evaluation of lead-based paint hazards, and abatements for the permanent elimination of lead-based paint hazards are conducted safely, effectively and reliably. In addition, training providers will be accredited to ensure that high quality education for these professionals is available. EPA believes this certification and accreditation program will allow homeowners and others to hire a well-qualified work force that is adequately trained in the proper procedures for conducting lead-based paint activities.

SEC. 1003, states that the purposes of this Act are to develop a national strategy to build the infrastructure necessary to eliminate lead-based paint hazards in all housing as expeditiously as possible, to reorient the national approach to the presence of lead-based paint in housing to implement, on a priority basis, a broad program to evaluate and reduce lead-based paint hazards in the Nation's housing stock, to encourage effective action to prevent childhood lead poisoning by establishing a workable framework for

lead-based paint hazard evaluation and reduction and by ending the confusion over reasonable standards of care, to ensure that the existence of lead-based paint hazards is taken into account in the development of government housing policies and in the sale, rental, and renovation of homes and apartments, to mobilize national resources expeditiously, through a partnership among all levels of government and the private sector, to develop the most promising, cost-effective methods for evaluating and reducing lead-based paint hazards, to reduce the threat of childhood lead poisoning in housing owned, assisted, or transferred by the Federal Government, and to educate the public concerning the hazards and sources of lead-based paint poisoning and steps to reduce and eliminate such hazards (EPA, 1994).

Essentially, Title X is about information and educating parents, workers, contractors, real estate agents, and financial institutions among others. It honors the right of parents to know that they are raising their children in a safe environment. When people are informed, they can play a major role in protecting themselves and their children against environmental pollutants. With this key information on lead in their housing and the steps to take to manage the lead, parents can be a powerful force in protecting their children from lead poisoning. The rule gives them the tools they need (Goldman, 1997).

## **Chapter 3. Evaluating the Title X Education Mandate**

### **3.1. Goals and Objectives**

On October 28, 1992, President Bush signed into law P.L. 102550, an omnibus housing bill which includes as Title X the "Residential Lead Based Paint Hazard Reduction Act of 1992." To analyze the effectiveness of the education mandate of Title X, a survey was constructed to gather demographic information and test for a basic knowledge of lead-based paint and the hazards associated with this material. Education is measured by performance in two ways. First, performance is measured by using the voluntary survey that was given to contractors working in the City of New Orleans, Louisiana. The contractors, which are defined for the purpose of this study as a person contracted to perform construction, remodeling, or renovation activities, were presented with the survey while attending a course designed to train contractors on the hazards of lead-based paint. The survey results are analyzed for relationships between demographic information and the results of the scored section of the survey. Performance of a post-course test is then measured to evaluate the impact of the training course on the hazards of lead-based paint developed by a HUD grant. However, it is not an objective of this study to measure the effectiveness of this training, but only to determine whether there is an impact as a result of contractors completing the course.

### **3.2. Validity of Study**

The City of New Orleans has recently passed an ordinance in October of 2001 requiring all contractors performing work in the City Limits of New Orleans to have a minimum of 8 hours of lead-based paint hazards training that is approved by HUD due to incidents in the city limits where children were found to have lead poisoning as a result of

improper work controls during remodeling and renovation activities. Ordinance No. 4264 M.C.S states, “the need to amend the Code of the City of New Orleans, Chapter 82, Article VIII, relative to the prevention of lead poisoning in the City of New Orleans, in order to further minimize the potential for Lead Poisoning from painting operations.” These activities where lead poisoning occurred were performed at the children’s primary residence, and the children were found to have blood lead levels well above the amounts EPA has deemed safe. One of the most recent incidents used by the city involved a family losing a pet to lead poisoning. This led the family to explore the cause of death. Once lead poisoning was the known culprit, then the children were tested. Lead poisoning was discovered and the children were treated. The city crated a task force to address the risk and attempt reduce the risk posed to the children leaving in the City of New Orleans.

The course delivered to the contractors in the New Orleans Area is titled *Addressing Lead-based Paint Hazards During Renovation, Remodeling, and Rehabilitation in Federally Owned and Assisted Housing*. The course was developed by HUD to train contractors on lead-based paint hazards for the purpose of protecting residences and workers. The course is based on HUD’s Lead Safe Work Practices for federally owned and assisted housing; however, as noted the City of New Orleans has passed an ordinance that requires all contractors performing construction, remodeling, or renovation in the city to be certified and to use lead safe work practices and obtain training specific to the practices in a HUD approved course. The ordinance states that, ““Certified” means a process used by the Louisiana Department of Environmental Quality (LDEQ) and the US Environmental Protection Agency (EPA) to identify

individuals who have completed training and other requirements to permit the safe execution of lead risk assessments and inspections, or lead hazard reduction and control work. "Certified" includes current "Interim Certification" by Department of Health Services, unless and until this status is modified by state legislation." Contractors are not allowed to perform work in the New Orleans Area until the training has been completed.

To ensure a valid sample, possible issues that may cause a bias are addressed. Cost, location, method of delivery, and need for the training are identified as critical areas for which special considerations were made. The LSU Lead-based Paint Management Program and the Louisiana Division of Administration partnered on a HUD grant from the Center for Healthy Housing, formerly the Center for Lead Safe Housing, to conduct the 8-hour HUD course. The course sessions were conducted on three dates in the beginning of 2002. February 4<sup>th</sup>, 18<sup>th</sup>, and 25<sup>th</sup> were the three sessions held in the New Orleans Area to accommodate the participants. The training was free of charge to the participants and all contractors were in need of the training to continue a steady workflow. The course instructor is accredited and certified to instruct courses in Inspecting for Lead Hazards, Lead Hazard Risk Assessment, and Supervision of Lead Abatement. The same primary instructor was utilized for all three of the courses. Following the course, the participants were required to take a post-course test to gauge knowledge transfer. A score of 70% on the test is required to receive a notice of completion for the 8-hour course.

The post-course test scores were evaluated by session. Session statistics are compared to each other and to the scores on the survey for each session. The comparisons are performed to provide support for correlations between demographic variables and

performance. Correlations are important to determine possible means by which contractors may have been educated on Title X and the hazards of lead-based paint.

The relationship between the survey and the post-course test are both basic and straightforward. The scored questions from the survey are also on the post-course test. The questions for the survey were selected to require a demonstration of a basic knowledge of lead-based paint and the hazards associated with lead-based paint. This basic level of knowledge is not sufficient to perform lead-based paint abatement work but is an awareness knowledge level for remodeling or renovation work that may have incidental contact with lead-based paint. Lead-based paint abatement can only be performed by an accredited contractor as defined by Title X. In theory, once the 8-hour course has been completed, the participants should be able to perform interim controls for safe remodeling or renovation activity should the potential for lead-based paint be identified at a property. Interim controls are not defined as abatement. Rather, these controls are utilized in remodeling or renovation activities, which are not regulated by Title X, to protect both the worker and the residence.

## **Chapter 4. Pre-Course Survey**

### **4.1. Survey Overview**

A survey was designed with a total of 12 questions. See Appendix A to view the case summary of the survey. Questions 1 through 5 are designed to capture demographic information on the subjects. Questions 6 through 12 are designed to test for basic knowledge that Title X is mandated to disseminate through infrastructure intended to educate not only contractors but the general public as well. Infrastructure that currently includes dissemination of information in real estate transactions whether sale or lease, health clinics where children from low income areas are cared for, and oversight of the target housing that may be primary care facilities for children. These 7 questions are selected from the post-course test. The instrument was distributed by the instructor in the Louisiana State University (LSU) Division of Continuing Administration Lead-based Paint Management Program. The subjects were given the following instructions:

“I am administering a survey for a graduate student in the Environmental Studies Masters Program at LSU. You are not required to fill out the survey, but you would be helping the student with his thesis research. The survey does not ask for your name or any other information that identifies your identity. I will now distribute the surveys and will collect them again in 10 minutes. Thank you again for your assistance.”

The instrument is designed to ensure the subjects remain anonymous by numbering surveys by case and grouping data. The author can in no way identify the name of the subject. To ensure confidentiality, the protocols, or surveys, will be destroyed once the study is complete.

#### **4.2. Honing the Instrument: Survey Pilot**

The survey was piloted to participants of two different groups. Participants of the LSU Asbestos Management Program and Indoor Air Quality course were given the survey to ensure that the survey was easy to read, easy to understand, and appropriate to subjects. The instrument was revised three times as a result of the pilot. The participants of the Asbestos Management Program completed 67 voluntary surveys and agreed to comment. The pilot subjects thought having the answers to the survey questions on a separate page was confusing. The survey was originally two pages and the pilot subjects suggested it be shortened to one page. The Indoor Air Quality course participants were asked to complete the survey and 53 surveys were completed. The pilot subjects asked that the direction for marking answers be placed on the survey; therefore, “Please Circle the Correct Answer” was added to the top of the survey below the blank for the date. The group also suggested that non-licensed contractors not complete the demographic questions. A line was added informing subject who answered no to the first question, “Are you a licensed contractor or employed by a licensed contractor?” to skip to question number 6 which was the first of the scored questions on the survey. A large number of pilot subjects felt the survey was targeting licensed contractors so the survey was modified as a result.

#### **4.3. Variables**

The demographic questions captured data on whether a contractor is licensed, how long the subject has been licensed or employed by a licensed contractor, what type of work is performed (industrial, commercial, or residential), and two questions capturing

information on whether the contractor had performed work in target housing, defined as housing built before 1978, and whether the contractor had performed work in property known to have lead-based paint present. These first questions were designed to capture information that will stand as demographic information. These are independent variables, or stimulus variables, that affect performance on the scored questions. The dependant variable in the study is performance on the scored questions. Performance on the test is used as a measure of education. Determining a definition of education is critical to the study and an operational definition was needed to validate the results of the survey. The operational definition of education for the purposes of this study is performance based and will be a passing score. A passing score is “answering 70 percent or more questions regarding lead-based paint correctly on the survey.” This is the operational definition utilized on the post-course test that will be detailed later. The survey itself is an instrument to measure education in the group, but the survey also served as a baseline measurement for the group to determine the impact of a specialized 8-hour lead-based paint program used to train contractors.

#### **4.4. Analysis of Statistical Data by Session**

A total of 119 participants attended the training session and 85 of the participants completed the survey. A case summary of the surveys is included as Appendix B. This equates to a return rate of 71%. Of the surveys completed, 71 were licensed contractors or were employed by a licensed contractor. There are 142 licensed contractors in the City of New Orleans as reported by the Louisiana Board of Licensed Contractors. There are 775 contractors in the New Orleans Area. The New Orleans Area was defined as

approximately a 50 miles radius of the city. The remaining 11 surveys were contractors that are not licensed.

Classical measurement theory begins with the assumption that all measurement contains some error. Any observed score has two components: a true score and error. The sessions are evaluated separately for reliability measure. The split of data into session groups is random and the split groups will be analyzed to ensure validity and reliability. The more similar the descriptive statistics of the three groups are, the more reliable the data in theory (Kidder, 1981). Validity is determined using the demographics of the participants.

In each group, at least 85% of the contractors perform residential construction, remodeling, or renovation. Therefore, a great majority of the group will perform work on property that could be primary care facilities for children. Surveys of 45 participants revealed contractors had performed remodeling, renovation, or rehabilitation of residential property that is considered target housing, built prior to 1978 by definition, with an additional 7 unaware. A total of 32 surveyed participants had performed remodeling or renovation work in homes known to contain lead-based paint and 27 were unaware. These numbers show a high level of risk to children as a large number of contractors are performing work in homes that may contain lead-based paint.

Because multiple employees from any one company could and most likely did attend the training sessions, it is assumed for the purposes of this study that individual performance is the measure of education as apposed to the performance of a company. Hence, individual performance determines the effectiveness of Title X. The rule does not differentiate between contractors and employees of a contractor, and for the purpose of

this study, no differentiation will be made between the two. A contractor bring defined as a person working for a company performing construction, remodeling, or renovation activities.

The 2/4 group, groups are referred to by the session month and day the session was held, of subjects scored higher on the survey questions than the other two course session groups. It is very impressive that the question answered correctly with the greatest frequency asks for what Title X provides guidance and funding (see Table 4.1: 2/4 Survey Summary). This may demonstrate a correlation between licensed contractors, 27 in this group, and contractors having worked in target housing and housing known to contain lead-based paint with an education of Title X which governs remodeling and renovation activities in these homes.

Table 4.1: 2/4 Survey Summary

<b>Survey Report for 2/4 Group</b>	
Question #	31 Total Surveys
1	Licensed Contractors: 26 Yes, 5 No
2	Experience: 16 Less than 10 yrs., 9 Over 10 yrs.
3	Type of Work: 1 Industrial, 3 Commercial, 27 Residential
4	19 Yes, 7 No, 3 Unaware
5	10 Yes, 6 No, 12 Unaware
6	70.97% Correct
7	61.29% Correct
8	80.65% Correct
9	61.29% Correct
10	77.42% Correct
11	41.94% Correct
12	74.19% Correct
Average Score	66.82% Correct

These contractors are as a majority rather new to the business. A total of 26 surveyed contractors have less than 10 years and 9 have more than 10 years experience with 6 choosing not to answer. 27 of the 31 are residential contractors who work closely

with the city so lead-based paint knowledge in the areas of inspection and hazard control would be important as the City of New Orleans is one of the largest HUD funded areas in the United States. The question most frequently missed by this group is the question regarding the OSHA Permissible Exposure Limit or PEL for lead. Half of the contractors have performed remodeling, renovation, or rehabilitation of property built before 1978. Target housing has a high percentage of lead-based paint (see Table 1.1). Approximately half of these contractors, 10 to be exact, had performed these activities on property known to contain lead-based paint.

The statistics from the 2/18 and the 2/25 session are very similar (see Table 4.2: 2/18 Survey Summary). Of the 26 participants completing surveys from the 2/18 session, 22 of the participants are licensed contractors. This session of contractors was comprised of more years of experience in the business, 11 had more than 10 years experience, 2 were unaware, and 7 had less than 10 years.

Table 4.2: 2/18 Survey Summary

<b>Survey Report for 2/18 Group</b>	
Question #	26 Total Surveys
1	Licensed Contractors: 22 Yes, 4 No
2	7 Less than 10 yrs., 11 Over 10 yrs., 2 Unaware
3	2 Industrial, 4 Commercial, 21 Residential
4	14 Yes, 5 No, 1 Unaware
5	9 Yes, 9 No, 6 Unaware
6	46.15% Correct
7	50.00% Correct
8	34.62% Correct
9	73.08% Correct
10	69.23% Correct
11	15.38% Correct
12	61.54% Correct
Average Score	50.00% Correct

The 2/25 session (see Table 4.3: 2/25 Survey Summary) had 27 total surveys completed. 15 contractors had been practicing for more than 10 years, 1 was unaware of

the company’s time in business as a licensed contractor, while 11 had less than 10 years of expertise. The 2/18 and the 2/25 groups had nearly the same average for scored survey questions at 50% and 56.56% correct respectively. The groups also had low scores in the same category of scored questions.

Table 4.3: 2/25 Survey Summary

<b>Survey Report for 2/25 Group</b>	
Question #	27 Total Surveys
1	Licensed Contractors: 25 Yes, 2 No
2	11 Less than 10 yrs., 15 Over 10 yrs., 1 Unaware
3	1 Industrial, 7 Commercial, 22 Residential
4	22 Yes, 2 No, 3 Unaware
5	13 Yes, 5 No, 9 Unaware
6	59.26% Correct
7	33.33% Correct
8	62.96% Correct
9	62.96% Correct
10	81.48% Correct
11	25.93% Correct
12	62.96% Correct
Average Score	55.56% Correct

A total of 14 contractors in the 2/18 session had performed remodeling, renovation, or rehabilitation on property built prior to 1978 and 22 contractors in the 2/25 session responded the same. Responding to work in properties containing lead-based paint, the surveys reveal 9 and 13 respectively.

The range of scores in sessions held 2/4 and 2/18 are the same (see Table 4.4: Pre-Course Survey Statistics); however, a decrease in the range of scores is seen in the last session. The median and mode scores for the 2/25 session held consistent with previous courses with the average, or mean, of the scores actually above the 2/18 session. The 2/25 group lacks scores above 71.42% as the maximum score reveals that no perfect score was present in this group. The other sessions did have participants with perfect scores on the survey questions. All variables held constant, the statistical analysis shows that the first

group performed better on the scored section of the survey, but no session performs adequately. That is, no session answered above 70% correct on the scored portion of the survey as a group so no session passed as a group.

Table 4.4: Pre-Course Survey Statistics

<b>Pre-Course Survey Scored Data Summary Statistics</b>					
<i>2/4 Session</i>		<i>2-18 Session</i>		<i>2-25 Session</i>	
Mean	66.82	Mean	50.00	Mean	55.56
Standard Error	4.10	Standard Error	3.74	Standard Error	4.27
Median	71.43	Median	57.14	Median	57.14
Mode	57.14	Mode	57.14	Mode	71.43
Standard Deviation	22.85	Standard Deviation	19.06	Standard Deviation	22.18
Sample Variance	522.24	Sample Variance	363.19	Sample Variance	491.83
Range	85.71	Range	85.71	Range	71.42
Minimum	14.29	Minimum	14.29	Minimum	14.29
Maximum	100	Maximum	100	Maximum	85.71
Count	31	Count	26	Count	27
Confidence Level(95.0%)	8.3824	Confidence Level(95.0%)	7.6974	Confidence Level(95.0%)	8.7730

#### **4.5. Analysis of Statistical Data for Survey Sample**

Licensed contractors in the New Orleans area had a vested interest in attending the training and the frequency table illustrates the attendance of licensed contractors as 82.4% of the attendees. Once the session statistics are aggregated, the numbers of licensed contractors appear more significant. A total of 3 of the surveys do not have any information given for this question (see Table 4.5: Survey Question #1). The City of New Orleans contacted the contractors to the training session and one can assume licensed contractors were preferred but not required, or that unlicensed contractors are subcontracted for their services.

Using a true score so that error is accounted for, four questions must have been answered correctly for a passing score using the operational definition of 70% answered correctly. 49 of the 58 contractors with passing scores were licensed.

Table 4.5: Survey Question #1

**Are you a Licensed Contractor or Employed by a Licensed Contractor?**

Question #1	Frequency of Answer	Percent	Cumulative Percent
Licensed	70	82.4	82.4
Not Licensed	12	14.1	96.5
No Answer	3	3.5	100.0
Total	85	100.0	

Contractor experience data is illustrated in Table 4.6: Survey Question #2. The frequency table revealed an even split of experience with both contractors with less than 10 years of experience and contractors with more than 10 years of experience at 40% each. Contractors not licensed were asked not to complete this question which justifies the large percentage of subjects not answering the question. If you add the number of subjects, 34, 34 and 4, who answered the question, the total equals 71.

Table 4.6: Survey Question #2

**Contractor Experience**

Question #2	Frequency of Answer	Percent	Cumulative Percent
Less than 10 years	34	40.0	40.0
More than 10 years	34	40.0	80.0
No Answer	13	15.3	95.3
Unaware	4	4.7	100.0
Total	85	100.0	

A total of 70 subjects responded as licensed contractors with another 3 unaware of the contractor’s license status and 4 unaware of the time as a contractor. This is helpful when attempting to determine the reliability and validity of the survey. The participants appear to have read and understood the question, as the totals are nearly the same number. Of the 58 passing scores, 22 participants have with more than 10 years of experience, 25 participants have less than 10 years experience, 1 was unaware, and remainder did not answer.

With the ordinance requiring certified contractors, contractors are required to be licensed in order to perform lead-based paint hazard activities. This fact explains the presence of 6 commercial contractors, illustrated in Table 4.7: Survey Question #3, who require a license to perform this type of work.

Table 4.7: Survey Question #3

<b>Type of Work</b>			
Question #3	Frequency of Answer	Percent	Cumulative Percent
Commercial	6	7.1	7.1
Commercial & Residential	7	8.2	15.3
Industrial, Commercial, & Residential	1	1.2	16.5
Residential	67	78.8	95.3
No Answer	4	4.7	100.0
Total	85	100.0	

These contractors may see a logical progression to move into the residential area and could be motivated to do so in an attempt to secure additional business and income. Even

if these contractors were excluded, contractors performing residential work comprise 88.2% of the subjects. Again, it is logical to assume that the survey captures data from multiple employees from any one contractor; therefore, the same company could employ these 6 commercial contractors.

As stated earlier, HUD defines target housing as property constructed prior to 1978. Table 4.8: Survey Question #4 below summarizes the results of the question capturing information on target housing. The object of this question was to determine if contractors were aware of this date trigger for target housing and the definition of target housing.

Table 4.8: Survey Question #4

**Work on Property Built Pre-1978**

Question #4	Frequency	Percent	Cumulative Percent
Both Yes and No	1	1.2	1.2
No	15	17.6	18.8
No Answer	10	11.8	30.6
Unaware	5	5.9	36.5
Yes	54	63.5	100.0
Total	85	100.0	

Due to the age of the City of New Orleans and the surrounding area, a large portion of the property was constructed before 1978. Of the 85 participants surveyed, 54, or 63.5%, of the contractors replied that they had performed remodeling, renovation, or rehabilitation of property built before 1978. Also, 10 of the 85 subjects did not reply and an additional 5 were unaware. One subject answered both yes and no to the question. 38

of the participants with passing scores performed work on property built before 1978, 12 answered no, and 17 were unaware of work on property of this age.

It is logical to assume that a significant percentage of the property in the City of New Orleans contain lead-based paint and as stated earlier, lead-based paint can only be detected by laboratory analysis or XRF testing. As seen in Table 4.9: Survey Question #5 the number of subjects unaware of work on property containing lead-based paint was 27, or 31.8 percent.

Table 4.9: Survey Question #5

**Work on Property Known to Contain Lead-based Paint**

Question #5	Frequency of Answer	Percent	Cumulative Percent
No	21	24.7	24.7
No Answer	5	5.9	30.6
Unaware	27	31.8	62.4
Yes	32	37.6	100.0
Total	85	100.0	

This lack of knowledge is a problem that Title X and the recent New Orleans’ ordinance were enacted to address. This number is almost equal to the 32 subjects that are aware of work in such property. If 40% of all housing contains lead-based paint as illustrated in Table 1.1: Lead in Housing, then the responses to the work on target housing and work on property containing lead-based paint questions may confirm or refute these numbers. Also, of the participants with passing scores, 24 have performed work on property known to contain lead-based paint, 12 had not, 17 were unaware, and the remainder did not answer.

## **Chapter 5. Post-Course Test**

### **5.1. Test Overview**

The post-course test was designed as part of the 8-hour HUD developed course. The test can be viewed in Appendix C. All courses are developed with the use of grant funding by universities in the United States. *Addressing Lead-based Paint Hazards During Renovation, Remodeling, and Rehabilitation in Federally Owned and Assisted Housing* is the title of the course. The test is required to receive a notice of completion for the course so the completion rate on the test is higher than that of the survey. A notice of completion is required to perform work in the New Orleans area as the ordinance discussed earlier states. 20 questions in a multiple-choice format comprise the test. The participants are required to answer at least 70% of the questions correctly to receive a notice of completion. For this reason, answering “70 percent or more questions regarding lead-based paint correctly” is used as the performance based operational definition of education and is correlated with the definition used for the scored survey questions. The questions cover health effects of lead, lead-safe work practices, interim controls, and hazards associated with lead-based paint. These topics are covered in detail in the course during lecture, group activities, and in visual aids such as power point slides and video.

### **5.2. Analysis of Data**

The post-course test was completed by 108 participants total, 35 in the 2/4 session, 34 in the 2/18 session, and 39 in the 2/25 session, 8 chose not to complete a test. The statistics from the three sessions were very similar. A case summary of the scores from the post-course test is included as Appendix D. However, the statistical results of individual scored questions were not included in this analysis to protect the identity of the subjects. The

course participants are required to identify themselves by name, social security number, contact information, and employer on the test. Scores are captured from the LSU database and are not linked to participant information, only the course session and a case sample number are detailed.

The range for the scores in each session increased from session to session in date order (see Table 5.1: Post Course Test Results). The minimum score continued to drop as the sessions progressed. However, the median and mode for the 2/4 session and the 2/18 session were the same, 90 and 95 respectively.

Table 5.1: Post-Course Test Report

<b>Post-Course Test Summary Statistics</b>					
<i>2/4 Session</i>		<i>2/18 Session</i>		<i>2/25 Session</i>	
Mean	83.29	Mean	87.06	Mean	78.21
Standard Error	2.12	Standard Error	2.09	Standard Error	3.24
Median	90	Median	90	Median	85
Mode	95	Mode	95	Mode	90
Standard Deviation	12.54	Standard Deviation	12.19	Standard Deviation	20.21
Sample Variance	157.27	Sample Variance	148.67	Sample Variance	408.54
Range	45	Range	60	Range	75
Minimum	55	Minimum	40	Minimum	25
Maximum	100	Maximum	100	Maximum	100
Count	35	Count	34	Count	39
Confidence Level(95.0%)	4.3079	Confidence Level(95.0%)	4.2543	Confidence Level(95.0%)	6.5521

The session 2/25 median and mode only drop 5% per value with scores of 85 and 90. With standard error taken into consideration, the average or mean of the 2/4 and the 2/18 session were nearly identical with a small dip in the average of the 2/25 session. The mean, mode, and median scores for the 2/25 session were a reflection of the increase in range that was derived with a much lower minimum score on the test being recorded.

As a collective group, the average score on the test, 82.65%, was a passing score. The standard deviation for the 108 test scores was 15.95 and the standard error was only

1.53. 8 course participants received perfect scores on the post-course test and another 24 participants only missed one question or scored 95% on the test. Only 17 of the 108 tests that were completed did not receive a passing score. These scores were tests that had less than 70% of the 20 questions answered correctly. 7 of the non-passing scores were from the 2/4 group and 8 of the non-passing scores were scores from the 2/25 group while there were only 2 from the 2/18 group.

## **Chapter 6. Discussion**

### **6.1. Summary of Findings**

The survey and the post-course test were analyzed by session as a random split to ensure a valid and reliable sample. Descriptive statistics appeared to show a valid and reliable sample. Once this was established, the data was analyzed as a collective group. Data from the scored portion of the survey showed that the education mandate of Title X has not been effective in the New Orleans area. The average score for the contactors on the survey by session were 66.82%, 50.00%, and 55.56% in date order. The Louisiana State Board of Contractors licensed 82.4% of the companies employing the contractors completing the survey. 88.2% performed residential construction, remodeling, or renovation as opposed to commercial or industrial activities. 58 of the 85 participants that completed the survey received a passing score if a true score is utilized. Of these contractors with passing scores, there appears to be a correlation between licensed contractors that have performed work in target housing or homes known to contain lead-based paint. However, experience did not appear to a factor in determining performance on the survey as 25 contractors had less than 10 years experience, 22 had more than 10 years experience, and 1 was unaware.

The post-course test demonstrates an impact, as the average scores on the test were 83.29%, 87.06%, and 78.21% in date order. The average increase over the average score of the collective group of contractors surveyed was 22.87%.

Scores are cross tabulated to identify correlations between demographic data and survey scores. A true score is used during the cross tabulation in an attempt to account for the standard error in the survey results. This assumes the true score is a combination of

the observed score and the error that is equal to a score of 57% or 4 out of 7 on the scored portion of the survey. The following cross tabulation shows the number of subjects that performed at level of at least 4 out of 7 correct answers on the scored portion of the survey:

- 11 licensed contractors that have performed work on property known to contain lead-based paint.
- 14 licensed contractors that had performed residential construction activities.
- 12 licensed contractors that performed work in pre-1978 built property.
- 8 contractors had less than 10 years experience and performed work in pre-1978 built property.
- 7 contractors had less than 10 years experience and performed work on property known to contain lead-based paint.
- 8 contractors had less than 10 years experience and performed residential construction activities.

The cross-tabulated data revealed trends toward contractors that are licensed and have less than 10 year of experience in the field perform at levels on the scored portion of the survey considered to be passing. Also, past experiences in target or properties known to contain lead-based paint may have affected the ability to receive a passing score.

The average scores for the collective group on the post-course test were above 70%. Average scores increased by 16.47, 30.50, and 21.65 in each of the three course sessions for an average increase of 22.87%. The standard error is greater in the pre-course survey results, but the survey was scored based on a reduced number of questions making each question worth a greater percentage. For this reason, the mean scores of the survey

and the post-course test were not further analyzed. The objective of the study was to determine if the effectiveness of the education mandate, not to measure the effectiveness of the training course. However, the course clearly had an impact on performance as the participants' mean scores increase. This impact was validated by the fact that the post-course test required performance on questions requiring a higher level of knowledge. The course educated the contractors on topics needed to properly inform and protect property owners and their children from the hazards associated with lead-based paint. When the contractors attended specialized training, the scores showed an average increase over 20%.

Data from the scored portion of the survey reveal that the current education mandate and infrastructure built as a result of Title X is not effective. Contractors lacked the ability to perform satisfactory in a demonstration of a basic knowledge of lead-based paint and lead-based paint hazards. The post-course test scores showed that if there specialized training to increase knowledge, to learn the controls, hazards, and regulation governing lead based paint, then contractors' performance was impact in a positive manner.

## **6.2. Policy Analysis**

Title X is rooted in general values that remain current over time, that is, great concern over the well being of children. The facts about lead poisoning remain the same; the effects of lead poisoning and exposure on the development of children are far reaching (Weitzman & Glotzer, 1992). Program evaluation using cost-benefit analysis is commonly used to determine the effectiveness of programs but does this form of analysis give insight to the problems in the reach of the education mandate of Title X.

The use of cost-benefit analysis over the long run may be an effective part of program evaluation. Rossi and Freeman (1993) point out that one must decide what perspective to take in calculating costs and benefits. Separate analyses based on different perspectives can be used to provide information on how benefits compare to costs as they affect relevant stakeholders. The cost for the lifetime care of children with disabilities related to lead poisoning may be calculated and compared with the costs of prevention programs and abatement of lead in the home. A change in the focus of EPA could lead to a change in the way costs and benefits are calculated (Ingraham, 1987).

The benefits of training and education are essential, however the current infrastructure does not appear to be yielding justifiable results given the millions spent on education and the lack of effectiveness as demonstrated by this New Orleans area study of contractors. Programs may be evaluated through means other than cost-benefit analysis. For example, the EPA issued a call to a cross section of stakeholders on the development of training and certification requirements and work practice standards for individuals and firms involved in lead-based paint activities (Federal Register, 1997). As a result of concerns received from interest groups during the comment period, EPA delayed promulgation of Title X until additional information was obtained from these groups. This delay prevents timely evaluation of the reduction of hazards from lead in buildings. This study may show that this time was not productive in building an infrastructure for educating contractors and the public alike. If contractors are looked as the general public, rather than specialized craftsmen, the scored portion of the survey shows that infrastructure for education in the New Orleans area was not effective. However, if these same contractors are seen as skilled craftsmen, there was a better

chance that contractors scored passing marks on the survey if work was performed by the contractor in target housing or housing that was known to contain lead-based paint. Therefore, there is some infrastructure that was built to educate these contractors. Whether this is adequate or effective, information of this sort would not be factored into cost-benefit analysis at least in the short term.

### **6.3. Political Issues**

The political influence on the proposed Title X rule was a major one as it caused a major route of lead-based paint contamination into the home of children to be omitted. EPA spent two years writing Title X. Under the September 2, 1994 proposal that was presented for comment, individuals and firms conducting deleading activities in public and commercial buildings, superstructures and bridges would have been subject to EPA training and certification requirements and work practice standards and, possibly, the OSHA training requirements contained in OSHA's interim final lead standard. Under the proposed rule, EPA's intention was to include OSHA's training requirements in EPA's training and certification program. However, commenters noted uncertainty as to whether EPA's proposed definition of "deleading" would have included precisely the same activities which would trigger the training requirements under OSHA's interim final lead standard. Consequently, commenters believed that EPA's training and certification program could have imposed OSHA training when in fact OSHA may not require it. Other commenters also believed that OSHA's training requirements were adequate and that EPA's training and certification program was unnecessary for individuals and firms conducting "deleading" activities in public and commercial buildings, superstructures and bridges (EPA, 1997).

One principal change in the final rule was the decision to delay the promulgation of training and certification requirements and work practice standards for individuals and firms conducting lead-based paint activities in public buildings (except child-occupied facilities), commercial buildings, superstructures and bridges. This decision was primarily based on the need to clarify the "deleading" definition contained in the Title X proposal, and the Agency's desire to avoid conflict and overlap with the training requirements contained in the OSHA's interim final lead standard (29 CFR 1926.62) that are only targeted at occupational exposure. In industry, lead-based paint was also used extensively for some the reasons it was used residentially as a coating for commercial buildings and steel structures. An estimated 90,000 bridges in the United States are coated with lead-based paint (Katauskas, 1990). Between 1985 and 1998, 77% of all bridges that were repainted had coatings that contained lead. This is important because proper maintenance of steel structures requires the removal of all old coatings before a new coating can be applied. Old coatings are removed from the steel structure through abrasive blasting where a high velocity stream of silica sand or other media is directed at the metal. As a result, the process sends small particles of lead-based paint and contaminated abrasive airborne where it becomes a potential hazard to the environment for persons in or near the area (DHHS, 1992). These additional requirements and regulations have to date not been promulgated, and child exposure as a result of occupational related activities has not been addressed.

Additionally, various trade organizations based their reasons for seeking a training exemption on the level of education and/or experience their professional members already possess. In some instances, commenters also referenced an existing

certification process that their members must undergo and implied that this certification process equaled or exceeded the certification process proposed by the EPA for lead-based paint professionals.

In general, the EPA agrees that the basic work experience and/or educational requirements of many nationally recognized certification programs either meet or exceed the experience and/or educational prerequisites contained in the final rule under Sec. 745.226(b) and (c). Several of these certification programs are covered by Sec. 745.226(b)(1)(iii)(B)(3) of the rule, including programs sponsored by the American Board of Industrial Hygiene, the National Society of Professional Engineers and the Board of Certified Safety Professionals. Additionally, members of other organizations who possess the minimum work experience and/or educational requirements contained in Sec. 745.226(b) or (c) also may qualify to become certified under today's final rule. However, the EPA disagrees that work experience and/or educational prerequisites alone ought to be sufficient for the purposes of certifying individuals to conduct lead-based paint activities. Further, the EPA does not believe that the certification programs identified by these trade organizations adequately address and provide specific training in the identification, evaluation and abatement of lead-based paint and its associated hazards. Notably, none of the commenters provided the EPA with evidence of a currently available training course and/or module that expressly addresses lead-based paint activities as part of their professional certification process. Furthermore, commenters did not present evidence that their certification programs included hands-on instruction in the conduct of lead-based paint activities, which is a critical element of the training courses in the final rule.

Therefore, although the certification requirements contained in Sec. 745.226(b) and (c) recognize a broad range of work experiences and educational backgrounds as the first step in qualifying to become an inspector, risk assessor, supervisor, project designer or abatement worker, Title X does not provide for any training exemptions. In most cases, individuals entering the lead-based paint activities field will need specialized training. EPA is willing to work with professional organizations and other groups that want to develop training courses for their members that meet EPA's accreditation requirements (EPA, 1992). However, EPA understands that specialized training is needed in addition to specified expertise to protect property owners, their children to be specific, and contractors alike.

## **Chapter 7. Recommendations**

### **7.1. Specialized Training for Contractors**

The data analysis demonstrates an impact of specialized training on contractors in this case. The work practice standards in Title X are not intended to regulate all activities that involve or disturb lead-based paint, but only those that are described as an inspection, risk assessment or abatement by an individual who offers these services. This rule would not regulate a renovation contractor that incidentally disturbs lead-based paint or an individual who samples paint on a kitchen cabinet to determine if the paint contains lead. The rule would cover a contractor who offers to abate a home of lead-based paint hazards, or an inspector who offers to conduct a lead-based paint inspection in a residential dwelling. This allows for activities to circumvent the regulation during abatement activities but deeming the activity a remodeling or renovation activity (EPA, 1992). Contractors performing remodeling or renovation must receive this training to bring their knowledge of the hazards of lead-based paint to an acceptable level. This should be required and could be accomplished in two ways.

First, cities should follow the example of New Orleans and require contractors to receive at least minimal training on the hazards of lead-based paint. Training for contractors should be a HUD developed and approved training course. The requirement should not be limited to federally assisted housing but should be required for all property in areas where buildings pre-date 1978 or are suspected to have lead-based paint.

The second method to educate contractors would be more effective. Adjustments in either the organization of functions or the interpretation of goals during program implementation are not unusual. Implementation is often a dynamic process (Jones,

1984). In fact, the dynamic nature of the implementation process is significant for Title X since there has been a shift in the political climate since enactment in 1992. The more conservative Congress of 1997 has had an effect on the implementation process by not providing additional funding needed for the startup of programs. According to Bardach (1977), numerous special interest groups pursue their own goals during any policy implementation process. These goals may or may not reflect the goals of the policy mandate. To follow the original proposed policy mandate for Title X would require all property whether private, public, commercial, or industrial to be renovated, remodeled, or maintained by licensed and accredited contractors. Contractors would need to be educated, trained, and accredited in lead-based paint hazards course at a minimum to perform these activities and disclose the potential hazards of lead-based paint to property owners.

## **7.2. Educate Parents**

The best way to protect yourself and your family from lead poisoning is to learn how to identify sources of lead, detect lead poisoning symptoms and reduce or prevent exposure. Because lead exposure is a multifaceted phenomenon with "complex and interrelated pathways from ... sources to children," prevention also must be a multifaceted effort. In the literature, the primary and secondary prevention efforts of public health workers, primary care providers, and property owners have been emphasized. Generally, parents have been cast in passive roles -- either as recipients of preventive information or as sources of data about the child's possible exposure (Knestrick & Milstead, 1998). Parental efforts to decrease exposure have been considered chiefly in the context of

tertiary prevention; for instance, Binns et al noted that lead-poisoned children may "benefit if parents are able to decrease lead exposure."

Accumulated evidence led the Centers for Disease Control to change its lead policies in 1991 (Tesman & Hills, 1994). Prior to the actual policy making by the CDC in 1991, the Lead Contamination Control Act of 1988 authorized the CDC to award grants to state and local agencies in order to screen infants and children for elevated blood levels. The program also provided for medical and environmental referrals to public health departments, as well as public and professional education of physicians, nurses, and other providers. In 1991 the CDC revised its policies and made several recommendations, including mandatory screening of all children and lowering the blood lead level of concern from 25 mcg/dL to 10 mcg/dL.

The CDC was effective in enlisting the American Academy of Pediatrics to support the 1991 policy revisions, an example of a strategy in which interest group pressure does have positive impact and may cause officials to pay attention to certain issues (Kingdon, 1995). The involvement of the American Academy of Pediatrics is important because the process of primary lead poisoning prevention takes place over a long period of time and the continued support of special interest groups is essential (Centers for Disease Control , 1991).

At the present, contractors cannot be relied upon to guide property owners in lead-safe remodeling and renovation activities. Common sense, not expensive or inconvenient tests and gadgets, is the most effective approach to reducing and eliminating lead in the environment. If lead-based paint is suspected, then property owners should contact an accredited lead inspector or risk assessor to perform a detailed lead inspection of the

property. The accredited individual can then advise the property owner of the level of risk present. If remodeling, renovation, or rehabilitation of the property is needed, then a licensed contractor that has experience and credentials should be used to perform abatement of lead-based paint.

While the benefits of lead poisoning prevention efforts may seem obvious to pediatric nurses and other health care providers, evaluation of any program requires the consideration of the range of stakeholders, in essence the people who will be impacted by the program (Rossi & Freeman, 1993). Stakeholders can be groups that will either hold competing views of the program or will be affected by the outcomes. However, the best method for protecting children remains the same. In the case of Title X, the stakeholders are multiple: policymakers; and decision makers, legislative sponsors, manufacturers and businesses that use lead in their products, physicians and pediatric nurses who are paid for providing services, contractors, and the children and families whose lives are affected. Parents must be properly informed and a continued relationship with pediatricians is vital. To encourage abatement efforts, the Congress funded abatement demonstration grants of \$150 million to HUD and appropriated \$37 million for CDC's lead poisoning prevention grants (Tesman & Hills, 1994). To encourage and educate property owners early in the parenting process, a funding program to promote lead safety through pediatricians and OBGYN's would be very productive. The pamphlets developed by HUD to educate property buyers and renters during real estate transactions as required presently by Title X or distribution of a basic information packet such as the EPA brochure "Lead Poisoning and Your Children" would assist in educating parents. Some

behavioral controls suggested by CDC include housekeeping, hygiene, nutrition, and other domestic practices.

Basic information should include:

- Keep children away from peeling or chipping paint and accessible or chewable surfaces painted with lead-based paint, especially windows, window sills, and window wells. Wet mop and wet wipe hard surfaces, using trisodium phosphate detergent (found at hardware stores) or automatic dishwasher soap and water. Do not vacuum hard surfaces because this activity is believed to scatter dust.
- Keeping children clean and properly fed should also be a priority. Wash children's hands and faces before they eat. Wash toys and pacifiers frequently. Make sure children eat regular nutritious meals, since more lead is absorbed on an empty stomach. Make sure children's diets contain plenty of iron and calcium. Examples of foods high in iron are liver, fortified cereal, cooked beans, spinach, and raisins. Examples of foods high in calcium are milk, yogurt, cheese, and cooked greens.

These medical professionals would be asked to cover the health effects of lead-based paint with parents and provide the pamphlet as additional information on how to protect themselves and their children. To gather a careful and explicit lead exposure history, practitioners should do more than assess possible lead exposures. They also should assess parental knowledge of lead sources and beliefs about the degree of the child's exposure; providers also should determine whether parents are taking steps to reduce possible exposure (Knestrick & Milstead, 1998). This program would also educate property owners that may perform remodeling or renovation activities themselves. Lead-

based paint exposures through activities such as these have not been addressed in this study, but should still be of concern.

### **7.3. Additional Research**

The need for additional research is apparent. Only 42 of the 85 participants in this study received a passing score of 70% or better if the observed score is analyzed. However, there are an additional 26 participant scores that are considered passing if a true score is used to attempt and account for standard error. Two general areas require additional research too help educate contractors and assess a more accurate measure of education. Delivery methods and the extent to which infrastructure has been built to educate contractors are areas that need further research to determine the effectiveness of the education mandate of Title X.

#### **7.3.1. Delivery Methods**

Research in the areas of delivery of training to contractors would be of great interest. How is the education mandate and information of Title X best delivered to contractors and property owners to ensure the highest impact of the training? Should some self-study or computer-based training be developed and implemented to create a hybrid approach to education?

Some blended or hybrid approach in educating the contractors performing renovation or remodeling should have two benefits. One, a self-study or computer-based awareness training would create a based of knowledge on lead-based paint that could allow for greater specialized training in an instructor lead format. Second, it would allow contractors to establish a baseline of knowledge through a method of education that does not require workflow to be interrupted. The self-paced training could be completed after

work hours or days were weather or job conditions did not permit productive work. Both benefits will attempt to increase performance through motivating the contractors.

Additional survey information on years of formal education of the contractors would be beneficial although the education mandate of Title X does not take this into account. Also, this additional research may determine learning deficiencies as a result of poor reading / writing skills due to lack of education in contractors. Data could be captured from similar training or from the state board of contractors.

### **7.3.2. Infrastructure Analysis**

Another factor affecting education policy implementation is infrastructure. This study of contractors in the New Orleans area demonstrated that contractors that had performed work in target housing or property known to contain lead-based paint correlated to a performance of higher scores on survey questions relating to a basic knowledge of Title X and the hazards of lead-based paint. How do other cities fair when the effectiveness of education mandate of Title X is analyzed? There could be other indicators of performance that demonstrate key infrastructure components. Some indicators may be building trade. Would painters or carpenters have an infrastructure for education that plumbers may lack?

Conducting a study that mirrors this study a city with a similar population size and demographic composition as New Orleans, Louisiana, could be performed to attempt to identify infrastructure similarities or differences. A study of contractors throughout the State of Louisiana could also determine the effectiveness of educational infrastructure in the state so that it could be compared to that of New Orleans. Identifying other cities or even states that have increased regulatory requirements to further build infrastructure to

educate on the hazards of lead-based paint could also substantiate the impact of specialized training. Further research on the effectiveness of the education mandate should include a survey and post-cost test that are identical so that deficiencies can be tracked for continued improvement to education infrastructure and future training activities.

From this additional research, a model infrastructure for educating contractors could be hypothesized and tested for validity and reliability. This model would assist EPA and lawmaker in policy analysis, development, and implementation to ensure that contractors are educated on the hazards of lead-based paint. Educated contractors can then provide this information to property owners before a remodeling or renovation project has begun. Property owners and parents would then have the tools needed to make informed decisions regarding the health and safety of children residing at or using the property as a primary care facility during and after the completion of the project.

#### **7.4. Summary**

This study set out to determine the effectiveness of the Lead-based Paint Reduction Act of 1992, otherwise known as Title X. A survey given to individuals employed as contractors in the New Orleans, Louisiana, area was analyzed for demographic correlations, and scored for a basic knowledge of Title X and the hazards associated with lead-based paint. The survey was administered to contractors attending a HUD developed course designed to train individuals performing remodeling and renovation to property that may contain lead-based paint. The course sessions were held in the New Orleans area.

The voluntary survey was completed by 85 of the 116 during the three sessions and 108 of the 116 participants completed the post-course test. A passing score on the post-course test was required to receive a notice of completion certifying the contractors to perform lead-based paint interim controls. A passing score was defined as answering at least 70 percent of the scored questions correctly. This was the operational definition used for the post-course test given to the contractors; therefore, this same definition was used for both the scored portion of the survey as well as the post-course test. The post-test scores were not used to determine effectiveness. The data was analyzed to determine if the course had an impact on the educational performance of the contractors.

The survey and the post-course test were analyzed by session as a random split to ensure a valid and reliable sample. Descriptive statistics appeared to show a valid and reliable sample. Once this was established, the data was analyzed as a collective group. Data from the scored portion of the survey showed that the education mandate of Title X has not been effective in the New Orleans area. The average score for the contractors on the survey by session were 66.82%, 50.00%, and 55.56% in date order. The Louisiana State Board of Contractors licensed 82.4% of the companies employing the contractors completing the survey. 88.2% performed residential construction, remodeling, or renovation as opposed to commercial or industrial activities. 58 of the 85 participants that completed the survey received a passing score. Of these contractors with passing scores, there appears to be a correlation between licensed contractors that have performed work in target housing or homes known to contain lead-based paint. However, experience did not appear to be a factor in determining performance on the survey as 25 contractors had less than 10 years experience, 22 had more than 10 years experience, and 1 was unaware.

The post-course test demonstrates an impact, as the average scores on the test were 83.29%, 87.06%, and 78.21% in date order. The average increase over the average score of the collective group of contractors surveyed was 22.87%. The specialized training provided to the contractors did have an impact.

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## Appendix A: Survey for Contractors

### Survey for Contractors and Renovators

Louisiana State University - Environmental Planning and Management Survey

Please Circle the Correct Answer. Date: \_\_\_\_\_ (rev. 013102)

- #1 Are you a licensed contractor **or** employed by a licensed contractor for the State of Louisiana? If no, skip to question #6.  
(A) Yes (B) No (C) Unaware
- #2 How long have you been a licensed contractor or worked for the licensed contractor?  
(A) Less than 10 years (B) 10 years or more (C) Unaware
- #3 What best describes the type of construction, remodeling, or renovation work you perform?  
(A) Industrial (B) Commercial (C) Residential
- #4 Have you performed construction, remodeling, or renovation of property built prior to 1978?  
(A) Yes (B) No (C) Unaware
- #5 Have you performed construction, remodeling, or renovation of property that was known to contain lead-based paint?  
(A) Yes (B) No (C) Unaware
- #6 "Interim controls" are designed to  
(A) permanently eliminate lead hazards. (B) prevent OSHA citations. (C) temporarily reduce human exposure to lead-based paint hazards.
- #7 Which of the following paint removal methods does HUD permit?  
(A) Extensive dry scraping (B) Dry vacuuming with shop vacuum (C) Power sanding with HEPA attachment
- #8 Title X, an amendment to the Toxic Substances Control Act (TSCA), provides guidance and funding for?  
(A) Asbestos Containing Materials (B) Lead-based paint (C) Benzene
- #9 Which would be **most severely** affected by exposure to lead?  
(A) A three-year old child and the fetus of a pregnant woman. (B) A painter involved in maintenance work and a laborer performing demolition. (C) None of the above individuals would be affected by lead exposure
- #10 Principles of lead-safe work include?  
(A) Minimizing dust by using wet methods (B) Thorough clean up and containing dust and debris (C) All of the above
- #11 The Permissible Exposure Limit or PEL under the OSHA Lead in Construction Standard is?  
(A) 20 ug/m<sup>3</sup> (B) 40 ug/m<sup>3</sup> (C) 50 ug/m<sup>3</sup>
- #12 Housing and Urban Development (HUD) guidelines should be followed  
(A) only in federally assisted housing units. (B) in all facilities. (C) only by licensed contractors.

## Appendix B: Case Summaries

Case Summaries for Survey Data								
Number Correct		Case #	Licensed Contractor?	Experience	Type of Work	Work in Pre-1978?	Work in Lead-based Paint	
0	1	25	Licensed		Residential	Unaware	Unaware	
	Total	N	1	1	1	1	1	1
1	1	40	Not Licensed		Residential	Yes	Yes	
	2	45	Licensed	Unaware	Residential	Yes	No	
	3	48	Not Licensed		Residential	No Answer	No	
	4	60	Licensed	More than 10 years		Yes	Yes	
	5	67	Licensed	More than 10 years	Commercial	Unaware	Unaware	
	6	68	Licensed	Less than 10 years	Residential	Yes	Yes	
	Total	N	6	6	6	6	6	6
2	1	13	Licensed	Less than 10 years	Residential	No	Unaware	
	2	14	Not Licensed			No Answer	No Answer	
	3	32	Licensed	Less than 10 years	Residential	No	Unaware	
	4	59	Licensed	More than 10 years	Residential	Yes	Yes	
	5	74	Licensed	More than 10 years	Residential	Yes	Unaware	
	6	75	Licensed	More than 10 years	Residential	Yes	No	
	7	76	Not Licensed	Less than 10 years	Residential	Yes	No	
	8	77	Licensed	More than 10 years	Residential	Yes	No	
	Total	N	8	8	8	8	8	8
3	1	12	Licensed	Less than 10 years	Residential	No	Unaware	
	2	28	Licensed	Less than 10 years	Commercial & Residential	Yes	Unaware	
	3	44	Not Licensed		Residential, Industrial,	No	No	
	4	47	Licensed	More than 10 years	Commercial, & Residential	Yes	No	
	5	49	Licensed	Less than 10 years	Commercial	Unaware	Unaware	
	6	52	Licensed	More than 10 years	Residential	Yes	Yes	
	7	54	Licensed	More than 10 years	Residential	No	No	
	8	56	Licensed	More than 10 years	Residential	Yes	Yes	
	9	66	Licensed	Unaware	Residential	Yes	Unaware	
	10	70	Licensed	More than 10 years	Residential	Yes	Yes	
	11	73	Licensed	Less than 10 years	Residential	Yes	Unaware	
	12	80	Not Licensed		Residential	AB	No	
	Total	N	12	12	12	12	12	12
4	1	1	Licensed	Less than 10 years	Residential	No	Unaware	
	2	10	Licensed	Less than 10 years	Residential	No	Unaware	
	3	11	Licensed	Less than 10 years	Residential	No	Unaware	
	4	15	Licensed	More than 10 years	Commercial & Residential	Yes	Yes	
	5	20	Not Licensed		Residential	Yes	No	
	6	21	Licensed	More than 10 years	Residential	Yes	No	
	7	22	Licensed	More than 10 years	Residential	Yes	No	
	8	24	Not Licensed		Residential	Yes	Yes	
	9	30	Licensed	Less than 10 years	Residential	No	Yes	
	10	31	Not Licensed			No Answer	No Answer	
	11	36	Licensed	Less than 10 years	Residential	No	Unaware	
	12	37			Residential	No Answer	No Answer	
	13	38			Residential	No Answer	Yes	
	14	39			Residential	No Answer	No Answer	
	15	42	Licensed	Less than 10 years	Residential	Yes	No	

	16	46	Licensed	More than 10 years	Residential	No	No
	17	50	Licensed	Less than 10 years	Commercial	No	Unaware
	18	51	Licensed	More than 10 years	Commercial & Residential	Yes	Yes
	19	53	Licensed	More than 10 years	Commercial & Residential	No Answer	No
	20	55	Licensed	More than 10 years	Residential	Yes	Yes
	21	57	Licensed	More than 10 years	Residential	Yes	Unaware
	22	58	Licensed	More than 10 years	Residential	Yes	Unaware
	23	65	Not Licensed	Unaware	Residential	No Answer	Yes
	24	71	Licensed	Less than 10 years	Residential	Yes	Yes
	25	72	Licensed	More than 10 years	Residential	Yes	No
	26	83	Licensed	Less than 10 years	Commercial	No	Yes
	Total	N	26	26	26	26	26
5	1	3	Licensed	Less than 10 years	Residential	Yes	Yes
	2	9	Licensed	Less than 10 years	Residential	No	Unaware
	3	16	Licensed	Less than 10 years	Residential	Yes	Yes
	4	18	Licensed	Less than 10 years	Residential	Unaware	Unaware
	5	19	Licensed	More than 10 years	Residential	Yes	Unaware
	6	26	Licensed	More than 10 years	Residential	Yes	No
	7	34	Licensed	Less than 10 years	Residential	No Answer	Unaware
	8	35	Licensed	Unaware	Residential	Yes	No
	9	62	Licensed	More than 10 years	Residential	Yes	Yes
	10	63	Licensed	Less than 10 years	Residential	Unaware	Unaware
	11	64	Licensed	More than 10 years	Residential	Yes	Yes
	12	79	Licensed	More than 10 years	Residential	Yes	Yes
	13	81	Licensed	Less than 10 years	Commercial	No	Yes
	14	82	Licensed	Less than 10 years	Commercial & Residential	Yes	No
	15	84	Licensed	Less than 10 years	Residential	Yes	Unaware
	16	85	Not Licensed	Less than 10 years	Residential	Yes	Yes
	Total	N	16	16	16	16	16
6	1	4	Licensed	Less than 10 years	Residential	Yes	Yes
	2	5	Licensed	More than 10 years	Residential	Yes	Yes
	3	17	Licensed	More than 10 years	Residential	Yes	Yes
	4	23	Licensed	More than 10 years	Residential	Yes	Unaware
	5	27	Not Licensed			No Answer	No Answer
	6	29	Licensed	More than 10 years	Commercial & Residential	Yes	No
	7	41	Licensed	Less than 10 years	Residential	Yes	Yes
	8	61	Licensed	More than 10 years	Residential	Yes	Unaware
	9	69	Licensed	More than 10 years	Commercial & Residential	Yes	Yes
	10	78	Licensed	More than 10 years	Commercial	Yes	Unaware
	Total	N	10	10	10	10	10
7	1	2	Licensed	More than 10 years	Residential	Yes	Unaware
	2	6	Licensed	Less than 10 years	Residential	Yes	Yes
	3	7	Licensed	Less than 10 years	Residential	Yes	Yes
	4	8	Licensed	Less than 10 years	Residential	Yes	Yes
	5	33	Licensed	Less than 10 years	Residential	Yes	No
	6	43	Licensed	Less than 10 years	Residential	Yes	Yes
	Total	N	6	6	6	6	6
Total	N		85	85	85	85	85

## Appendix C: Post-Course Test

### LEAD-SAFE WORK PRACTICES TRAINING PROGRAM FOR RENOVATORS AND REMODELERS

#### END OF COURSE TEST

*Read the following questions or statements and select the best answer.*

1. What is a good indicator that a house or housing unit may contain lead-based paint?
  - A. Age of the tenants
  - B. Date of construction
  - C. Date the owner purchased the property
  - D. None of the above
  
2. The best way to check for lead exposure in children and adults is to take samples of:
  - A. Blood
  - B. Urine
  - C. Skin cells
  - D. Lung tissue
  
3. How can dust be controlled during lead-safe renovation jobs?
  - A. Use a HEPA vacuum
  - B. Keep debris picked up in the work area
  - C. Mist work surfaces with water
  - D. All of the above
  
4. "Clearance examination" of an interior work area after renovation means:
  - A. Finishing work by taking down warning signs
  - B. Having a trained and qualified person who did not do the renovation work perform a visual inspection and dust test in the dwelling unit
  - C. Both A and B are part of the clearance examination
  - D. Looking for low beams and things that you might bump your head on

5. "Interim controls" are designed to:
- A. Permanently eliminate lead hazards
  - B. Prevent OSHA citations
  - C. Temporarily reduce human exposure to lead-based paint hazards
  - D. None of the above
6. Which of the following equipment is appropriate for use during renovation jobs where lead may be disturbed?
- A. HEPA vacuum, cleaning detergents, mops and buckets
  - B. Blow torch to burn off paint
  - C. Power sander with shop vacuum for dust control
  - D. Shop vacuum for clean-up
7. Where are clearance samples collected in the work area?
- A. From walls and ceilings
  - B. From floors, window sills, and window troughs
  - C. From table tops and plastic sheeting
  - D. From just inside the entry to the work area only
8. What is the purpose of a "tack pad"?
- A. To collect pushpins that fall to the floor
  - B. To catch annoying flies on a hot day
  - C. To help control the spread of dust from the work area
  - D. None of the above
9. What is the purpose of mini-enclosures such as a zip wall?
- A. They aid in cleanup by limiting the size of the work area
  - B. They help prevent the escape of lead dust from the work area
  - C. Both A and B are correct
  - D. To keep the profit margins up
10. Principles of lead-safe work include:
- A. Minimizing dust by using wet methods
  - B. Thorough clean up
  - C. Containing dust and debris
  - D. All of the above

11. On lead-safe renovation jobs, what should be used to collect waste material for proper disposal:
- A. Open dumpsters
  - B. Thick plastic bags or sheeting, preferably 6 mil or equivalent
  - C. Pick-up trucks and passenger vehicles
  - D. The living and dining areas of the dwelling unit
12. Which is **not** considered a good way to protect residents from lead hazards during conduct of renovation or remodeling?
- A. Seal off forced air ducts in the work area
  - B. Prohibit residents and children from entering the work area
  - C. Cover the residents' belongings with a "painter's tarp" or drop cloth
  - D. Place plastic ("poly") sheeting on the floor of the work area and use painter's tape to keep it from moving.
13. Which would be **most severely** affected by exposure to lead?
- A. A three year old child and the fetus of a pregnant woman
  - B. A painter involved in maintenance work and a laborer performing demolition
  - C. A "do-it-yourselfer" who is remodeling his basement and a housewife vacuuming the carpets
  - D. None of the above individuals would be affected by lead exposure
14. What should you absolutely **not** do with the waste generated by your work and cleanup?
- A. Throw it in the residents garbage can
  - B. Seal the waste in heavy duty plastic bags
  - C. Send the waste to an appropriate landfill
  - D. None of the above
15. Which of the following paint removal methods does HUD permit?
- A. Open flame burning
  - B. Power sanding with HEPA attachment
  - C. Extensive dry scraping
  - D. Dry vacuuming with shop vacuum
16. Why do we use lead safe work practices?
- A. To protect the health of children and pregnant women
  - B. To keep the house safe
  - C. Because it is required in all property receiving Federal support
  - D. All of the above

17. The primary route of exposure to lead for an adult is \_\_\_\_\_.
- A. Eating lead dust from contaminated food or food touched with dirty hands
  - B. Eating paint chips
  - C. Breathing airborne dust in the workplace
  - D. Chewing on pencils
18. What is the primary source of lead exposure for a child under six years of age?
- A. Lead in dust on horizontal surfaces
  - B. Lead dust in the air
  - C. Lead dust in the soil
  - D. Lead in pencils
19. Which of the following would prevent lead dust from becoming airborne during work?
- A. Leaving the debris on the floor and being careful not to step on it
  - B. Using a spray bottle to mist painted surfaces during the work
  - C. Drilling through a blob of shaving cream
  - D. Both B and C would
20. Why is a clearance test performed after a job?
- A. It provides data for research
  - B. It ensures the work area is safe for re-occupancy
  - C. It provides more work for contractors
  - D. It's an OSHA thing

## Appendix D: Post-Course Test Case Summary

Case Summary of Post-Course Test Scores by Course Date						
Record #	02/04/2002		02/18/2002		02/25/2002	
1	55	%	40	%	25	%
2	60	%	65	%	30	%
3	60	%	70	%	30	%
4	65	%	75	%	30	%
5	65	%	75	%	50	%
6	70	%	80	%	60	%
7	70	%	80	%	65	%
8	75	%	80	%	65	%
9	75	%	80	%	70	%
10	75	%	85	%	70	%
11	75	%	85	%	75	%
12	75	%	85	%	75	%
13	80	%	85	%	80	%
14	80	%	85	%	80	%
15	80	%	90	%	80	%
16	85	%	90	%	80	%
17	85	%	90	%	80	%
18	90	%	90	%	85	%
19	90	%	90	%	85	%
20	90	%	90	%	85	%
21	90	%	90	%	85	%
22	90	%	95	%	90	%
23	90	%	95	%	90	%
24	95	%	95	%	90	%
25	95	%	95	%	90	%
26	95	%	95	%	90	%
27	95	%	95	%	90	%
28	95	%	95	%	90	%
29	95	%	95	%	90	%
30	95	%	100	%	90	%
31	95	%	100	%	90	%
32	95	%	100	%	90	%
33	95	%	100	%	95	%
34	95	%	100	%	95	%
35	100	%			95	%
36					95	%
37					95	%
38					100	%
39					100	%

## **Vita**

William Troy Roussel was born in New Orleans, Louisiana. He received his high school diploma in 1989 from Deer Park High School in Deer Park, Texas. He attended Louisiana State University and received a Bachelor of Science in Industrial Technology with a focus on Occupational Health and Safety in 1995. After spending the next three years working in industry at an oil refinery as occupational and environmental safety officer and as a workers compensation loss prevention officer in the State of Louisiana, he accepted a position at Louisiana State University with the goal of pursuing a master's degree part-time. Mr. Roussel has worked in two departments while pursuing his master's degree at Louisiana State University, the Office of Occupational and Environmental Safety and the Division of Continuing Education.