Economic Analysis for the TSCA Lead Renovation, Repair, and Painting Program Opt-out and Recordkeeping Final Rule for Target Housing and Child-Occupied Facilities

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Notice

This is not an official guidance document and should not be relied upon to determine applicable regulatory requirements. This document was prepared to provide economic information for the rulemaking process, and to meet various administrative and legislative requirements. Due to the nature of the information available to EPA, the document contains various assumptions that may not reflect the regulatory determinations that an individual firm would make were it to apply the rule's requirements to its specific circumstances. Persons seeking information on regulatory requirements as they apply to specific facilities should consult 40 CFR Part 745, the preamble for the regulatory action, EPA guidance documents, and EPA's National Lead Information Center.

Table of Contents

Executive Summary

Introduction

This report presents an economic analysis of alternative regulatory options for revising the lead, renovation, repair and painting (LRRP) program regulations for target housing and child occupied facilities (COFs).[1] The LRRP rule for target housing and COFs was promulgated in 2008 (73 FR 21692) and is codified in Part 745 of Title 40 of the Code of Federal Regulations (CFR). The rule was promulgated under the authority of §402(c) of the Toxic Substances Control Act (TSCA). Section IV of TSCA was established by the Residential Lead-Based Paint Hazard Reduction Act of 1992, also known as Title X of the Housing and Community Development Act of 1992, Public Law 102-550.

Past use of lead-based paint has resulted in contamination that continues to pose human health hazards. While intact lead-based paint is not likely to contribute to such hazards, the deterioration of a structure over time or acute environmental stresses, such as are commonly present during renovation activities, has been found to create lead hazards. Since many buildings constructed before 1978 have lead-based paint, it is likely that renovation activities in pre-1978 buildings will contribute to lead hazards unless appropriate containment and clean-up practices are employed.

The 2008 LRRP regulations require entities that perform renovation, repair and painting work for compensation in buildings covered by the rule to become certified by EPA, ensure that their employees are trained as either renovators or workers, and use lead-safe work practices when disturbing lead-based paint.

The rule contains two major revisions to the LRRP program. The first revision is the removal of the opt-out provision in 40 CFR §745.82(c), under which renovators do not need to follow the work practices in the LRRP rule if they obtain a signed statement from the owner of a target housing unit agreeing that the required LRRP work practices will not be used and stating that the renovation will occur in the owner's residence, no child under age 6 or pregnant woman resides there, and the housing is not a COF. The second revision is a requirement that renovation firms provide owners and occupants with a copy of the records demonstrating compliance with the training and work practice requirements of the LRRP rule (referred to here as the "recordkeeping checklist requirement").

Disturbing lead-based paint in renovation, repair, and painting events generates lead dust that is an important source of lead exposure. Exposure to lead results in increased blood lead levels associated with various adverse health effects. If EPA were to take no action, society would not incur the costs to comply with the rule, but the negative health and environmental effects due to these preventable lead exposures would continue.

Number of Facilities Subject to the Rule

Table ES-1 provides summary information about the numbers of structures affected by the rule's requirements. There are 78 million target housing units and COFs, composed of 77.9 million target housing units and 0.1 million COFs in public or commercial buildings. The 2008 LRRP rule applied to 37.7 million target housing units and 0.1 million public and commercial buildings. About 40.2 million

[1] Target housing is defined as any housing constructed before 1978, except housing for the elderly or persons with disabilities (unless any child under age 6 resides or is expected to reside in such housing) or any 0-bedroom dwelling. A COF is defined as a building, or portion of a building, constructed prior to 1978, visited regularly by the same child, under 6 years of age, on at least two different days within any week (Sunday through Saturday period), provided that each day's visit lasts at least 3 hours and the combined weekly visits last at least 6 hours, and the combined annual visits last at least 60 hours.

target housing units would be added to the regulated universe due to the elimination of the opt-out provision. The recordkeeping checklist provision of the rule would apply to all 78 million target housing units and COFs.

Table ES-1: Number of Structures in Regulated Universe by Type

	Affected by Removal of Opt-out Provision	Affected by Additional Recordkeeping	Number of Structures
Target housing: Owner-occupied housing where no child <age 6 or pregnant woman resides, and that does not qualify as a COF	X	X	40,222,000
Target housing covered by 2008 LRRP rule: Rental housing, COF in target housing, or a child <age 6 or pregnant woman resides in housing		X	37,665,000
Subtotal – all target housing			*77,888,000*
COFs in public or commercial - covered by 2008 LRRP rule		X	97,000
Total			**77,985,000**

Note: Number of structures includes buildings with and without lead-based paint.
Estimated number of structures affected by the removal of the opt-out provision assumes that all owners of target housing eligible for the opt-out provision under the 2008 LRRP rule would have chosen to opt-out.

Rule Options Analyzed

This economic analysis considers a variety of options for addressing the risks created by renovation, repair, and painting (RRP) activities disturbing lead-based paint in housing previously eligible for the opt-out provision. These options include different alternatives for the effective date of the rule; an option phasing out the opt-out provision depending on when the housing was built; and different options for the work practices requirements.

Options A through D all apply the 2008 LRRP requirements to renovations in the housing previously eligible for the opt-out provision. However, the date when the opt-out provision would be eliminated differs across options A through D. Options E1 through E4 all have the same effective date, but have varying work practice requirements. Table ES-2 summarizes the options considered in this analysis; they are described in more detail below.

Options A and D both start eliminating the opt-out provision in June 2010, but Option A removes it for all houses in June 2010 while Option D allows the owners of houses built between 1960 and 1978 to continue to opt out until June 2011. Options B and C have effective dates of January 2011 and June 2011 (respectively) for the complete elimination of the opt-out provision.

Options E1 through E4 have the same effective dates and universe of regulated structures as Option A, but include alternative work practice requirements. Option E1 has the same containment requirements as the 2008 LRRP rule, but does not include any cleaning or cleaning verification work practices. Option E2 has the same cleaning and cleaning verification requirements as the 2008 LRRP rule, but does not include any containment work practices. Option E3 has the same cleaning requirements as the 2008 LRRP rule, but does not include any containment or cleaning verification work practices. Option E4 has the same containment, cleaning and cleaning verification requirements as the 2008 LRRP rule, but does not restrict or prohibit any paint removal practices.

All the options would also require renovation firms to provide owners and occupants of the buildings with a copy of the records demonstrating compliance with the training and work practice requirements of the LRRP rule. The effective date for the recordkeeping checklist requirement is June 2010 under all options.

Table ES-2: Options Included in Economic Analysis

Option	Effective Dates and Scope For Opt-Out Elimination*	Containment, Cleaning, and Cleaning Verification Requirements	Paint Removal Practices Restricted or Prohibited
A (final rule)	June 2010, no phase-out	Yes	Yes
B	January 2011, no phase-out	Yes	Yes
C	June 2011, no phase-out	Yes	Yes
D	June 2010 for pre-1960 housing, June 2011 for housing built between 1960 and 1978	Yes	Yes
E1	June 2010, no phase-out	Containment Only	Yes
E2	June 2010, no phase-out	Cleaning and Cleaning Verification Only	Yes
E3	June 2010, no phase-out	Cleaning Only	Yes
E4	June 2010, no phase-out	Yes	No

*The effective date for the recordkeeping checklist requirement is June 2010 under all options.

Costs

The costs associated with the revisions to the §402(c) LRRP Rule are divided into four categories: (1) work practice costs, (2) training costs, (3) certification costs (which include the firm's paperwork burden and EPA administrative and enforcement costs), and (4) recordkeeping checklist provision costs.[2] The costs associated with the first three components are all attributable to the elimination of the opt-out provision, which will extend the 2008 LRRP rule requirements to additional housing units. In addition to the work practice costs associated with the RRP events in these housing units, this change is predicted to result in more individuals and firms seeking training and certification.[3] The fourth component, recordkeeping checklist provision costs, applies to all renovations regulated under the 2008 LRRP rule as well as the additional housing units that would no longer be eligible for the opt-out provision.

[2] Note that the costs of the action as estimated in the Economic Analysis are expressed in 2005 dollars. The estimated costs would be approximately 10 percent higher if they were adjusted to be expressed in 2009$.

[3] This analysis assumes that renovation firms are somewhat specialized in terms of whether they work in facilities where the RRP program is applicable. However, there may be many instances where firms working in opt-out housing will already have become certified, and their staff been trained, because they also work in regulated facilities ineligible for the opt-out provision. If firms are less specialized than the analysis assumed, there may be little to no incremental training and certification costs due to the rule.

Costs are driven, in part, by the additional number of renovation, repair, and painting (RRP) events where renovators test for lead-based paint once the opt-out provision is removed; and the subset of these events that test positive for lead-based paint and where RRP is performed using the lead-safe cleaning, containment, and verification practices required by the rule (referred to as lead-safe work practice events).

The number of events under each option is summarized in Table ES-3 and is compared with the number of events regulated under the 2008 LRRP rule. The differences in the number of events in the first year for options A through D are due to variation in the date the opt-out provision is eliminated, so the differences in the costs estimated for Options A through D are all due to the timing of the opt-out elimination. And since Options A and E1 through E4 have the same effective dates and universe of regulated structures, the cost differences among these options are all attributable to their different work practice costs.

Because not all buildings built before 1978 have lead-based paint, the number of renovation events that need to use lead safe work practices (LSWP) is a subset of the total number of events covered by the rule. Currently available test kits for detecting whether lead-based paint is present have a high false positive rate resulting in the frequent use of lead safe work practices when they are not necessary, i.e., when lead-based paint is not present. EPA is working on the development of test kits that accurately identify both the presence and absence of lead in paint at levels that exceed the Federal standards. This analysis assumes that improved test kits will be in use starting in June 2011. Thus, the number of events with lead safe work practices is estimated to decrease from the first year to the second year because of the adoption of the improved test kits.

Table ES-3: Number of Renovation Events and Total Rule Costs

Scope		Number of RRP Events (Millions)[2]				Total Rule Costs (Millions 2005$)[3]				
		Year 1		Year 2			Year 2		Annualized	
Option		Total Events	LSWP Events	Total Events	LSWP Events	Year 1	3% Discount Rate	7% Discount Rate	3% Discount Rate	7% Discount Rate
2008 LRRP Rule		*11.4*	*8.4*	*11.4*	*4.4*	*$758*	*$395*	*$380*	*$404*	*$441*
Increase Due to Rule[1]	**Option A**	**7.3**	**5.4**	**7.2**	**3.0**	**$507**	**$290**	**$279**	**$295**	**$320**
	Option B	3.6	2.7	7.2	3.0	$263	$336	$323	$287	$306
	Option C	0.0	0.0	7.2	3.0	$20	$382	$368	$280	$291
	Option D	3.8	3.1	7.2	3.0	$291	$334	$321	$288	$308
	Option E1	7.3	5.4	7.2	3.0	$442	$254	$245	$258	$281
	Option E2	7.3	5.4	7.2	3.0	$447	$257	$247	$261	$283
	Option E3	7.3	5.4	7.2	3.0	$421	$242	$233	$246	$267
	Option E4	7.3	5.4	7.2	3.0	$502	$287	$276	$292	$317

1. The results for the rule options are incremental to the estimates for the 2008 LRRP rule (in shaded row).
2. Numbers of events for the options only include the events affected by the elimination of the opt-out provision. The events affected by the additional recordkeeping checklist requirement would also include those covered by the 2008 LRRP rule. For example, 18.7 (11.4 + 7.3) million events have recordkeeping checklist provision requirements in the first year under Option A.
3. Costs for 2008 LRRP rule do not include recordkeeping checklist costs.
Analysis assumes a 75% compliance rate with the rule.
LSWP = Lead-Safe Work Practices.
Option A represents the final rule.

Table ES-4 indicates the component costs that comprise the total cost for Option A. Work practice costs in housing formerly eligible for the opt-out provision represents the largest share of total costs of the rule.

Table ES-4: Costs for Option A by Cost Type (millions 2005$)				
3 Percent Discount Rate				
Cost Type	**Year 1**	**Year 2**	**Year 3**	**Annualized**
Work Practice	$336	$216	$209	$218
Training	$76	$18	$17	$20
Certification	$63	$25	$24	$26
Checklist - Target Housing	$31	$30	$29	$30
Checklist - COF in Public or Commercial Bldg	$1	$1	$1	$1
Total	**$507**	**$290**	**$281**	**$295**
7 Percent Discount Rate				
Cost Type	**Year 1**	**Year 2**	**Year 3**	**Annualized**
Work Practice	$336	$208	$194	$236
Training	$76	$17	$16	$23
Certification	$63	$24	$22	$29
Checklist - Target Housing	$31	$29	$27	$32
Checklist - COF in Public or Commercial Bldg	$1	$1	$1	$1
Total	$507	$279	$260	$320

In addition to the number of renovation events complying with the rule, other major factors in determining the costs of the rule revisions are the additional number of firms certified and the additional number of renovators and workers trained. The elimination of the opt-out provision is predicted to result in more individuals and firms seeking training and certification in order to meet the increased demand for RRP performed by certified firms and trained renovators resulting from the increase in the number of events where it will be required. Each renovation project covered by the LRRP rule must be performed by a certified firm and the work must be performed and/or directed by an individual who has become a certified renovator by successfully completing renovator training from an accredited training provider. The renovation activities may be performed by workers who have been provided on-the-job training by a certified renovator. However, the certified renovator must be physically present at the work site while signs are being posted, containment is being established, and the work area is being cleaned after the renovation to ensure that these tasks are performed correctly.

Table ES-5 presents a summary of the estimated increase in the number of establishments that will seek firm certification each year as a result of the removal of the opt-out provision, as well as the increase in the estimated number of employees that will need to be trained as renovators and workers in the first three years, and compares this to prior estimates for the 2008 LRRP rule.

Table ES-5: Number of Establishments Certified and Renovators and Workers Trained (thousands)

		2008 LRRP Rule	Additional Number Estimated under LRRP Revision Options			
			A & E1-E4	**B**	**C**	**D**
Year 1	Total Number of Establishments (with Employees and without) Seeking Certification	*212*	**111**	56	0	59
	Total Number of Renovators Seeking Training	*236*	**127**	63	0	67
	Total Number of Workers Seeking Training	*338*	**190**	95	0	100
Year 2	Total Number of Establishments (with Employees and without) Seeking Certification	*70*	**22**	67	111	64
	Total Number of Renovators Seeking Training	*78*	**22**	74	126	72
	Total Number of Workers Seeking Training	*337*	**189**	189	189	189
Year 3	Total Number of Establishments (with Employees and without) Seeking Certification	*70*	**22**	22	22	22
	Total Number of Renovators Seeking Training	*78*	**22**	22	22	22
	Total Number of Workers Seeking Training	*335*	**188**	188	188	188

Results for the rule options only include the events affected by the elimination of the opt-out provision. These numbers are incremental to the estimates for the 2008 LRRP rule (in the shaded row).
Analysis assumes a 75% compliance rate with the rule.
Option A represents the final rule.

The estimates presented in Table ES-5 reflect the simplifying assumption that additional initial certification and training due to the removal of the opt-out provision takes place over a 12 month period starting from the effective date. For example, it is estimated that an additional 127 thousand trained renovators would be necessary to meet the increased demand after the elimination of the opt-out provision, so under Option A all 127 thousand are assumed to be trained from June 2010 through June 2011. Under Option B, the opt-out provision is eliminated half-way through the first year (January 2011). Thus, half of the 127 thousand, or 56 thousand renovators, are assumed to incur the training costs in the first year. Since the opt-out provision is not eliminated until the second year under Option C (June 2011), it is assumed that no training costs are incurred in the first year under Option C. A simplifying assumption was necessary because it is not possible to predict the precise timing of the training and certification that would occur under the various options. In reality, any additional firms and renovators that become certified and trained because of the removal of the opt-out provision may do so before the removal of the opt-out provision goes into effect. Thus, under Option C, it is unlikely that there would actually be zero firms certified or renovators trained in the first year after promulgation of the rule.

Benefits

A great deal of information on the numerous adverse health effects of lead is available from decades of medical observation and scientific research. Inhaled or ingested lead is distributed throughout the body and is toxic to many organ systems. As a result, its toxicity manifests itself in the form of impacts on several organ systems. A reduction in lead exposure resulting from the rule would lead to a reduction in these adverse health effects and the costs of treating them. Young children (from birth through age five) are particularly sensitive to lead, which impairs a child's neuropsychological development (frequently measured by IQ change).

These cognitive and behavioral effects, discussed above, are strongly related to future productivity and expected earnings. The estimated value of an IQ point is approximately $13,000, which represents the present value of a loss in expected lifetime earnings due to a one point IQ drop. This estimated value of an IQ point is limited to reduced income, and does not include other potential impacts such as additional education costs for special and remedial education, and medical costs to treat very high levels of lead.

Investigating associations between lead exposure and behavior, mood, and social conduct of children has been an emerging area of research. Early studies indicated linkages between lower-level lead toxicity and behavioral problems (e.g., aggression, attentional problems, and hyperactivity) in children. Blood-lead and tooth-lead levels have been associated with behavioral features of attention-deficit hyperactivity disorder (ADHD), including distractibility, poor organization, lack of persistence in completing tasks, and daydreaming, in various cohorts of children with a wide range of lead exposures. The relationship between lead exposure and delinquent and criminal behavior also has been addressed in several investigations. Studies linking attention deficits, aggressive and disruptive behaviors, and poor self-regulation with lead have raised the prospect that early exposure may result in an increased likelihood of engaging in antisocial behaviors in later life. Elevated lead levels have been associated with several measures of behavioral disturbance and delinquent behavior.

Epidemiologic studies have consistently demonstrated associations between lead exposure and enhanced risk of deleterious cardiovascular outcomes, including increased blood pressure and increased hypertension.

Both epidemiologic and toxicologic studies have shown that environmentally relevant levels of lead affect many different organ systems. Neurotoxic effects in children and cardiovascular effects in adults are among those best substantiated as occurring at blood-lead concentrations as low as 5 to 10 ug/dL (or possibly lower); and these categories of effects are currently of greatest public health concern. Other newly demonstrated immune and renal system effects among general population groups are also emerging as low-level lead exposure effects of potential public health concern. It appears that some of these effects, particularly changes in the levels of certain blood enzymes and in aspects of children's neurobehavioral development, may occur at blood-lead levels so low as to be essentially without a threshold.

The rule's removal of the opt-out provision will apply the LRRP program's work practices, training and certification requirements to renovations in all target housing and COFs (including housing previously eligible for the opt-out provision). This will reduce lead exposure by increasing the containment and cleanup of dust and debris generated by RRP activities. Additional reductions in lead exposure will be achieved by prohibiting the use of certain paint preparation and removal techniques in jobs that require lead-safe work practices. These reductions in exposure will in turn reduce the risks of adverse health and ecological effects in the vicinity of these activities.

The requirement that renovators provide the owners and occupants of renovated buildings with copies of the records renovation firms must maintain to document compliance with the rule's training and work practice requirements will enable building owners and occupants to better understand what the renovation firm did to comply with the rule and how the rule's provisions affected their specific renovation. Educating the owners and occupants in this way is likely to help them to be better able to protect themselves from lead-based paint hazards that may have been created by the renovation and improve their ability to assist the EPA in monitoring compliance with the LRRP rule. These improvements in education and monitoring will improve compliance with the rule, which will ultimately protect children and adults from exposure to lead hazards due to renovation activities.

Removing the opt-out provision will protect children and adults from exposure to lead dust from renovations in a variety of situations. They include children under the age of six who visit a friend, relative, or caregiver's house where a renovation has been performed under the opt-out provision; children who move into such housing when their family purchases it after such a renovation has been performed; and children who live in a property adjacent to housing where renovation has been performed under the opt-out provision. Removing the opt-out provision will also protect individuals age 6 and older

who live in houses that were renovated under the opt-out provision; who move into such housing after such a renovation has been performed; and who live in adjacent properties.

In addition, removal of the opt-out provision will provide additional protection for women who do not know they are pregnant at the time a renovation commences, women who become pregnant shortly after a renovation occurs, and women of child-bearing age in general. This is particularly important because the transplacental transfer of lead in humans is well documented, and infants are generally born with a lead body burden reflecting that of the mother.

Removing the opt-out provision will also result in fewer homes being purchased with pre-existing lead hazards. It is common for home owners to perform activities that disturb paint before selling a house. Removing the opt-out provision decreases the likelihood of lead hazards being present when new occupants move into the home.

Eliminating the opt-out provision will also protect individuals residing adjacent to homes undergoing renovations. Renovations on the exterior of a residence can spread leaded dust and debris some distance from the renovation activity. There are approximately 1.6 million owner-occupied single-family attached homes built before 1978 eligible for the opt-out provision. If these homeowners opt out of the LRRP program, renovations on the exterior of these homes are likely to contaminate neighboring yards and porches, resulting in exposure inside the neighboring houses as well as outside (because exterior dust is tracked into the home). Many more single-family detached homes are located in close proximity to each other, and renovations performed under the opt-out provision present a similar risk for these homes.

Removing the opt-out provision will also provide protection to family pets living in owner-occupied housing where no children under age 6 or pregnant women reside. Lead poisoning resulting from renovations has been documented in both cats and dogs, resulting in both veterinary care costs and, in some instances, loss of a family pet.

EPA has calculated crude benefits numbers for several groups of individuals protected by removing the opt-out provision. This has been done by estimating the number of individuals in each group and combining this with the average benefit per individual for a similar group from previous LRRP rule analyses. These averages do not replicate the scenarios used in the previous analyses, which included an array of factors such as age of child, type of renovation, size of job, and building vintage, so the calculations in this chapter do not reflect the methodology that EPA previously had peer reviewed for the LRRP rule analysis.

As a result of severe time constraints for the conduct of this analysis, the average benefits per individual from the previous analyses have not been modified to reflect any differences in exposure between populations protected by the 2008 rule and those protected by the removal of the opt-out provision. While these values can serve as a proxy to provide a sense of the magnitude of benefits from this action, the amount of error in these values is unknown.

Estimating benefits from avoided lead exposure is not an issue that lends itself to simplified calculations. Thus, the benefits calculations used here should be viewed as crude indicators of the magnitude of benefits. In light of this, the analysis calculates benefits under two different scenarios. In one of the scenarios, aggregate benefits are based on average benefits per individual from previous analyses multiplied by an estimate of the number of people affected by the rule. In the second scenario, benefits are calculated by applying a simple linear adjustment factor to one of the components in the first scenario, in order to reflect the uncertainties created by relying on the average benefit per individual from previous analyses as a basis for the calculation.

Table ES-6 and Table ES-7 summarize the result of the benefits calculations for both scenarios using a 3% and a 7% discount rate, respectively.

Table ES-6: Summary of Benefits for Option A (final rule) – millions of dollars, 3% discount rate)

Population	Children Under 6 IQ Benefits		Adult Cardiovascular Benefits		Combined	
	Scenario 1	Scenario 2	Scenario 1	Scenario 2	Scenario 1	Scenario 2
(1) Reside in housing renovated under opt-out provision	Not applicable – children under 6 do not reside in opt-out eligible housing		$656.5	$2,626	$656.5	$2,626
(2) Live contiguous to attached house renovated under opt-out provision	$15.4	$15.4	$119	$119	$134.4	$134.4
(3) Move into house renovated under opt-out provision	$68.2	$272.7	45*	$722*	$68.2*	$272.7*
(4) Receive childcare in housing renovated under opt-out provision	$6.9	$27.5	Not applicable		$6.9	$27.5
Subtotal	**$90.5**	**$315.6**	**$775.5**	**$2,745**	**$866.0**	**$3,060.6**

Uncalculated Benefits
(5) Live near house renovated under opt-out provision, other than contiguous attached house;
(6) Spend time in friend's or relative's house renovated under opt-out provision;
(7) Health effects for all populations other than IQ loss in children <6 and blood pressure effects in older individuals.

* Adult component not included in subtotal because these benefits are assumed to be incorporated into row #1 above based on the exposure assumptions used.

Table ES-7: Summary of Benefits for Option A (final rule) – millions of dollars, 7% discount rate

Population	Children Under 6 IQ Benefits		Adult Cardiovascular Benefits		Combined	
	Scenario 1	Scenario 2	Scenario 1	Scenario 2	Scenario 1	Scenario 2
(1) Reside in housing renovated under opt-out provision	Not applicable – children under 6 do not reside in opt-out eligible housing		$698.8	$2,795	$698.8	$2,795
(2) Live contiguous to attached house renovated under opt-out provision	$16.4	$16.4	$127	$127	$143.4	$151.6
(3) Move into house renovated under opt-out provision	$72.6	$290.3	$48*	768*	$72.6*	$290.3*
(4) Receive childcare in housing renovated under opt-out provision	$7.3	$29.2	Not applicable		$7.3	$29.2
Subtotal	**$96.3**	**$335.9**	**$825.8**	**$2,922**	**$920.1**	**$3,257.9**

Uncalculated Benefits
(5) Live near house renovated under opt-out provision, other than contiguous attached house;
(6) Spend time in friend's or relative's house renovated under opt-out provision;
(7) Health effects for all populations other than IQ loss in children <6 and blood pressure effects in older individuals.

* Adult component not included in subtotal because these benefits are assumed to be incorporated into row #1 above based on the exposure assumptions used.

Small Entity Impacts

The Regulatory Flexibility Act (RFA) of 1980, amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA) of 1996, requires regulators to assess the effects of regulations on small entities including businesses, nonprofit organizations, and governments. The vast majority of entities in the industries affected by the rule are small. The small entity impact analysis considers firms that would seek certification as a result of the elimination of the opt-out provision (opt-out entities) separately from the firms that are currently regulated under the 2008 LRRP rule (currently regulated entities). The revisions to the renovation, repair, and painting program will affect approximately 289,000 small entities; of those small entities, it is predicted that up to 101,000 will incur certification, work practice, and training costs as a result of the elimination of the opt-out provision.

Two factors are evaluated in analyzing the rule's impacts on small entities, (1) the number of firms that would experience the impact, and (2) the size of the impact. Average annual compliance costs as a percentage of average annual revenues are used to assess the potential average impact of the rule on small businesses and small governments. This ratio is a good measure of entities' ability to afford the costs attributable to a regulatory requirement, because comparing compliance costs to revenues provides a reasonable indication of the magnitude of the regulatory burden relative to a commonly available measure of economic activity. Where regulatory costs represent a small fraction of a typical entity's revenues, the financial impacts of the regulation on such entities may be considered as not significant. For non-profit organizations, impacts are measured by comparing rule costs to the organization's annual expenditures. When expenditure data were not available, however, revenue information was used as a proxy for expenditures. It is appropriate to calculate the impact ratios using annualized costs, because these costs are more representative of the continuing costs entities face to comply with the rule.

There are approximately 101,000 small entities that would be affected by the removal of the opt-out provision. The average annualized cost to a typical small entity in this group is estimated to range from about $1,133 to $6,408 per year, depending on the number of renovation, repair, and painting events undertaken by a small entity in the industry sector involved. As shown in Table ES-8, the cost impact of the revisions on small opt-out entities ranges from about 0.8 percent to 1.7 percent of revenues, depending on the industry sector. (If renovation firms are less specialized than the analysis assumed, in terms of whether they work in facilities where the RRP program is applicable, impacts will be lower than calculated because some firms that also work in regulated facilities ineligible for the opt-out provision will already have incurred costs for training and certification.)

Table ES-8: Typical-Year Number of Small Entities with RRP Events and Associated Cost-Impact Ratio to Entities Affected by both the Removal of the Opt-out Provision and the Additional Recordkeeping Requirements

		Final Rule (Option A)	
	Entity Type	**Number of Small Entities**	**Average Cost-Impact Ratio**
Residential Contractors (working in target housing)			
Residential remodelers	Business	32,093	0.83%
Siding contractors	Business	2,335	1.19%
Finish carpentry contractors	Business	22,790	1.13%
Other building equipment contractors	Business	1,059	1.14%
Other building finishing contractors	Business	1,450	1.11%
Tile and terrazzo contractors	Business	3,255	1.17%
Plumbing and HVAC contractors	Business	10,953	1.12%
Glass and glazing contractors	Business	966	0.90%
Painting and wall covering contractors	Business	12,650	1.70%
Electrical contractors	Business	7,787	1.37%
Drywall and insulation contractors	Business	5,326	1.14%
Total		**100,662**	

There are approximately 189,000 small entities that are not predicted to be affected by the removal of the opt-out provision, but that are expected to be affected by the additional recordkeeping requirements. These are all entities that were previously assumed to be affected by the 2008 LRRP rule. For a typical small entity in this group, the average annualized cost of the rule is estimated to range from about $1 to $283 per year, depending on the number of RRP events undertaken by a small entity in the industry sector involved. As shown in Table ES-9, the cost impact on currently regulated small entities ranges from about 0.0001 percent to 0.08 percent of revenues, depending on the industry sector.

Table ES-9: Typical-Year Number of Small Entities with RRP Events where the 2008 LRRP Rule is Applicable and Only Affected by the Additional Recordkeeping Requirements			
		Final Rule (Option A)	
Description	**Entity Type**	**Number of Small Entities**	**Average Cost-Impact Ratio**
Public School Districts	Government	6,492	0.0001%
Private Schools	Non-Profit	6,174	0.0005%
Daycare Centers	Non-Profit	10,481	0.0005%
Non-Residential Landlords	Business	11,056	0.0010%
Non-Residential Contractors (working in public or commercial building COFs)	Business	2,866	0.01%
Residential Contractors (working in target housing)			
Residential remodelers	Business	41,359	0.02%
Siding contractors	Business	3,008	0.03%
Finish carpentry contractors	Business	29,369	0.03%
Other building equipment contractors	Business	1,365	0.03%
Other building finishing contractors	Business	1,868	0.03%
Tile and terrazzo contractors	Business	4,195	0.03%
Plumbing and HVAC contractors	Business	14,114	0.03%
Glass and glazing contractors	Business	1,244	0.02%
Painting and wall covering contractors	Business	16,302	0.04%
Electrical contractors	Business	10,035	0.04%
Drywall and insulation contractors	Business	6,863	0.03%
Residential Property Managers	Business	5,824	0.08%
Lessors of Residential Real Estate	Business	15,970	0.03%
Total		**188,588**	

Combining the small entities affected by the removal of the opt-out provision with those affected only by the additional recordkeeping requirements, Table ES-10 presents the total number of small governments, non-profit organizations, and small for-profit businesses affected by the rule, and the average cost-to-revenue ratios for each category. It is estimated that under Option A, a total of 289,000 small entities would be affected by the program, including 266,000 small businesses with average impacts of 0.4 percent, nearly 17,000 small non-profits with average impacts of about 0.0001 percent, and over 6,000 small governments with average impacts of about 0.0005 percent.

Table ES-10: Aggregate Impacts on All Small Entities		
	Total Number of Small Entities Affected	**Average Impacts, All Small Entities**
Option A		
Small Governments	6,492	0.0001%
Non-Profit Organizations	16,655	0.0005%
Small For-Profit Businesses	266,102	0.43%
Total	**289,250**	

Some of the small entities subject to the rule have employees while others are non-employers. The non-employers typically perform fewer jobs than firms with employees, and thus have lower work practice compliance costs. However, they also have lower average revenues than entities with employees, so their impacts (measured as costs divided by revenues) can be higher. Impact estimates for non-employers should be interpreted with caution, as some non-employers may have issues related to understatement of income, which would tend to exaggerate the average impact ratio for this class of small entities.

As shown in Table ES-11, there are 75,000 non-employer renovation contractors estimated to be affected by the removal of the opt-out provision. The average cost to these contractors is estimated to be $1,193 apiece. This represents 1.3% to 4.7% of reported revenues, depending on the industry sector. This rule's new recordkeeping requirement is estimated to affect an additional 96,000 non-employer renovation contractors not affected by removal of the opt-out provision. The costs to these contractors are estimated to be $42 apiece. This represents 0.05% to 0.17% of revenues, depending on the industry sector.

Table ES-11: Cost-to-Revenue Ratios: Non-Employers

Industry Description	Number of Small Entities	Average Cost-Impact Ratio
Residential Opt-Out Contractors		
Residential remodelers	22,522	3.48%
Siding contractors	1,651	3.65%
Finish carpentry contractors	19,170	3.91%
Other building equipment contractors	664	3.03%
Other building finishing contractors	1,222	1.56%
Tile and terrazzo contractors	2,739	3.11%
Plumbing and HVAC contractors	6,162	2.07%
Glass and glazing contractors	685	1.96%
Painting and wall covering contractors	10,639	4.73%
Electrical contractors	4,869	2.96%
Drywall and insulation contractors	4,497	1.30%
Total, Small Construction Establishments	**74,821**	**3.07%**
Currently Regulated Contractors		
Residential remodelers	29,024	0.12%
Siding contractors	2,128	0.13%
Finish carpentry contractors	24,705	0.14%
Other building equipment contractors	856	0.11%
Other building finishing contractors	1,575	0.06%
Tile and terrazzo contractors	3,530	0.11%
Plumbing and HVAC contractors	7,940	0.07%
Glass and glazing contractors	883	0.07%
Painting and wall covering contractors	13,710	0.17%
Electrical contractors	6,275	0.10%
Drywall and insulation contractors	5,796	0.05%
Total, Small Construction Establishments	**96,422**	**0.11%**

1. Introduction

This report presents an economic analysis of alternative regulatory options for revising the lead, renovation, repair and painting (LRRP) program regulations for target housing and child occupied facilities (COFs). The LRRP rule for target housing and COFs was promulgated in 2008 (73 FR 21692) and is codified in Part 745 of Title 40 of the Code of Federal Regulations (CFR). The rule was promulgated under the authority of §402(c) of the Toxic Substances Control Act (TSCA). Section IV of TSCA was established by the Residential Lead-Based Paint Hazard Reduction Act of 1992, also known as Title X of the Housing and Community Development Act of 1992, Public Law 102-550.

The existing LRRP regulations require entities that perform renovation, repair and painting work for compensation in buildings covered by the rule to become certified by EPA, ensure that their employees are trained as either renovators or workers, and use lead-safe work practices when disturbing lead-based paint.

Past use of lead-based paint has resulted in contamination that continues to pose human health hazards. While intact lead-based paint is not likely to contribute to such hazards, the deterioration of a structure over time or acute environmental stresses, such as are commonly present during renovation activities, has been found to create lead hazards. Since many buildings constructed before 1978 have lead-based paint, it is likely that renovation activities in pre-1978 buildings will contribute to lead hazards unless appropriate containment and clean-up practices are employed.

The proposed revisions to the LRRP program include: (1) the removal of the opt-out provision for owner-occupied target housing without either children under the age of 6 or a pregnant woman in residence, and (2) an additional requirement that the renovator provide a copy of their recordkeeping checklist to owners and occupants of renovated structures.

1.1 Purpose of the LRRP Rule Revisions

Removing the opt-out provision will protect individuals (including children under age 6 and pregnant women), who visit, move into, or live adjacent to a home renovated under the opt-out provision, from exposure to lead hazards due to renovation activities. Requiring renovators to provide owners and occupants of renovated buildings with copies of the records documenting the renovation firm's compliance with the rule's training and work practice requirements will enable them to better understand what the renovation firm did to comply with the rule and improve their ability to assist the EPA in monitoring compliance with the RRP rule. EPA anticipates that the rule will further develop a market[1] for lead safe renovation services that has been established by past lead rules.

The LRRP rule requires certification of entities that perform renovation, repair and/or painting in buildings covered by the regulations. This includes construction contractors (including sole practitioners) as well as landlords and other building owners (such as school districts) that may perform RRP activities using their own staff. It does not, however, cover renovation, repair and painting (RRP) work performed by homeowners on their own homes. The certified entity must ensure that all persons performing RRP activities on behalf of the entity in buildings covered by the rule are either renovators who have received formal training in EPA-approved work practices from an EPA-accredited course or workers who have received on-the-job training in these approved work practices. In addition, the rule requires the use of these approved work practices to ensure that proper cleanup has occurred. Supporting these work practices, training and certification requirements, EPA is undertaking an enhanced outreach program to

[1] These markets are expected to consist of suppliers who offer lead safe renovation services (LSRS) and consumers who are willing to pay the incremental costs associated with using LSRS over non-LSRS.

educate the general public about the dangers of lead exposure and ways to limit exposure resulting from RRP activities.

1.2 Goal of the Economic Analysis

The purpose of this report is to analyze various options for the LRRP rulemaking revisions. The report addresses the requirements for economic analysis of Executive Order 12866 – *Regulatory Planning and Review*; the Regulatory Flexibility Act (RFA) and the Small Business Regulatory Enforcement Fairness Act (SBRFA); Executive Order 12898 – *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*; Executive Order 13045 – *Protection of Children from Environmental Health Risks and Safety Risks*; the Unfunded Mandates Reform Act; Executive Order 12875 – *Enhancing the Intergovernmental Partnership*; and the Paperwork Reduction Act (PRA).

This economic analysis considers various regulatory options. The effective date for the recordkeeping checklist requirement is June 2010 under all options. Options A through D all include containment, cleaning, and cleaning verification requirements, as well as restricting or prohibiting certain paint removal practices. However, options A through D differ in terms of the effective dates of the elimination of the opt-out provision. In addition, the economic analysis considers four options with varying work practice requirements, Options E1 through E4. Table 1-1 summarizes the options considered in this analysis; they are described in more detail below.

Options A and D both have effective dates of June 2010 for the elimination of the opt-out provision, but Option A does not phase in the opt-out elimination while Option D is limits opt-out elimination to pre-1960 structures during Phase 1 of the regulation and expands the requirements to structures built between 1960 and 1978 in Phase 2, which has an effective date of June 2011. Options B and C have effective dates of January 2011 and June 2011 for the elimination of the opt-out provision respectively, and neither option phases in this requirement.

Options E1 through E4 have the same effective dates and universe of regulated structures as Option A, but consider alternative work practice requirements. Option E1 has the same containment requirements as 40 CFR 745.85, but does not include any cleaning or cleaning verification work practices. Option E2 has the same cleaning and cleaning verification requirements as 40 CFR 745.85, but does not include any containment work practices. Option E3 has the same cleaning requirements as 40 CFR 745.85, but does not include any containment or cleaning verification work practices. Option E4 has the same containment, cleaning and cleaning verification requirements as 40 CFR 745.85, but does not restrict or prohibit any paint removal practices.

Table 1-1: Options Included in Economic Analysis			
Option	**Effective Dates and Scope For Opt-Out Elimination***	**Containment, Cleaning, and Cleaning Verification Requirements**	**Paint Removal Practices Restricted or Prohibited**
A	June 2010, no phase-in	Yes	Yes
B	January 2011, no phase-in	Yes	Yes
C	June 2011, no phase-in	Yes	Yes
D	June 2010 for pre-1960 housing, June 2011 for housing built between 1960 and 1978	Yes	Yes
E1	June 2010, no phase-in	Containment Only	Yes
E2	June 2010, no phase-in	Cleaning and Cleaning Verification Only	Yes
E3	June 2010, no phase-in	Cleaning Only	Yes
E4	June 2010, no phase-in	Yes	No
*The effective date for the recordkeeping checklist requirement is June 2010 under all options.			

1.3 Organization of this Report

Chapter 2 profiles the RRP industry, as well as non-profit and governmental suppliers of childcare including family daycare providers. It examines the supply of and demand for renovation, remodeling and painting services. Using data from a variety of sources, including the U.S. Economic Census, the chapter discusses the size of the RRP industry and characteristics of its firms, as well as the organizational structure and competitiveness of the industry. The demand for RRP services is characterized and the factors that affect demand are discussed. Other affected industries (e.g. training providers, property owners and managers) are also profiled in this chapter.

Chapter 3 characterizes the lead contamination problem to be addressed under the proposed rule. It discusses how incomplete information and external costs have resulted in inefficient levels of lead contamination resulting from renovation activity, and introduces regulation as a reasonable solution for these market failures. The chapter also reviews state and local regulations that affect RRP activities and demonstrates that these are not sufficient to address the problem.

Chapter 4 describes in detail the methods used to calculate costs of the various regulatory options considered. It describes the data sources used and is organized around the four general categories of costs incurred under the proposed rule: work practice compliance costs, training costs, certification and administrative costs, and checklist provision costs. The last section of the chapter estimates the costs of each option over a 50-year period and presents annualized costs at both 3 percent and 7 percent.

Chapter 5 calculates crude benefits numbers for several groups of individuals protected by removing the opt-out provision. While these values can serve as a proxy to provide a sense of the magnitude of benefits from this action, the amount of error in these values is unknown.

Chapter 6 presents findings of distributional analyses relevant to specific rule-making requirements, including small business impacts, environmental justice, protection of children and unfunded mandates.

2. Lead, Renovation, Repair, and Painting Industry Profile

The LRRP rule for target housing and child occupied facilities (COFs) was promulgated in 2008 (73 FR 21692) and is codified in Part 745 of Title 40 of the Code of Federal Regulations (CFR). The rule was promulgated under the authority of §402(c) of the Toxic Substances Control Act (TSCA). Section IV of TSCA was established by the Residential Lead-Based Paint Hazard Reduction Act of 1992, also known as Title X of the Housing and Community Development Act of 1992, Public Law 102-550.

The existing LRRP regulations apply to entities that perform renovation, repair and painting work for compensation in target housing or child occupied facilities, including building owners or managers who use their own staff to conduct RRP activities. These entities must become certified by EPA, ensure that their employees are trained as either renovators or workers, and use lead-safe work practices when disturbing lead-based paint.

The revisions to the LRRP program include: (1) the removal of the opt-out provision for owner-occupied target housing without either children under the age of 6 or a pregnant woman in residence, (2) an additional requirement that the renovator provide a copy of their recordkeeping checklist to owners and occupants of renovated structures, and (3) clarifications and other technical changes to the LRRP program that do not have cost implications.

Target housing is defined in section 401 of the Toxic Substances Control Act (TSCA) as any housing constructed before 1978, except housing for the elderly or persons with disabilities (unless any child under age 6 resides or is expected to reside in such housing) or any 0-bedroom dwelling.

A COF is defined under the rule in Title 40 of the Code of Federal Regulations (CFR) §745.83, as:

> Child-occupied facility means a building, or portion of a building, constructed prior to 1978, visited regularly by the same child, under 6 years of age, on at least two different days within any week (Sunday through Saturday period), provided that each day's visit lasts at least 3 hours and the combined weekly visits last at least 6 hours, and the combined annual visits last at least 60 hours. Child-occupied facilities may include, but are not limited to, day care centers, preschools and kindergarten classrooms. Child-occupied facilities may be located in target housing or in public and commercial buildings. With respect to common areas in public and commercial buildings that contain child-occupied facilities, the child-occupied facility encompasses only those common areas that are routinely used by children under age 6, such as restrooms and cafeterias. Common areas that children under age 6 only pass through, such as hallways, stairways, and garages are not included. In addition, for public and commercial buildings that contain child-occupied facilities, the child-occupied facility encompasses only the exterior sides of the building that are immediately adjacent to the child-occupied facility or the common areas routinely used by children under age 6.

The term renovation is defined in 40 CFR §745.83 to encompass a wide variety of construction activities:

> Renovation means the modification of any existing structure, or portion thereof, that results in the disturbance of painted surfaces, unless that activity is performed as part of an abatement as defined by this part (40 CFR § 745.223). The term renovation includes (but is not limited to): the removal, modification or repair of painted surfaces or painted components (e.g., modification of painted doors, surface restoration, window repair, surface preparation activity (such as sanding, scraping, or other such activities that may generate paint dust)); the removal of building components (e.g., walls, ceilings, plumbing, windows); weatherization projects (e.g., cutting holes in painted surfaces to install blown-in insulation or to gain access to attics, planing thresholds to install weather-stripping), and interim controls that disturb painted surfaces. A renovation performed for the purpose of converting a building, or part of a building, into target housing or a child-occupied facility is a renovation under this subpart.

Thus, renovation includes repair work as well as painting work involving sanding, scraping, or other paint removal. Renovation activities are conducted without the intent of removing lead, but may disturb it in the process. Lead abatement activities, on the other hand, are conducted with the intent to remove lead-based paint or otherwise permanently eliminate a lead-based paint hazard. Depending on the reason they are undertaken, many activities, such as replacing windows, can be either renovation or abatement. Because the rule will address renovation, rather than abatement activity, this profile characterizes the renovation industry as opposed to the abatement services industry.

The industry profile is categorized into eight sections. Section 2.1 discusses the supply of contractor-provided renovation services. Section 2.2 presents information on the numbers and types of child care facilities and schools. Section 2.3 presents information on the number and sizes of non-residential property owners and managers likely to be affected by the rule. Section 2.4 focuses on the demand-side of renovation by identifying the quantity of renovation activities performed. Section 2.5 discusses the overall market organization for the renovation industry. Section 2.6 describes the residential property owner and manager industry. Section 2.7 discusses training providers. Section 2.8 provides an overview of the structures that would be affected by the revisions to the LRRP rule.

2.1 Contractors that Supply Renovation Services

Data from the U.S. Economic Census were used to identify the North American Industry Classification System (NAICS) industry groups that may provide renovation, repair and painting work (U.S. Census Bureau 2004a). An establishment is assigned to a NAICS group based on the activities from which it derives the greatest share of its revenues. These activities may or may not make up the majority of work (i.e. labor hours) performed by the establishment, which may also be involved in a variety of other related (or unrelated) lines of work. The analysis identified 12 NAICS codes that are likely to include the vast majority of construction-related establishments that will be affected by the rule. Affected industry groups include two building construction sectors (NAICS 236118 – Residential Remodelers; and NAICS 236220 – Commercial and Institutional Building Construction) and ten specialty trade contractor sectors.

The number of contracting establishments affected is also discussed in Chapter 4. This profile examines the financial and employment characteristics of construction establishments likely to provide renovation work in child-occupied facilities.

NAICS sectors likely to perform projects regulated under the LRRP rule, as well as examples of the work they perform, are presented in Table 2-1.

Table 2-1: Contractor Sectors likely to be affected by the rule	
2002 NAICS	**Examples of Work Performed**
236118 - Residential Remodelers	• Addition, alteration and renovation of single-family homes • Addition, alteration and renovation of multifamily buildings • Home improvement (e.g., adding on, remodeling, renovating)
236220 - Commercial Building Construction	• Addition, alteration, maintenance and repair of commercial and institutional buildings • Commercial and Institutional building general contractors
238150 - Glass and Glazing Contractors	• Mirror Installation • Window pane or sheet installation
238170 - Siding Contractors	• Vinyl Siding, soffit and fascia, installation • Wood Siding, Installation
238210 - Electrical Contractors	• Electrical wiring contractors • Lighting system installation • Electrical power control panel and outlet installation
238220 – Plumbing and HVAC Contractors	• Heating equipment installation • Plumbing fixture installation • Plumbing and heating contractors
238290 – Other Building Equipment Contractors	• Pipe, duct and boiler installation • Water pipe insulating • Deodorization (i.e., air filtration) system installation
238310 – Drywall and Insulation Contractors	• Panel or rigid board insulation installation • Mineral wool insulation installation • Plastering (i.e., ornamental, plain) contractors
238320 – Painting and Wall Covering Contractors	• House painting • Paint and Wallpaper Stripping • Paperhanging and removal contractors
238340 – Tile and Terrazzo Contractors	• Ceramic tile installation • Mantel, marble or stone, installation • Mosaic work
238350 – Finish Carpentry Contractors	• Door and window, prefabricated, installation • Millwork installation • Paneling installation
238390 - Other Building Finishing Contractors	• Window shade and blind installation • Building fixture and fitting (except mechanical equipment) installation • Drapery fixture (e.g., hardware, rods, tracks) installation
Source: U.S. Census Bureau 2004a	

2.1.1 Number of Establishments with Employees

The U.S. Economic Census tracks businesses with paid employees (employer establishments) and non-employer establishments (self-employed contractors) separately.[1] This discussion deals with employer establishments only; non-employers are addressed in the next section.

Table 2-2 presents both the number of establishments and the number of employees in each NAICS group of interest. The number of establishments "includes all establishments that were in business at any time during the year are included. Construction establishments that were inactive or idle for the entire year were not included" (U.S. Census Bureau 2006a). Table 2-2 also presents the average per-establishment employment numbers by NAICS code. The average employment numbers are small for all affected sectors. Overall, Other Building Equipment contractors have the largest number of employees per establishment (20.8 people), while Residential Remodelers have the smallest (3.9 people).

Table 2-2: Number of Employer Establishments and Employees by NAICS Code

NAICS	Industry	Establishments	Number of Employees	Average Size
236118	Residential Remodelers	82,750	320,208	3.9
236220	Commercial building construction	37,208	715,896	19.2
238150	Glass and glazing contractors	5,294	50,800	9.6
238170	Siding contractors	6,632	43,042	6.5
238210	Electrical contractors	62,586	771,184	12.3
238220	Plumbing and HVAC contractors	87,501	974,368	11.1
238290	Other building equipment contractors	6,087	126,559	20.8
238310	Drywall and insulation contractors	19,598	311,077	15.9
238320	Painting and wall covering contractors	38,943	234,562	6.0
238340	Tile and terrazzo contractors	8,950	60,001	6.7
238350	Finish Carpentry contractors	35,087	179,476	5.1
238390	Other building finishing contractors	3,729	50,617	13.6
	Total, All sectors	394,365	3,837,790	9.7

Source: U.S. Census Bureau 2005c

Table 2-3 presents the total number of employees and the number of construction workers in each identified industry. The number of employees "includes all full-time and part-time individuals on the payrolls of construction establishments during any part of the pay period which included the 12th of March, May, August, and November" (U.S. Census Bureau 2005m). The number of construction workers "includes all payroll workers (up through the working supervisory level) directly engaged in construction operations, such as painters, carpenters, plumbers, and electricians… journeymen, mechanics…truck drivers and helpers." Non-construction employees include "payroll employees in executive, purchasing, accounting, …and routine office functions" (U.S. Census Bureau 2005m). Because construction workers form the vast majority of the people who require training under the rule,

[1] Data at the firm level were not available for these NAICS groups when the analysis was performed.

their role in the composition of each sector's labor force provides an indication of the extent to which each sector will be affected by the regulations.

In total, about 3.8 million people work for the 394,365 establishments in the potentially affected industries. About 73 percent of these employees are construction workers. The affected sectors differ in terms of the composition of their labor force. For example, construction workers make up 84 percent of employees in the Drywall and Insulation contractor sector. In the Residential Remodelers sector, however, construction workers make up only 65 percent of the labor force (U.S. Census Bureau 2005c)

Table 2-3: Number of Employer Establishments, Total Employees and Employees involved in Construction

NAICS	Description	Total Number of Employees	Number of Construction Workers	Construction Workers as Percent of Total Employees
236118	Residential Remodelers	320,208	207,637	65%
236220	Commercial Building Construction	715,896	478,923	67%
238150	Glass and Glazing Contractors	50,800	34,086	67%
238170	Siding Contractors	43,042	30,284	70%
238210	Electrical Contractors	771,184	606,403	79%
238220	Plumbing and HVAC Contractors	974,368	712,452	73%
238290	Other Building Equipment Contractors	126,559	90,504	72%
238310	Drywall and Insulation Contractors	311,077	261,239	84%
238320	Painting and Wall Covering Contractors	234,562	184,328	79%
238340	Tile and Terrazzo Contractors	60,001	44,729	75%
238350	Finish Carpentry Contractors	179,476	129,888	72%
238390	Other Building Finishing Contractors	50,617	37,353	74%
Total		3,837,790	2,817,826	73%

Sources: U.S. Census Bureau 2005c

2.1.2 Number of Non-Employer Establishments

As mentioned above, the U.S. Economic Census tracks non-employer establishments separately from establishments with employees. Data on the number of non-employer establishments were available from the U.S. Small Business Administration. A non-employer firm "is defined as one that has no paid employees, has annual business receipts of $1,000 or more ($1 or more in the construction industries), and is subject to federal income taxes" (U.S. Small Business Administration 2006a). Essentially, non-employers are self-employed contractors. Because little financial and operational data is available for non-employers, the vast majority of this profile focuses on establishments with employees. This subsection discusses the number of non-employers in the affected industry sectors and the receipts of these establishments.

The U.S. Small Business Administration did not provide data on the number or revenues of non-employer establishments in each of the 6-digit level NAICS industries addressed in this profile. Data on the number of such establishments was available for Plumbing and HVAC contractors (NAICS 238220) and Electrical contractors (NAICS 238210) only; for the remaining industries, data was provided at the more general 4-digit NAICS level. In total, there are nearly 1.2 million self-employed contractors.

To estimate the number of non-employer establishments in each of the 6-digit sectors, it was assumed that the distribution of non-employer establishments in each 4-digit NAICS code is the same as the distribution of establishments with payroll in the same 4-digit group. Similarly, to estimate the revenues

of these establishments, it was assumed that the distribution of receipts in each 4-digit NAICS code is the same as the distribution of revenues of payroll establishments in the same 4-digit industry.

Table 2-4 presents the estimated number and revenues of non-employer establishments in each of the 12 sectors affected by the rule.

Table 2-4: Number and Annual Revenues of Non-Employer Establishments in Affected Sectors

NAICS	Description	Number of Non-Employer Establishments	Revenues of Non-Employer Establishments (000)
236118	Residential Remodelers	194,182	$6,187,917
236220	Commercial Building construction	74,255	$4,784,817
238150	Glass and Glazing contractors	12,723	$720,934
238170	Siding contractors	15,939	$485,112
238210	Electrical contractors	102,219	$3,834,347
238220	Plumbing and HVAC contractors	110,183	$5,920,986
238290	Other Building Equipment contractors	9,710	$356,461
238310	Drywall and Insulation contractors	103,398	$8,798,899
238320	Painting and Wall Covering contractors	205,462	$4,823,217
238340	Tile and Terrazzo contractors	47,220	$1,684,174
238350	Finish Carpentry contractors	185,118	$5,254,955
238390	Other Building Finishing contractors	19,674	$1,396,611

Sources: U.S. Census Bureau 2005h, U.S. Census Bureau 2004q, U.S. Census Bureau 2005i

2.1.3 Financial Profile

In this section, Census data is used to examine key financial indicators for the renovation industry. The indicators include net value of construction (value of construction less value of construction subcontracted out to others) and labor costs. Net value of construction work is used instead of the total value of construction work because it is a measure of the work actually performed by the establishment. Table 2-5 presents the average per establishment net value of construction work (NVCW) for each industry sector. The table also presents labor costs as a percent of the net value of construction for each of the affected NAICS codes.

Table 2-5: Financial Summary for Contractor Sectors Affected by the rule

2002 NAICS code	Industry Name	Annual Net Value of Construction Work (000)	Number of Establishments	Net Value of Construction Work per Establishment (000)	Total Payroll (000)	Payroll as % of Net Values of Construction Work
236118	Residential Remodelers	$30,627,850	82,750	$370	$8,703,503	28
236220	Commercial Building construction	$108,229,283	37,208	$2,909	$29,210,092	27
238150	Glass and Glazing contractors	$6,016,766	5,294	$1,137	$1,764,314	29
238170	Siding contractors	$3,810,070	6,632	$574	$1,185,348	31
238210	Electrical contractors	$77,671,846	62,586	$1,241	$29,324,486	38
238220	Plumbing and HVAC contractors	$105,323,163	87,501	$1,204	$35,942,262	34
238290	Other Building Equipment contractors	$13,680,062	6,087	$2,247	$4,940,641	36
238310	Drywall and Insulation contractors	$27,046,301	19,598	$1,380	$9,766,997	36
238320	Painting and wall covering contractors	$15,316,726	38,943	$393	$6,005,447	39
238340	Tile and Terrazzo contractors	$5,639,641	8,950	$630	$1,834,890	33
238350	Finish Carpentry contractors	$15,640,544	35,087	$446	$4,711,739	30
238390	Other Building Finishing contractors	$4,560,138	3,729	$1,223	$1,719,039	38
	Total, all industries	**$407,922,749**	**394,365**	**$1,034**	**$135,108,758**	**33**

Source: U.S. Census Bureau 2005c

Table 2-5 shows the wide range of values of construction work per establishment across all NAICS codes of interest. The average establishment in the Residential Remodeler industry (NAICS 236118) has the smallest net value of construction work ($370,000), followed by the Finish Carpentry contractors industry ($446,000). Meanwhile, the average establishment in the Commercial Building Construction industry (NAICS 236220) has the largest net value of construction value ($2,909,000), with the Other Building Equipment contractors industry netting the second largest value ($2,247,000). It should come as no surprise that the Commercial Building Construction industry's net value of construction is so much larger than the Residential Remodeler industry's net value of construction work given that commercial building construction projects tend to be substantially larger in scope and size than residential remodeling projects.

As demonstrated in Table 2-5, while labor constitutes about 33% of net value of construction for all the industry sectors, the composition varies across industry sectors. The Painting and Wall Covering contractor (NAICS 238220) industry is most dependent on labor, with an overall labor cost to net value of construction ratio of 39 percent. The Commercial Building Construction industry, with an overall labor cost to net value of construction work ratio of 27 percent, is the least dependent of the 12 sectors (U.S. Census Bureau 2005c). It is worth mentioning that labor (as measured by payroll) is a relatively small percentage (27% to 39%) of total net value, reflecting the fact that a large percent of revenues go to covering the cost of materials and profit.

2.1.3.1 Establishment Size by Revenue Bracket

The Small Business Administration (SBA) defines a small business in both the Residential Remodeler and Commercial Building Construction industries as one that has revenues of $33.5 million dollars a year or less. The small business definition for the ten specialty contractor industries is $14 million per year (U.S. Small Business Administration 2008). The SBA size standards apply to firms rather than establishments; at the time the analysis was performed, revenue data in the 2002 Economic Census was only available at the establishment level. Since a firm may consist of one establishment, a few establishments or even a very large number of establishments, by using establishment rather than firm data, this analysis overestimates the number of small businesses in the affected industry.

The remainder of this section examines the number of establishments, number of employees, net value of construction work and value of business done[2] distributed by establishment revenue bracket. These data were available from the 2002 Economic Census at the NAICS code level only. Establishments were classified into two revenue categories based on the total value of business done – those with revenues less that $10 million and those with revenues greater than $10 million. Because the Census groups all establishments with revenues of $10 million or more into one revenue bracket, it is not possible to determine what percentage of Residential Remodeler nor Commercial Building Construction establishments have revenues of less than $33.5 million. Note, however, that nearly 100 percent of Residential Remodeler establishments have revenues of less than $10 million per year. The same cannot be said for Commercial Building Construction establishments, as 12 percent have revenues greater than $10 million per year. The percent of establishments, employees and net value of construction contributed by establishments in each revenue bracket is presented in Table 2-6.

[2] Value of business done is defined by the U.S. Census Bureau as including "the sum of value of construction work and other business receipts. Value of business done is the sum of receipts, billings, or sales from establishments of construction business activities plus receipts from other business activities" (U.S. Census Bureau 2004d).

Table 2-6: Small and Large Establishments as Percent of Industry

NAICS	NAICS	Percent of Establishments	Percent of Employees	Percent of Net Value of Construction	Percent of Value of Business done
236118	**Residential Remodelers**				
236118	Revenues < $10 million	100%	95%	92%	91%
236118	Revenues > $10 million	0%	5%	8%	9%
236220	**Commercial Building Contractors**				
236220	Revenues < $10 million	88%	41%	30%	24%
236220	Revenues > $10 million	12%	59%	70%	76%
238150	**Glass and Glazing Contractors**				
238150	Revenues < $10 million	98%	82%	77%	77%
238150	Revenues > $10 million	2%	18%	23%	23%
238170	**Siding Contractors**				
238170	Revenues < $10 million	100%	90%	88%	87%
238170	Revenues > $10 million	0%	10%	12%	13%
238210	**Electrical Contractors**				
238210	Revenues < $10 million	98%	68%	61%	60%
238210	Revenues > $10 million	2%	32%	39%	40%
238220	**Plumbing and HVAC Contractors**				
238220	Revenues < $10 million	98%	70%	63%	61%
238220	Revenues > $10 million	2%	30%	37%	39%
238290	**Other Building Equipment Contractors**				
238290	Revenues < $10 million	95%	60%	55%	55%
238290	Revenues > $10 million	5%	40%	45%	45%
238310	**Drywall and Insulation Contractors**				
238310	Revenues < $10 million	97%	64%	60%	60%
238310	Revenues > $10 million	3%	36%	40%	40%
238320	**Painting and Wall Covering Contractors**				
238320	Revenues < $10 million	100%	92%	88%	88%
238320	Revenues > $10 million	0%	8%	12%	12%
238340	**Tile and Terazzo Contractors**				
238340	Revenues < $10 million	100%	91%	86%	86%
238340	Revenues > $10 million	0%	9%	14%	14%
238350	**Finish Carpentry Contractors**				
238350	Revenues < $10 million	100%	86%	84%	83%
238350	Revenues > $10 million	0%	14%	16%	17%
238390	**Other Building Finishing Contractors**				
238390	Revenues < $10 million	98%	81%	74%	74%
238390	Revenues > $10 million	2%	19%	26%	26%
	Total				
Total	Revenues < $10 million	98%	69%	58%	50%
Total	Revenues > $10 million	2%	31%	42%	50%

100 percent = establishments in this revenue category make up over 99.5 percent, but less than 100 percent of establishments in the industry.

Source: U.S. Census Bureau 2004c,d,e,f,g,h,i,j,k,l,m; U.S. Census Bureau 2005m

The distribution of the number of establishments for all twelve NAICS codes is greatly skewed toward smaller establishments. In five out of twelve industry sectors, over 99.5 percent of establishments have revenues below $10 million. For the remaining sectors, establishments with revenues greater than $10

million make up less than 5 percent of establishments in any sector (with the exception of the Commercial Building Construction industry where 12% of establishments earn more than $10 million in revenues[3]). Thus, about 98 percent of all establishments in the affected industries have revenues well below the SBA definition of small business.

Establishments with revenues of less than $10 million account for between 41 and 95 percent of total employment for each sector, and about 69 percent of employment overall. The distribution of the net value of construction work and the total value of business done is skewed toward smaller establishments in a manner similar to the distribution of employees. Establishments with revenues of less than $10 million account for between 30 and 92 percent of the net value of construction work and between 24 and 91 percent of the total value of business done in each sector. It is worth mentioning that if the Commercial Building Construction industry is removed, the lows in the previously cited categories jump to 55 percent. Overall (across all industry sectors) small businesses contribute about 58 percent of the net value of construction work and 50% of the total value of business (U.S. Census Bureau 2004c,d,e,f,g,h,i,j,k,l,m; U.S. Census Bureau 2005m).

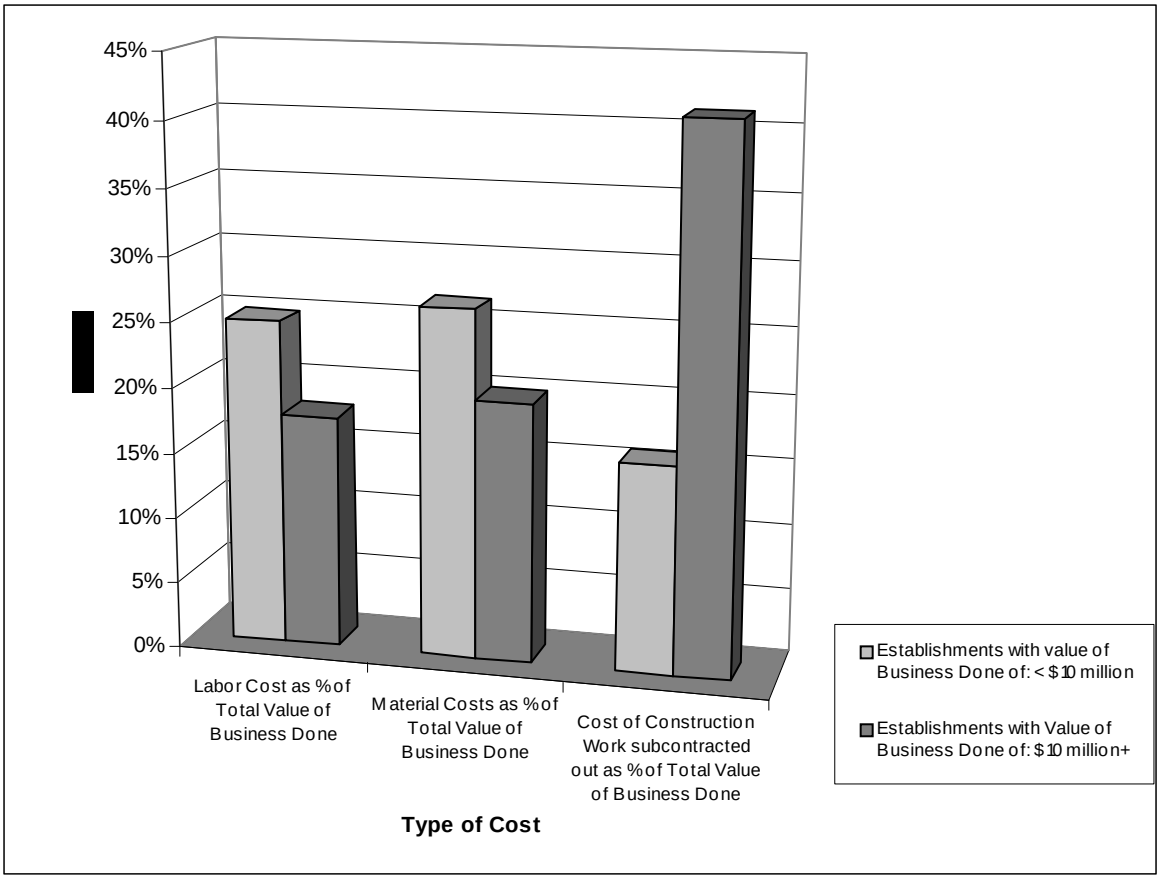
2.1.3.2 Labor and Material Costs as a Percentage of Total Value of Business Done

In order to better understand the potential impacts of the rule on the affected industries, and particularly on small businesses, it is important to observe whether establishment costs as a percentage of the total establishments' total revenues differ for small and large establishments. Figure 2-1 examines labor and material costs, as well as the cost of construction work subcontracted out as a percentage of the total value of business done for the twelve affected sectors. While the rule will increase the cost of material slightly, the major impact will be on labor costs, including the training of staff. Each of the sectors was broken down into two size categories by revenue bracket: less than $10 million and $10 million and more. The cost of labor, of materials, and of construction work subcontracted out was summed across the 12 industry sectors for large and for small establishments. These values were then compared to their total value of business.

Labor costs, material costs, and the cost of construction work subcontracted out as a percentage of total value of business done are presented in Figure 2-1. Regardless of size of establishments, material costs tend to be a slightly larger percentage of total revenues than do labor costs. Labor costs make up about 25 percent of revenues for small establishments and about 16 percent for large establishments. Based on Census data, large establishments subcontract out a much larger percentage of their work than do small businesses.

[3] Once again, this difference arises because of the larger size of a majority of Commercial building construction projects. Regardless, if only 12% earn revenues greater than $10 million, it can easily be assumed that a much smaller percentage of establishments in this industry earn revenues greater than the SBA cutoff of $33.5 million.

Figure 2-1: Labor and Material Costs as % of Total Value of Business Done



Source: U.S. Census Bureau 2005a

2.2 Child Care and Schools: Child Occupied Facilities

For the purposes of analysis, COFs are divided into the following categories[4]:

- **Kindergartens and Pre-Kindergartens in Schools:** Located in public and private schools;
- **Daycare centers:** Organized (licensed) facilities located in public and commercial buildings;
- **Family daycare:** Organized (licensed) daycare facilities located in the provider's home; and
- **Informal daycare:** Informal (i.e. not licensed) day care providers, including relatives and non-relatives. Some of these providers may be paid for their services.

There is a great deal of diversity and complexity in the childcare industry. The formal childcare sector consists primarily of two types of facilities – center-based care and family daycare. Daycare centers are typically located in commercial or educational buildings, including schools and university campuses. They include private for-profit and non-profit facilities that can operate as independent centers or as part of chains. For-profit facilities can be found in office buildings, factories, other workplace settings, or in stand-alone facilities. Non-profit facilities may be found in YMCAs or other community centers, churches, college and university campuses, as well as in office or stand-alone buildings. Government

[4] The analysis is limited to kindergartens, pre-schools, daycare centers, family daycare, and informal daycare. Due to a lack of data, it does not include other facilities that may qualify as COFs under the rule.

education and human services agencies also provide daycare through programs such as Head Start, as well as through kindergarten and pre-kindergarten programs at local schools.

Unlike center-based care, family daycare is typically offered in the home of the caregiver. Family daycare facilities tend to serve smaller groups of children and have a smaller child-to-caregiver ratio (KeepKidsHealthy 2001). In addition to formal care provided by daycare centers, schools, and family daycare, children may also be cared for informally by relatives, family friends, or other acquaintances. Informal care may be paid or unpaid, and usually takes place at the home of either the child or the provider.

Table 2-7 summarizes the types and numbers of facilities and childcare providers in this universe, grouping them by the age of their construction. It shows that the rule would apply to 1,656,000 child-occupied facilities, of which 1,559,000 are in target housing.

Table 2-7: Total Number of Childcare Facilities in the United States, Number of Child-Occupied Facilities Potentially Affected by the Rule

Type	Total Childcare Facilities in the United States[a]	Number by Date of Construction[b,c,]	
		All Pre-1978	All Pre-1960
(1) Schools with pre-kindergartens and/or kindergartens	79,000	46,000	25,000
(2) Pre-schools and daycare centers located outside of schools	88,000	51,000	28,000
(3) Childcare in target housing	2,398,000	1,559,000	823,000
Total	**2,565,000**	**1,656,000**	**876,000**

a. The Total Childcare Facilities in the United States count includes facilities constructed both before and after 1978. Facilities constructed after 1978 are not regulated under the rule.
b. Not all facilities in the table have lead-based paint.
c. The number of facilities by date of construction is inclusive (pre-1960 is a subset of pre-1978).

Sources: Center for the Childcare Workforce and Human Services Policy Center 2002; U.S. Bureau of Labor Statistics 2006; U.S. Department of Education 2004; U.S. Department of Energy 2003; Wilder Research Center 2001, Wilder Research Center 2005.

2.2.1 Daycare Centers and Family Daycare

Establishments involved in the provision of day care of infants or children are classified under NAICS 624410 – Child Day Care Services. This industry covers child day care centers (including those located in the provider's home), pre-school centers, nursery schools and pre-kindergarten centers (except as part of elementary schools). In 2002, Census reported that this industry included over 55,000 firms that employed nearly 752,000 people (U.S. Census Bureau 2005d). Furthermore, Census reports 618,947 non-employers in the industry (U.S. Census Bureau 2005k).

While Census covers both family and center-based childcare under NAICS 624410, there is reason to believe that Census undercounts the number of employer firms in this industry. This is likely to occur for two reasons. First, it is likely that the number of firms reported by Census primarily includes centers, since care provided solely by one person (as occurs at many family daycare establishments) would be classified under non-employer statistics. Second, Census classifies a business into NAICS 624410 if its primary line of business is the provision of child day care services; it is likely that many facilities have alternate primary lines of business (YMCAs and churches, for example). The number of non-employers, on the other hand, is likely to include care providers such as nannies or babysitters that do not constitute formal care, but that cannot be disentangled from the total count.

In light of the limitations of the Census data, an alternative data source is used for this analysis. In 2005, the National Association for Regulatory Administration (NARA) in conjunction with the National Childcare Information Center (NCCIC) conducted a study on the number and licensed capacity of daycare centers and family daycare establishments in the 50 U.S. states. Based on these data, there are approximately 115,000 licensed daycare centers in the United States. Because licensing requirements differ from state to state, this count includes 105,444 facilities licensed as daycare centers, as well as about 10,000 facilities such as Head Start, religious daycare, and other similar establishments, which are required to obtain a license in some states, but must only be registered or certified in others.

According to the Department of Housing and Urban Development's (HUD) *First National Health Survey of Childcare Centers*, about 22 percent of licensed daycare centers are located in elementary schools. Since throughout this analysis, schools are analyzed separately from daycare centers, the number of daycare centers was reduced by 22 percent, bringing the total number of centers to 89,260. According to NCES data on public and private schools, however, an additional 1,421 schools without kindergartens have a pre-kindergarten program (See Section 2.2.2.1). These 1,421 centers are also excluded from the total center counts to avoid double-counting, bringing the number of centers to 87,840.

In addition to the 115,000 centers, NARA reported a total of 166,514 licensed small family childcare homes and 47,452 large family childcare homes.[5] With the addition of about 16,000 family daycare homes that are reported as certified, not licensed, NARA reports a total of 229,875 family daycare facilities.

Because some states either completely exempt family daycare with fewer than a certain number of students from licensing requirements, or offer voluntary registration, the family daycare numbers reported by NARA are likely to underestimate the total family daycare universe. As such, to estimate the number of family daycares, this analysis relied on a 2002 report by the Center for the Childcare Workforce, which provides data on family childcare providers caring for unrelated children in their own homes. Based on these data, it is estimated that there are a total of 591,071 family daycare facilities in the United States. Table 2-8 summarizes the size of the formal (center and family daycare) childcare universe.

[5] Here large and small refer to the number of children enrolled. It is not the same as the large and small definitions used by SBA.

Table 2-8: Number of Daycare Centers and Family Daycare Facilities in the United States		
	Daycare Centers (excluding schools)	**Total Family Daycare**
Number of facilities	87,840	591,071
Sources: NARA 2006; Center for Childcare Workforce 2002		

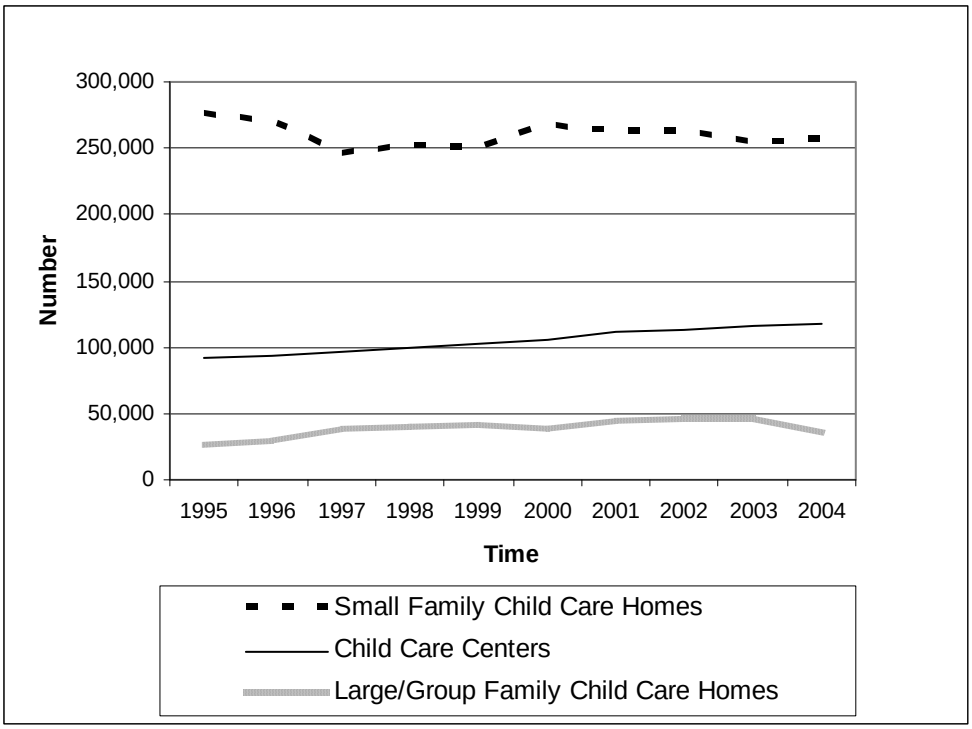
2.2.1.1 Daycare Center and Family Daycare Outlook

Figure 2-2 plots changes in the numbers of licensed child-occupied facilities between 1995 and 2004 using information compiled from the Childcare Licensing Studies published annually by the Children's Foundation and the National Association for Regulatory Administration (NARA).[6] These data give larger counts than the data above because they include facilities in Puerto Rico, Guam and the Virgin Islands.[7] But the trends displayed in this data are likely to be present in the smaller data set. The number of licensed Childcare Centers has grown gradually over time, from 92,000 in 1995 to 120,000 facilities in 2004. The number of Large/Group Family Childcare Homes grew in a similar manner, before tapering off in 2004. Over the time period specified, the number of Small Family Childcare Homes declined from 276,000 to 256,000, while exhibiting much more variation from year to year than the other two categories. Here, as noted earlier, large and small refer to the number of children enrolled, not the SBA definition of a large or small entity.

[6] When the Children's Foundation closed in 2005, NARA assumed sole responsibility for collecting licensing information through the annual study. However, because the methodology was altered with the new leadership, data from the 2005 Childcare Licensing Study were not included into Figure 2-2.

[7] While the rule would apply to Puerto Rico, Guam and the Virgin Islands, they are not included in this analysis for reasons of consistency since some of the major data sources used elsewhere in the analysis were limited to the 50 states and the District of Columbia. Holding all other things equal, by not including COFs in Puerto Rico, Guam, and the Virgin Islands, the analysis underestimates the costs and benefits of the rule.

Figure 2-2: Number of Licensed Child-Occupied Facilities: 1995-2004



Sources: National Childcare Information Center 2005

The market for lead-safe renovation activities in COFs is dependent on the number of care providing facilities. Figure 2-2 indicates that while there have been some fluctuations in the underlying components of the overall market, when considered over the entire time frame, the number of licensed COFs has been relatively stable.

While there wasn't significant growth in childcare over the 1995-2004 timeframe, a study forecasts growth in the demand for childcare labor. Fueling the future demand for childcare services is the expected increase in the amount of children below 5 between 2004 and 2014. Adding to this growing demand will be an increased female labor force participation rate, forcing families to find alternate care options for their children. Furthermore, many states will be implementing their own care programs for 3- and 4- year old children in the coming years. The government also plans to increase subsidies for low-income families attending day care programs (Bureau of Labor Statistics 2005). While trends point to increased demand for childcare labor, it is difficult to assess whether this will be accompanied by an increase in the number of facilities, and to what extent these new facilities will be located in pre-1978 buildings.

2.2.1.2 Informal Daycare

Informal daycare is provided by unlicensed providers, including relatives, friends, and others. Calculations determining the number of informal daycare providers are based on figures and percentages found in a report on the number of paid relatives and non-relatives providing childcare entitled "Estimating the Size Components of the U.S. Childcare Workforce and Caregiving Population: Key Findings from the Childcare Workforce Estimate" (Center for Childcare Work Force 2002).[8]

[8] For a more in-depth discussion of the methodology refer to Section 2 of Chapter 4 of this analysis.

Target Housing COFs

Family daycare and informal daycare take place in target housing. Renovation events in some target housing COFs would be regulated under the 2008 LRRP rule regardless of their status as a COF; for example, if they are owner-occupied units where a child under the age of six or a pregnant woman resides or if they are rental units. For a detailed explanation of the methodology used to estimate the number of target housing COFs, please see Section 4.2 of Chapter 4. Section 2.8 presents the estimated numbers of target housing COFs affected by the rule.

2.2.2 Public and Private Schools

This section describes the number and size of public and private schools with kindergartens and pre-kindergartens.

2.2.2.1 Number of Schools

According to the National Center for Education Statistics, during the 2004-2005 academic year, there were 93,295 public schools with students in the United States. In total, these schools served 48.8 million students (NCES 2006a). The rule will apply only to those portions of schools that meet the COF definition. Thus, the rule is expected to primarily impact schools that have kindergarten or pre-kindergarten programs. According to the NCES's Public Elementary and Secondary School Universe Survey, which collects data on all operational public schools in the United States, in 2004-2005, 52,129 of the 93,295 U.S. public schools (roughly 56 percent) provided either pre-kindergarten or kindergarten services.[9] Of these 52,129 schools, 20,885 offered both pre-kindergarten and kindergarten and 29,884 schools provided kindergarten services only. Only 1,400 schools offered pre-kindergarten, but not kindergarten services; this group of schools includes standalone preschools operated by local school boards, as well as daycare centers located in public middle schools, high schools, and ungraded schools (See Table 2-9). Note that these figures are not limited to schools with pre-1978 buildings.

Table 2-9: Number of Public Schools, by Type

Type of Public School	Number of Schools
Total number of public elementary and secondary schools	93,295
Number of schools with pre-kindergartens and kindergartens	20,885
Number of schools with pre-kindergartens but no kindergartens	1,400
Number of schools with kindergartens, but no pre-kindergartens	29,844
Total number of schools with pre-kindergartens	***22,285***
Total number of schools with kindergartens	***50,729***
Total number of schools with pre-kindergartens or kindergartens	**52,129**
Source: NCES 2006a,b	

As shown in Table 2-10, in 2004-2005 a total of 990,421 pre-kindergartners and 3,543,554 kindergartners were enrolled in pre-kindergartens and kindergartens offered at public schools, respectively. Given the number of programs described above, this means that there are roughly 44 pre-kindergarten students per school and 70 kindergarten students per school.

[9] A school was considered as having a pre-kindergarten if a) pre-kindergarten enrollment was greater than zero students, or b) the school reported that the lowest grade offered was pre-kindergarten, but enrollment data were not provided. Similarly, a school was considered as having a kindergarten if a) kindergarten enrollment was greater than zero, or b) the school reported that the lowest grade offered was pre-kindergarten or kindergarten, but did not report kindergarten enrollment.

Table 2-10: Enrollment in Public Pre-kindergarten and Kindergarten Program Statistics			
	Number of Schools offering program	**Number of Students Served**	**Average Students Served per School**
Pre-kindergartens in public schools	22,285	990,421	44
Kindergartens in public schools	50,729	3,543,554	70
Source: NCES 2006a,b			

Number of Public School Districts

Public schools in the United States are operated by local education agencies (LEAs), organizations "responsible for providing free public elementary/secondary instruction or education support services." The National Center for Education Statistics collects data on LEAs through its Common Core of Data (CCD) fiscal and non-fiscal surveys. NCES designed the Common Core of Data system to "accommodate the many and varied organizational structures used in the provision of public elementary and secondary education." As such the CCD contains records that represent "administrative and operating units that are unlike typical public schools and school districts – for example, regional administrative service centers without students."

According to the CCD Local Education Agency Universe Survey, in 2004-2005, 17,647 LEAs operated in the 50 contiguous states and the District of Columbia. Of these 17,647 agencies, 14,473 operated at least one school that offered pre-kindergarten or kindergarten services and may thus be affected by the rule.

Of the 14,473 local education agencies responsible for schools with pre-kindergarten and kindergarten programs, just under 13,200 are typical public school districts (usually county or town agencies responsible for providing education services in that location). An additional 949 agencies are charter school organizations. The remaining 333 agencies represent regional, state, and federal institutions, as well as supervisory union administrative centers.[10] Table 2-11 presents a detailed breakdown of the number of education agencies by agency type, as well as counts of schools with pre-kindergartens and/or kindergartens operated by each agency.

[10] Supervisory union administrative centers operate schools only in Massachusetts, Vermont, and Virginia.

Table 2-11: Number of Local Education Agencies Operating Schools with Kindergartens or Pre-Kindergartens, by Agency Type

Type of Local Education Agency	Number of Agencies	Number of Schools with Pre-K or Kindergarten Programs	Average Number of Pre-K or K Schools
Local School District	13,191	50,386	3.8
Supervisory Union Administrative Office	85	159	1.9
Regional Education Services Agency	167	308	1.8
State Institution	54	75	1.4
Federal Institution	27	188	7.0
Other Agency (Primarily Charter Schools)	949	1,013	1.1
Total	14,473	52,129	3.6

Source: NCES 2006b,c

The NCES collects data on the revenues and expenditures of local education agencies through its CCD School District Finance Survey. Table 2-12 presents the total revenues, average revenues, and percent revenues derived from federal, state, and local funds for education agencies operating schools with pre-kindergarten and/or or kindergarten programs. All figures are based only on agencies with available data; for each agency type, the table indicates the percent of LEAs represented in the totals. Note that financial data were not available for any federal institutions, nor for most state institutions.

Table 2-12: Total Revenues, Average Revenues and Percent of Revenues by Source for Local Education Agencies Operating with Pre-Kindergarten and/or Kindergarten Programs

		Revenues		Percent of Revenues by Revenue Source		
	% LEAs with Data	Total Revenues, (Millions of $)	Average LEA Revenues ($)	Federal	State	Local
Local School District	99%	$440,444	$33,560,173	8%	47%	45%
Supervisory Union Administrative Office	91%	$1,269	$16,481,935	8%	41%	52%
Regional Education Services Agency	95%	$7,612	$48,180,367	24%	35%	41%
State Institution	7%	$8	$2,115,250	12%	54%	34%
Federal Institution	0%	n.a.	n.a	n.a	n.a	n.a
Other Agency (Primarily charter schools)	81%	$2,074	$2,683,282	11%	68%	21%
All LEAs	***98%***	***$451,408***	***$31,933,217***	***9%***	***46%***	***45%***

Source: NCES 2006b,c,d

Table 2-13 presents the total and average expenditures of local education agencies. Total expenditures are composed of total current expenditures for elementary/secondary education, as well as other expenditures. Elementary/secondary education current expenditures include expenditures for instruction (e.g. teacher salaries), support services (including, but not limited to, administrative, maintenance, and operations costs), and other expenses, such as transportation and food services. Other expenditures include spending not related to elementary/secondary education, such as expenditures for community service, or adult education, capital outlay expenditures, payments to other government and educational entities, and debt interest payments. In Table 2-13 current expenditures are split out by type, while the remainder (capital and non-educational) are combined and labeled as "all other" expenditures.

Table 2-13: Total Expenses, Average Expenses, and Percent of Expenditures by Expenditure Type for Local Education Agencies

		Expenses		Percent of Expenditures by Expenditure Type			
	% LEAs with Data	Total Expenses (in Millions of $)	Average Expenses	Instruc.	Support Service	Other Current	All Other
Local School District	99%	$451,464	$34,399,846	52%	28%	3%	17%
Supervisory Union Administrative Office	91%	$1,203	$15,628,805	57%	32%	3%	8%
Regional Education Services Agency	95%	$7,154	$45,278,905	28%	33%	1%	38%
State Institution	7%	$7	$1,759,000	49%	39%	0%	11%
Federal Institution	0%	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Other Agency (Primarily charter schools)	81%	$2,023	$2,616,922	47%	41%	3%	9%
All LEAs	98%	$461,851	$32,671,971	51%	29%	3%	17%

Sources: NCES 2006b,c,d

For most LEAs, the majority of expenditures (51 percent on average, across all LEAs) are spent on instruction. In aggregate, the category containing maintenance costs (i.e. support service) makes up around one-third of all expenditures. Lastly, the "all other" expenditures category makes up a significant percentage of the expenditures for regional education services agencies.

Under the Regulatory Flexibility Act, public school districts are considered large if they serve a population of more than 50,000. Table 2-14 presents the number of LEAs that operate schools that have pre-kindergartens and/or kindergartens, by agency type and the size of the population served.

Table 2-14: Local Education Agencies that operate schools with Kindergartens and/or Pre-Kindergartens, by Agency Type and Size of Population Served

Type of Local Education Agency	Total Number of LEAs with Pre-K or K Programs	Number of LEAs Serving < 50,000[a]	Small LEAs as % of all LEAs with Pre-K or K Programs
Local School District	13,191	12,130	92%
Supervisory Union Administrative Office	85	84	99%
Regional Education Services Agency	167	167	100%
State Institution	54	0 [b]	0%
Federal Institution	27	0 [b]	0%
Other Agency (Primarily charter schools)	949	949	100%
All LEAs	14,473	13,330	92%

a. Local districts, supervisory union offices, regional education agencies and charter school districts for which no population data were available were assumed to serve a population of fewer than 50,000.

b. Assumes that all state and federal agencies are large.

Source: NCES 2006b,c,e,g

Private schools

In 2003-2004, the National Center for Education Statistics conducted a survey of private schools in the United States. NCES's Characteristics of Private Schools in the United States: Results From the 2003-2004 Private School Universe Survey (2006) presents a summary of survey results, including numbers of schools currently in operation, the number of students enrolled, and teachers employed. Table 2-15 presents summary statistics on national private schools, including a total count of all private schools, enrollment and teachers, as presented in NCES's report.

Table 2-15: Enrollment and Teacher Statistics for Private Schools

Entity	Number of Schools	Total Enrollment	Total Teachers	Average Enrollment	Average Teachers
Private Schools	34,681	5,212,992	441,384	150.3	12.7

Sources: NCES 2006e

According to the NCES data, in 2003-2004 there were 34,681 private schools in the U.S., enrolling a total of just over 5.2 million students, with a total teaching staff of over 441,000. On average, there were 150 students enrolled in a private school and 13 teachers per school. These figures must be interpreted with caution however, since they encompass elementary schools, secondary schools, etc. which, by definition, include different numbers of classes.

While the NCES report provides some data on the number of private schools by grade level, it does not provide data on grades offered by each individual school in the survey. In order to identify schools with kindergartens only, pre-kindergartens and kindergartens, and pre-kindergartens only, this analysis relied on the Excel database underlying NCES's 2003-2004 report. This database, which contains records for 29,907 of the estimated 34,461 private schools in the United States, specifies the highest and lowest grade offered at each school, as well as the number of students enrolled in each grade. The database, however, does not include sampling weights used to adjust some of the survey results to generate final numbers presented in NCES's report. In order to most accurately estimate the number of schools offering each combination of kindergarten or pre-kindergarten programs, as well as the number of children enrolled in these programs, this analysis:

- used the underlying database to identify schools with pre-kindergartens only, kindergartens only, and both kindergartens and pre-kindergartens, then
- inflated these counts to account for the 4,500 schools that were not included in the database. The numbers of schools offering each combination of programs was inflated using the ratio of the number of schools presented in the published report to the number of schools included in the database. Similarly, the number of children in each school setting, estimated based on the underlying data, was adjusted using the ratio of the number of kindergartners presented in the published report to the number of kindergartners reported in the database.[11]

Table 2-16 breaks down the totals from the previous table to provide a count of the number of private schools with pre-kindergartens and/or kindergartens.

Table 2-16: Number of Private Schools, by Type

Type of Private School	Number of schools
Total number of private elementary and secondary schools	34,681
Number of schools with pre-kindergartens and kindergartens	19,305
Number of schools with pre-kindergartens and no kindergartens	21
Number of schools with kindergartens but no pre-kindergartens	7,205
Total number of schools with pre-kindergartens	19,326
Total number of schools with kindergartens	26,510
Total number of schools with pre-kindergartens or kindergartens	26,531
Source: NCES 2006e	

Of the 34,681 private schools counted in the 2003-2004 survey, 26,531 provided either pre-kindergarten or kindergarten services.[12] Furthermore, of these 26,531 private schools, 19,305 provided both pre-kindergarten and kindergarten services. Only 21 private schools provided pre-kindergarten but not

[11] In its report, NCES tracks schools where kindergarten is the highest grade offered separately from regular elementary, middle and high schools. As such, when inflating counts obtained from underlying data, the analysis calculated two sets of ratios for the numbers of schools and numbers of children enrolled – one for regular, and another for kindergarten-terminal schools.

[12] A private school was identified as having a pre-kindergarten or kindergarten in the same fashion as a public school was in Section 2.2.1.

kindergarten services[13]; while 7,205 private schools offered kindergarten but not pre-kindergarten services. Note that these figures are not limited to schools in pre-1978 buildings.

Table 2-17 presents a count of the number of pre-kindergarten and kindergarten students served in private schools, as well as the average number of students served per school.

Table 2-17: Total Number and Average Kindergarten and Pre-Kindergarten Students Served Per School

	Number of Schools offering Program	Number of Students Served	Average Students Served per School
Pre-kindergartens in private schools	19,326	863,542	45
Kindergartens in private schools	26,510	555,531	21

Source: NCES 2006e

According to Table 2-17, there are 26,510 private schools with kindergartens, enrolling a total of 555,531 kindergarteners. Also, there are 19,326 private schools with pre-kindergartens, enrolling 863,542 pre-kindergarten students. The average number of private pre-kindergarten students per school (45) is more than double the average number of kindergarten students (21). Whereas public schools displayed nearly the opposite ratio with on average 44 pre-kindergarten students and 70 kindergarten students per school.

Non-profit organizations, including private schools, are defined as small under the Regulatory Flexibility Act if they are independently owned and operated and not dominant in their field. While determining whether a school meets this definition is difficult, it is useful to present some statistics describing the size distribution of private schools. Table 2-18 shows the distribution of private schools by the number of students they serve. This represents the total number of students served, and not just the number of kindergarten and pre-kindergarten students.

Table 2-18: Schools with Kindergarten or Pre-Kindergarten programs, by Number of Students in the School

	Number of Students Served									
	<100		**100-499[a]**		**500-999**		**1000-1499**		**>1500**	
	Total	%	Total	%	Total	%	Total	%	Total	%
Number of Private School	10,862	41%	13,951	53%	1,519	6%	161	1%	38	0%

Note: schools that did not report the total number of students were considered as having less than 100 student

a. Includes all schools with missing total student data. These schools are assumed to have student enrollment equal to the average school with over 100 students, or 285.

Source: NCES 2006e

The distribution of private schools in the U.S. is heavily skewed toward smaller schools, with 94% of private schools serving less than 500 students and 99% of private schools serving less than 1000 students.

[13] Beginning in 1995, the definition of school employed by the Private School Survey was expanded to include schools whose highest grade was kindergarten. Therefore, these statistics are likely to include some pre-kindergartens that are more likely also classified as preschools in other sources (NCES 2006e). Later sections explain how the calculations avoid double-counting. However, because this is a small figure, it is almost negligible.

However, these data do not indicate whether the schools are affiliated with or part of a larger organization.

2.3 Nonresidential Commercial Property Owners and Managers

Nonresidential commercial property owners and managers will be affected by the rule if they rent space to daycare facilities or other COFs in buildings constructed prior to 1978. The number and size of firms in this industry is described below.

2.3.1 Industry Definitions and Characteristics

Firms involved in the leasing of nonresidential buildings (except Miniwarehouses) are classified under NAICS 531120 – Lessors of nonresidential buildings (except Miniwarehouses). In 2002, this industry included 28,426 firms that employed 154,725 people (U.S. Census Bureau 2005b).

Firms involved in the management of non-residential properties are classified under NAICS 531312 – Nonresidential property managers. In 2002, this industry included 10,506 firms that employed 125,616 people (U.S. Census Bureau 2005b).[14] Table 2-19 includes only firms with employees. The U.S. Census Bureau does not differentiate between self-employed individuals that lease or manage commercial real estate as opposed to residential buildings. This analysis assumes that non-employers primarily lease residential buildings, rather than commercial property. As such, non-employer establishments are not included in this profile, or in the remainder of the analysis.

Table 2-19: Summary Statistics for NAICS 531120 and NAICS 531312

NAICS Code and Description	Firms	Annual Revenues (000)	Annual Payroll (000)	Employees
531120 - Lessors of nonresidential buildings (except miniwarehouses)	28,426	$51,778,431	$5,384,512	154,725
531312 - Nonresidential property managers	10,506	$12,297,703	$5,521,674	125,616
Total	38,932	$64,076,134	$10,906,186	280,341
Sources: U.S. Census Bureau 2005j				

The 2008 LRRP rule economic analysis (EPA 2008) indicated that a total of 17,705 daycare centers rent space in pre-1978 buildings. Because daycare centers are only one of many types of establishments renting non-residential space, and because the rule applies only to centers in buildings constructed prior to 1978, the analysis also assumes that each property manager or lessor firm owns only one regulated building. As such, the number of affected lessor/manager firms is equivalent to the number of daycare centers renting space, or 17,705.

2.3.2 Establishment Size and Industry Environment

The U.S. Small Business Administration indicates that to qualify for small business status, a firm in NAICS 531120 must have revenues of less than $7 million, while firms in NAICS 531312 must have revenues of less than $2 million (U.S. Small Business Administration 2008). Average revenues in these NAICS codes are significantly below the small business designation threshold (Table 2-20).

[14] Firms involved in the leasing and/or management of residential buildings are already covered under the residential lead RRP rule.

Table 2-20: Summary Statistics for NAICS 531120 and NAICS 531312 (Per Firm)			
NAICS Code and Description	**Average Annual Revenues ($)**	**Average Annual Payroll ($)**	**Paid Employees Per Firm**
531120 - Lessors of nonresidential buildings (except miniwarehouses)	$1,821,517	$189,422	5.4
531312 - Nonresidential property managers	$1,170,541	$525,573	12.0
Sources: U.S. Census 2005j			

Census data are not specific enough to report revenues at either the $7 million dollar or $2 million dollar cutoff; Table 2-21 presents the percent of firms in NAICS 531120 and NAICS 531312 that have revenues below $5 million and $1 million respectively. Consequently, the figures in Table 2-21 are all underestimates of the true percentages of firms that qualify as small businesses.

Table 2-21: Small and Large Firms as Percent of Industry				
NAICS Code:	**Description**	**Percent of Firms by Revenue Bracket**	**Percent of Industry Revenues by Revenue Bracket**	**Percent of Industry Employees by Revenue Bracket**
531120	Lessors of nonresidential buildings (except mini-warehouses)			
	Firms with Revenues < $5 million	96%	32%	73%
	Firms with Revenues of $5 million+	4%	68%	27%
531312	Nonresidential property managers			
	Firms with Revenues < $1 million	81%	19%	26%
	Firms with Revenues of $1 million +	19%	81%	74%
Sources: U.S. Census 2005j				

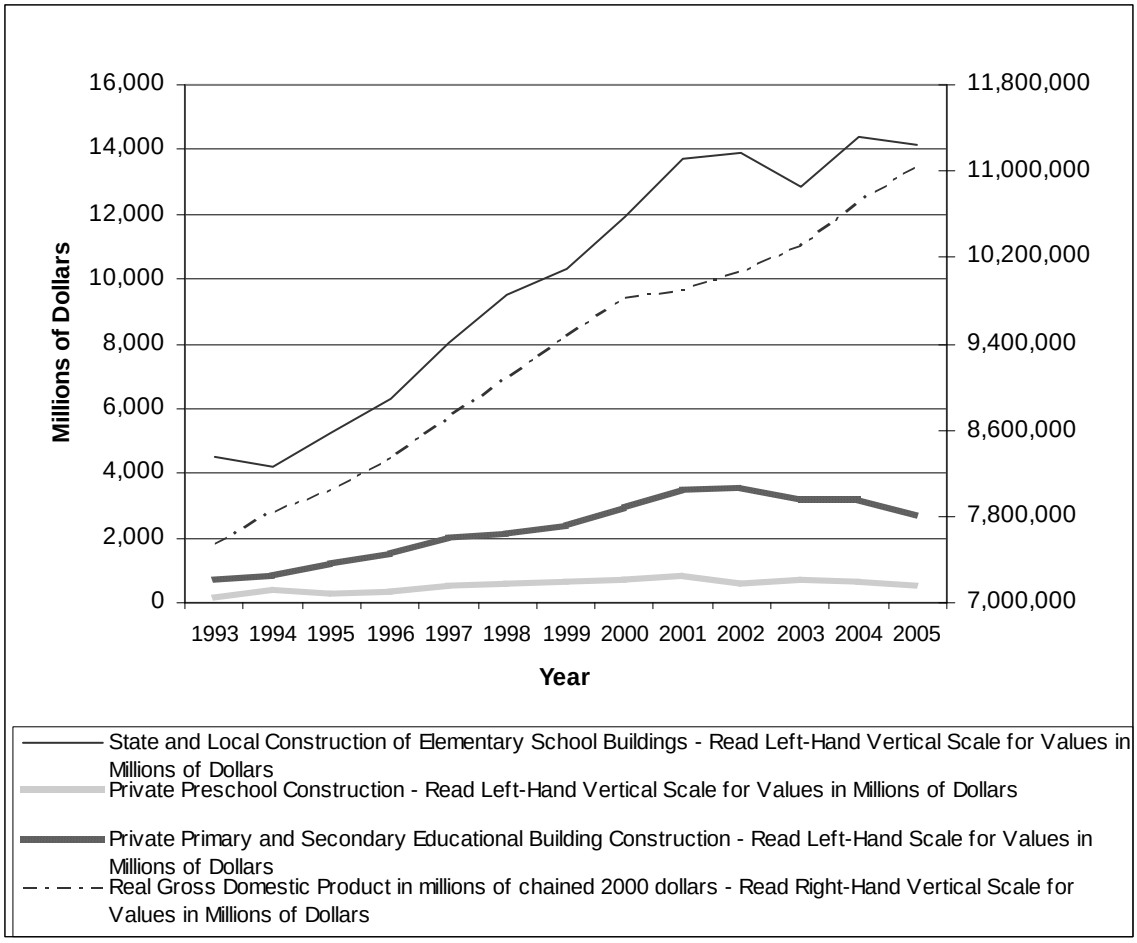
Based on 2002 data, 96 percent of NAICS 531120 firms and 81 percent of NAICS 531312 firms have revenues below $5 million and $1 million, respectively. In the Lessors of Nonresidential Buildings industry, these firms contribute 32 percent of the industry revenues while employing 73 percent of the workforce. The revenue and employment distribution is more skewed in the Nonresidential Property Managers sector. Small firms in this industry contribute only 19 percent of the revenues, while employing only 26 percent of the workforce.

2.4 The Demand for Renovation Services

The demand for renovation is responsive to changes in the overall economic conditions. The same factors that stimulate economic growth, such as low unemployment, high consumer confidence and low interest rates, also stimulate the demand for renovation activities. For both residential and nonresidential building projects, the U.S. Census Bureau tracks information on the "value of construction put in place," a figure composed of some of the variables previously discussed in this chapter such as labor and material costs (while also including other variables such as the contractors profit, the cost of architectural and engineering work, etc). Although the definition of construction includes renovations, alterations, additions, and other improvements, it does not include "maintenance and repairs to existing structures or service facilities" (U.S. Census Bureau 2006d), two components of primary interest to this rule.

Using this Census data, Figure 2-3 illustrates the relationship between the value of construction put in place for private preschools (a term that includes childcare and day-care centers, nurseries, and preschools), state and local elementary school buildings, private primary and secondary educational buildings, and real GDP (U.S. Census Bureau 2006b,c).[15] Both real GDP and the value of state and local construction of elementary school buildings substantially increased over the previous 12 years. Meanwhile, the value of private preschool construction and private primary and secondary educational buildings construction have seen more moderate growth, peaking around 2001 and then gradually tapering off.

Figure 2-3: Annual Value of Construction Put in Place Compared to GDP



Source: U.S. Census Bureau 2006b,c; U.S. Department of Commerce 2006

Construction is a term that encompasses not only the creation of new buildings but renovations to older structures as well. While the Census tracks this breakdown between renovation and new building construction for residential construction, it does not for non-residential construction. The U.S. Census Bureau, however, did compile statistics for the expenditures of non-residential improvements in 1986, 1989, and 1992. The U.S. Census defines improvements as "additions, alterations (renovations,

[15] State and Local Construction of Elementary School Buildings is meant to give an indication of public kindergarten construction, while Private Primary and Secondary Educational Building Construction is meant to give an indication of private school kindergartens. Since the variables shown in Figure 2-3 are more broadly defined than the variables of interest, they overestimate the value of construction put in place.

remodeling, etc.) and major replacements." While not being able to collect data on the number or extent of the individual projects, the Census was able to make some estimations in the non-residential domain, concluding that "about 23 percent of all buildings had some improvement work, while about 71 percent had some expenditures for repair" (U.S. Census Bureau 1999). The collected data, however, were not specific enough to capture improvement expenditures on COFs. Thus, Table 2-22 presents improvement expenditures as the percentage of the total value of non-residential educational building construction put in place in each of the three years for which improvement expenditure data were available.

Table 2-22: Improvement Expenditures as a Percentage of the Value of Construction Put in Place for Non-Residential Educational Buildings

Type of Construction	1986	1989	1992
Private Non-Residential Educational Buildings	40%	46%	19%
State and Local Non-Residential Educational Buildings	58%	35%	41%

Source: U.S. Census Bureau 1999, U.S. Census Bureau 2006b,c

As shown in Table 2-22, expenditures on improvements as a percent of the total value of educational building construction put in place vary year to year. Expenditures on improvement made up between 35 and 58 percent of the total value of construction put in place in either private or state and local non-residential buildings in the three selected years, with the data moderately variable. These figures indicate that a substantial amount of non-residential educational building expenditures are for activities that might disturb lead-based paint. The high frequency of these improvement activities points to the importance of schools in this rule.

2.5 Renovation Industry Market Structure

The previous sections focused on the supply and demand for renovation services. This section discusses the overall market structure of the renovation industry.

Firms and consumers interact in markets for goods and services with the results of these interactions depending on the competitive characteristics of the market. Competitive markets are characterized as markets with a large number of buyers (e.g., consumers) and sellers (e.g., firms) and relatively homogeneous goods. In competitive markets, neither firms nor consumers can influence the price of the good by altering their supply or demand decisions. Oligopolistic, monopolistic and monopsonistic markets are markets where either firms or consumers have market power and exhibit strategic behavior to change the price of the good sold. The competitive nature of an industry can be estimated by examining the following market characteristics.

- Number of establishments;
- Specialization of establishments;
- Number of consumers;
- Barriers to entry;
- Availability of substitutes; and
- Homogeneity of the good/service.

The data in Section 2.1 indicate that there are a large number of firms in the construction industry. Using data for the twelve NAICS codes, there are approximately 394,365 establishments with employees in construction sectors potentially affected by the rule. Of these establishments, only 2.3 percent have annual revenues of $10 million or more. In addition, there are about 1.2 million self-employed contractors in these industries, all of which are, in all likelihood, considered small by SBA standards. Given the large number of small establishments, it is unlikely that any one firm exhibits substantial market share in the overall market for renovation services. It is possible in some geographic areas for a small number of firms or a single firm to establish a market niche, but overall the market for renovation services appears to be quite competitive on the supply side.

The relatively low barriers to entry in the renovation industry enhance the competition taking place within it. Much of the work covered by this rule does not require particularly unusual or high levels of skills. Renovation work has traditionally attracted recent immigrants because a lack of English is not important (Farzad 2005). While any training required as part of this rule will increase the skill level, the cost of the training is expected to be relatively low.

There are also a large number of consumers in the industry. As such, no single consumer of renovation services is expected to exhibit influence over the price of these services.

There are three sources of substitutes for renovation services. First, consumers can substitute from one contractor to another. Second, consumers can substitute away from professional renovation and into DIY work. This is less likely to occur for COFs than for residential RRP work. Operators of COFs must be certified and have their employees trained in order to do covered RRP in the facility. Third, consumers can reduce the scope of the project or forgo renovation altogether. However, that is unlikely as the cost of the rule is a relatively small share of the cost of a renovation. Again, this is less likely to occur for COFs than for residential RRP work. Many states require annual inspections in COFs that assess the amount of chipped or peeling lead-based paint and dictate that appropriate measures must be taken to alleviate the risk that it imposes.

Additional characteristics of the RRP market result in reduced demand elasticity. First, some differentiation in RRP services does exist. Contractors can provide services at a higher price if they can convince consumers that their services are better or distinctly different from their competitors. This is an important factor in anticipating the impact of the RRP requirements on contractors. The costs of safely renovating or repairing target housing and COFs are expected to be higher than traditional methods. If the consumer is indifferent between safe- or unsafe-lead work practices, then those companies that choose not to use lead-safe work practices may have a competitive advantage in the market due to lower costs. However, if the consumer recognizes that higher quality renovation jobs are those jobs completed with lead-safe work practices, then firms may be able to comply with the regulation and charge a higher price. Under such a scenario, the consumer's marginal benefit for an additional unit of safe renovation may be higher than for an additional unit of unsafe renovation. The consumer who has a preference for lead-safe work practices would choose to do lead-safe renovation as long as the incremental cost of the lead-safe renovation is less than the incremental benefit of such a renovation. Also, the market for RRP services is fragmented and there are substantial costs involved in getting prices. Getting bids from various contractors takes time and consumers need to compare prices across services that differ along many dimensions. These difficulties make it easier for firms to increase their prices to cover the costs for the new requirements.

The combination of a large number of firms, a large number of consumers, low barriers to entry, and available substitutes indicate that the renovation industry is likely to have a relatively high price elasticity of supply. The price elasticity of demand, however, may be small in absolute value.

2.6 Residential Property Owners & Managers

Property owners and managers also will be affected by the rule if they choose to perform their own RRP projects rather than hire an outside contractor or if their renovation and maintenance costs rise as a result of the regulations.

Property owners and managers may have in-house crews that perform RRP activities. If this is the case, then the property owners and managers will directly bear the costs of training and certifying their workers as well as the cost of safe work practices. Furthermore, because all firms that perform regulated RRP projects will experience an increase in costs due to training of supervisors and workers and the use of safe work practices, it is assumed that costs to property owners and managers who hire outside contractors will increase.

2.6.1 Industry Definitions and Characteristics

Establishments involved in the leasing of apartments and other residential units are classified under NAICS 531110 - Lessors of Residential Buildings and Dwellings. This industry, in turn, is divided into two sub-sectors, NAICS 5311101—Lessors of Apartment Buildings and NAICS 5311109—Lessors of Dwellings Other than Apartment Buildings. According to the 2002 U.S. Economic Census data, together these industries include a total of 61,787 establishments that employ 292,405 people (U.S. Census Bureau 2004b).

Establishments involved in the management of residential properties are classified under NAICS 531311—Residential Property Managers. In 2002, this industry included 26,233 establishments that employed 289,870 people (U.S. Census Bureau 2004b). Table 2-23 presents summary statistics for the businesses in NAICS 531311 as well as NAICS 531110 and its sub-sectors.

Table 2-23: Summary Statistics for NAICS 531110, NAICS 5311101 and NAICS 5311109

NAICS Code and Description	Establishments	Annual Revenues (000)	Annual Payroll (000)	Paid Employees
5311101 - Lessors of Apartment Buildings	51,502	$51,708,553	$5,831,398	257,624
5311109 - Lessors of Dwellings other than Apartment Buildings	10,285	$5,263,795	$748,821	34,781
531311 - Residential property managers	26,223	$19,988,344	$8,193,831	289,870
Total	**88,010**	**$76,960,692**	**$14,774,050**	**582,275**

Source: U.S. Census Bureau 2004b

2.6.2 Establishment Size and Industry Environment

The U.S. Small Business Administration indicates that to qualify for small business status, a firm in NAICS 531110 must have annual revenues of less than $7 million, while establishments in NAICS 531311 must have revenues of less than $2 million (U.S. Small Business Administration, 2004). Although data on the number of firms by revenue bracket were not available from the 2002 U.S. Economic Census when this analysis was performed, the average revenues of establishments in these NAICS codes are significantly below the small business designation threshold (Table 2-24).

Table 2-24: Summary Statistics for NAICS 531110, NAICS 5311101 and NAICS 5311109 (Per Establishment)			
NAICS Code and Description	**Average Annual Revenues ($)**	**Average Annual Payroll ($)**	**Paid Employees per Establishment**
5311101 - Lessors of Apartment Buildings	$1,004,011	$113,227	5.0
5311109 - Lessors of dwellings other than apartment buildings	$511,793	$72,807	3.4
531311 - Residential property managers	$762,245	$312,467	11.1
Source: U.S. Census Bureau 2004b			

In 1997, 98.7 percent of the then 51,572 establishments in the Lessors of Residential Buildings and Dwellings sector had annual revenues below $5 million and about 85 percent of the 19,000 establishments in NAICS 531311 had revenues less than $1 million (U.S. Census Bureau 2000a).[16] Because 2002 data on the number of establishments by revenue bracket was not available at the time the estimates were developed, 1997 data was used to estimate the percent of establishments in each industry that qualify for small business status. Table 2-25 presents the percent of NAICS 531311 and NAICS 531110 establishments that have revenues below $1 million and $5 million, respectively. The table also presents the percent of industry revenues and employment that can be attributed to these establishments.

Table 2-25: Small and Large Establishments as Percent of Industry				
NAICS Code	**Description**	**Percent of Establishments by Revenue Bracket**	**Percent of Industry Revenues by Revenue Bracket**	**Percent of Industry Employees by Revenue Bracket**
531311	**Residential Property Managers**			
	Establishments with Revenues < $1 million	85	35	40
	Establishments with Revenues of ≥$1 million	15	65	60
531110	**Lessors of Residential Buildings and Dwellings**			
	Establishments with Revenues < $5 million	99	82	86
	Establishments with Revenues of ≥$5 million	1	18	14
Source: U.S. Census Bureau 2000a				

Based on 1997 data over 85 percent of NAICS 531311 establishments, and about 99 percent of NAICS 53110 establishments have revenues below the small business threshold defined by SBA. In the Residential Property Manager industry, these establishments contribute only 35 percent of the revenues, and employ only 40 percent of the workforce. The revenue and employment distribution is less skewed in the Lessor of Residential Buildings and Dwellings sector. Small establishments in this industry contribute about 82 percent of the revenues and employ 86 percent of the workforce (U.S. Census Bureau 2000a).

2.6.3 Industry Outlook

The market for lead-safe renovation activities will depend in part on the state of the rental housing market—an increase in rents would provide resources to construct new housing and/or renovate existing

[16] Includes establishments open year-round only.

housing. According to Harvard University's Joint Center for Housing Studies (JCHS), "rents fell in 9 of the 27 metropolitan areas tracked by the federal government [in 2003]. Nationally, real contract and gross rents barely increased last year." The JCHS indicates that both the weak labor market and increased home ownership contributed to the softening of the rental market (JCHS 2004).

At the same time as rents fell, the nation-wide rental vacancy rate increased from 8.9 percent in 2002 to 9.8 percent in 2003. The vacancy rate was slightly above 10 percent during the first three quarters of 2004 (U.S. Census Bureau 2004e). None-the-less, the JCHS predicts a strengthening of the rental market over the next ten years due to the influx of immigrants and the aging of the "echo baby-boom generation." The strengthening of the market may also come from overall economic growth and a stemming of home ownership growth due to rising interest rates and/or house prices (JCHS 2004).

2.7 Training Providers

Impacts of the rule will be felt beyond the construction industry. Certified renovators will need accredited training. Both initial and refresher training courses will be required for certified renovators.

2.7.1 Definitions and Industry Characteristics

It is likely that lead-based paint training courses will be provided by establishments categorized as NAICS code 611519: Other Technical and Trade Schools. Census defines NAICS 61159 as "establishments primarily engaged in offering job or career vocational or technical courses (except cosmetology and barber training, aviation and flight training, and apprenticeship training). The curriculums offered by these schools are highly structured and specialized and lead to job-specific certification" and these establishments are believed to currently provide training for lead abatement professionals (U.S. Census Bureau 2004p).

According to the 2002 Economic Census, there are a total of 3,323 establishments in the U.S. certified as Other Technical and Trade Schools (see Table 2-26). On average, each establishment employs 15.3 people. A striking characteristic is that about 19% of these establishments are exempt from the Federal Income Tax (FIT). Exempt establishments include non-profit organizations and educational institutions such as colleges or universities.

Table 2-26: Number of Establishments in NAICS 611519

Industry	Number of Establishments	Total Number of Employees	Average Number of Employees
NAICS 611519 - Other Technical and Trade Schools	3,323	50,709	15.3

Source: U.S. Census Bureau 2004n

Table 2-27 summarizes available financial information for establishments categorized under NAICS 611519. These include total revenues for the sector, average annual revenues per establishment, annual payroll for the sector, and payroll as a percent of revenue. As Table 2-27 indicates, for Other Technical and Trade schools, annual payroll is equal to about 35 percent of establishment revenue.

Table 2-27: Summary Statistics for NAICS 611519					
Industry	**Number of Establishments**	**Annual Sector Revenue (000)**	**Average Revenue per Establishment (000)**	**Average Payroll per Establishment (000)**	**Labor Cost as percent of Revenue**
NAICS 611519 - Other Technical and Trade Schools	3,323	$4,118,995	$1,240	$429	35 %
Source: U.S. Census Bureau 2004n					

According to the U.S. Small Business Administration, in order to qualify as a small business, a firm categorized under NAICS 611519 must have annual revenues of $7 million or less (U.S. Small Business Administration 2006a).[17] The 2002 Economic Census provided data on the number of firms by revenue bracket. In 2002, 94 percent of the then 2,274 firms classified as Other Technical and Trade Schools that were in operation for the entire year had revenues under $5 million (U.S. Census Bureau 2005f). This figure indicates that a large percentage of firms had revenues under the $6.5 million threshold and thus qualified for small business status.

2.7.2 Number and Type of Training Establishments

As mentioned in Section 2.7.1, there are over 3,000 establishments in the Other Technical and Trade school industry. It is likely that only a small portion of these establishments are involved in lead based paint-related training. To help characterize the lead training segment of the training provider industry, a random sample of firms that offer one or more of the courses required for EPA lead abatement certification were identified as part of the economic analysis of the 2006 proposed LRRP target housing rule (EPA 2006). The goal was both to collect tuition data for currently offered lead abatement training courses and to learn what types of institutions (private establishments, non-profits, unions, etc.) offer these classes.

The sample consisted of 83 establishments selected from the Lead Listing[18] directory of 194 training providers.[19] Data were collected from company web sites (when available) and/or over the phone. Information was obtained from 68 training providers; a total of 15 training providers could not be reached. Seven of the 68 contacted providers no longer offered lead abatement training courses.

There were five types of training providers in the sample: private for-profit establishments, non-profit establishments, educational institutions, trade unions and public/government training institutions. Trade unions provide tuition-free training to their members. Public/government providers train state employees and workers who qualify for financial assistance through government programs. They do not offer training to the general public.

[17] Effective July 31st, 2006.

[18] The Lead Listing (www.leadlisting.org) website was run for the U.S. Department of Housing and Urban Development's Office of Healthy Homes and Lead Hazard Control that contained a directory of lead service providers. It is no longer in operation (as of late 2004).

[19] The sample included all the establishments on the list that are certified to offer a Project Designer course (42 total), as well as a random sample of 41 establishments that were not certified to offer this class. The data were weighted by the inversed probability of selection into the sample (P=1 for providers that offer a Project Designer course and P=.270 for providers that do not offer this class). It was assumed that there was no non-response bias.

Table 2-28 summarizes the number of private establishments, educational institutions, non-profits, unions and public government providers that appeared in the sample. The table also presents the estimated national number of providers that fall into each of these categories. More than a third of lead hazard reduction training providers are private, for-profit establishments. The next largest group of providers is labor unions, followed by educational institutions (colleges and universities). None of the unions, however, are certified to offer the Project Designer course. About 13 percent of certified providers either do not offer training at this time, or have permanently stopped offering lead courses.

More than half of the privately owned, for-profit establishments in the sample (19 out of 35) offer environmental consulting services in addition to training. Thirteen of the 35 privately-owned providers specialize in training and do not offer other services. All of these 13 firms offer both lead and asbestos training courses, as well as, in most cases, OSHA safety, HAZ-MAT and/or mold classes. Although there was not enough information to determine the services provided by the remaining three companies, these findings indicate that lead-based paint training providers generally participate in several lines of business.

Table 2-28: Estimated Number of Training Providers

Type of Provider	Number in Sample	National Estimates	
		Total	Percent
Private Providers	35	74	38
Educational Institutions	11	27	14
Non-Profit	4	19	10
Union	9	42	22
Pub/Gov Providers	2	6	3
No Longer Offer Training	7	26	13
Total Companies	68	194	

a. Adjusted for non-response assuming no non-response bias and weighted based on the probability of selection into the sample

Source: U.S. Environmental Protection Agency 2006

2.8 Summary Characteristics: Numbers of Structures in the Regulated Universe

This section provides summary information about the numbers of target housing and public or commercial building COFs that form the basis for the analyses presented in the subsequent chapters of this report. Each tally is then subdivided into categories based on the age of the building and the type of structure. After each table, there is a discussion of how the numbers presented in that table were calculated.

Table 2-29 provides counts of the number of buildings by type and vintage of building. There are 78.0 million structures covered by the recordkeeping checklist provision of the revisions to the rule, including 77.9 million target housing units and 0.1 million COFs in public or commercial buildings. About 40.2 million target housing units would be added to the regulated universe due to the elimination of the opt-out provision. Table 2-29 also shows the regulated universe under the existing 2008 LRRP rule (37.7 million target housing units and 0.1 million public and commercial buildings).

Table 2-29: Number of Structures, by Type and Age of Construction		
Type	**All Pre-1960**	**All Pre-1978**
Target Housing where LLRP rule is applicable after opt-out provision removal	41,040,000	77,888,000
Target Housing where LRRP program was applicable under 2008 LRRP Rule: Rental, COF, or where a child <6 or pregnant woman resides)	20,321,000	37,665,000
Rental where a child <6 or pregnant woman resides	2,187,000	4,130,000
Rental where no child <6 or pregnant woman resides	14,180,000	26,289,000
Owner-Occupied where a child <6 or pregnant woman resides	3,529,000	6,422,000
Owner-Occupied COF where no child <6 or pregnant woman resides	424,000	824,000
Target Housing COFs	823,000	1,559,000
Renter-Occupied COF where a child <6 or pregnant woman resides	33,000	62,000
Renter-Occupied COF where no child <6 or pregnant woman resides	214,000	397,000
Owner-Occupied COF where a child <6 or pregnant woman resides	152,000	276,000
Owner-Occupied COF where no child <6 or pregnant woman resides	424,000	824,000
Target Housing Universe affected by elimination of the opt-out provision (Owner-Occupied where no child <6 or pregnant woman resides that is not a COF)	20,719,000	40,222,000
Public or Commercial Building COFs	54,000	97,000
Daycare Centers*	29,000	52,000
Schools*	25,000	45,000
Kindergarten Only	12,000	21,000
Kindergarten and Pre-Kindergarten	13,000	23,000

Note: Counts include buildings with and without lead-based paint.
* There are 800 pre-1978 schools that have pre-kindergartens but no kindergarten. In this table and in the cost and benefits analysis in Chapters 4 and 5, they are accounted for as daycare centers. In the small entity impact and Unfunded Mandates Reform Act analyses in Chapter 6 these buildings are accounted for as schools.

2.8.1 Target Housing

This section provides a brief discussion of the estimates of the number of the target housing units presented in Table 2-29; a detailed explanation of the data sources used to develop these estimates can be found in Section 4.2 of Chapter 4.

Estimates of the number of housing units by tenure of occupant (owner or renter), age of occupants, and pregnancy status of occupants were estimated using the 2003 American Housing Survey, which is described in more detail in Section 4.2 of Chapter 4. Section 4.2 of Chapter 4 also provides a detailed explanation of the estimated number of target housing units that are defined as COFs. The COFs in target housing include family daycare providers and the homes of family, friends, and neighbors who regularly care for someone else's children. These estimates include care provided for pay and not for pay, and rely primarily on estimates of the size of the childcare workforce as published by the Center for Childcare Workforce, 2002. This report includes data on the number of: (1) family childcare providers caring for unrelated children, (2) paid relatives and non-relatives providing childcare, and (3) unpaid relatives and non-relatives providing childcare. Based on data provided by the Center for Childcare Workforce, a total of just under 2.4 million caregivers provide care outside of the child's home for more than six hours per

week. As described in detail in Section 4.2, these data are used to estimate the number of COFs in target housing. These numbers are further reduced to estimate the number of pre-1960 and pre-1978 housing units based on American Housing Survey data.

2.8.2 Childcare Centers

In 2006, the National Association for Regulatory Administration (NARA) released a report entitled "The 2005 Childcare Licensing Study" providing counts of all the licensed childcare centers and family childcare homes in the United States. The NARA report indicated that there were approximately 115,000 licensed childcare centers, 66,700 of which are estimated to be built before 1978 according to Commercial Building Energy Consumption Suevey (CBECS) data (DOE 2003). According to HUD's *First National Health Survey of Childcare Centers* (HUD 2003), approximately 24 percent of licensed centers are located in elementary schools. These 15,753 centers are assumed to be included in the estimated 40,190 elementary schools with pre-schools and kindergartens. Thus, there are a total of 50,947 pre-1978 daycare centers located outside of elementary schools. According to NCES data on public and private schools, however, an additional 824 pre-1978 schools without kindergartens have a pre-kindergarten program, which brings the total number of buildings accounted for as daycare centers to 51,771 (EPA 2008).

2.8.2.1 Public Schools

The National Center for Education Statistics (NCES) reported that during the 2004-2005 academic year, there were more than 93,000 public schools in the United States. Of these 93,295 public schools, 52,129 had either a pre-kindergarten (PK) or kindergarten (K) program. The Common Core of Data Public Elementary/Secondary School Universe Survey data was used to calculate the number of private schools with PK or K programs. Using this data, a school was considered as having a pre-kindergarten if a) pre-kindergarten enrollment was greater than zero students, or b) the school reported that the lowest grade offered was pre-kindergarten, but enrollment data were not provided. Similarly, a school was considered as having a kindergarten if a) kindergarten enrollment was greater than zero, or b) the school reported that the lowest grade offered was pre-kindergarten or kindergarten, but did not report kindergarten enrollment. Again, the educational building age distribution found in CBECS and HUD (2003) was applied to the total counts, resulting in the estimated 17,000 pre-1960, and 30,000 pre-1978 public schools.

2.8.2.2 Private Schools

This analysis used NCES's Results from the 2003-2004 Private School Universe Survey report and the underlying dataset to estimate the number of private schools with kindergartens and/or pre-kindergartens. A school was considered as having a pre-kindergarten if a) pre-kindergarten enrollment was greater than zero students, or b) the school reported that the lowest grade offered was pre-kindergarten, but enrollment data were not provided. Similarly, a school was considered as having a kindergarten if a) kindergarten enrollment was greater than zero, or b) the school reported that the lowest grade offered was pre-kindergarten or kindergarten, but did not report kindergarten enrollment. The previously cited CBECS and HUD educational building age distribution was then applied to the private school universe to calculate the number of private schools by age of construction. This adjustment yielded 9,000 pre-1960, and 15,000 pre-1978 private schools.

For the purpose of the total cost analysis, private and public schools were categorized according to whether they offered kindergarten only, kindergarten and pre-kindergarten, and pre-kindergarten only.

Table 2-29 uses information drawn from Table 2-9 and Table 2-16 to obtain the total number of schools with each combination of programs. Table 2-9 and Table 2-16 indicate that there are 29,844 public schools and 7,205 private schools with kindergarten programs only, for a total of 37,049 such schools.

Table 2-9 and Table 2-16 also indicate that there are 20,885 public schools and 19,305 private schools with both pre-kindergarten and kindergarten programs. Finally, there are a total of 1,400 public and 21 private schools with pre-kindergarten, but no kindergarten, which are accounted for as daycare centers for the purposes of the analysis. Table 2-29 presents the total number of schools with kindergartens, kindergartens and pre-kindergartens, and pre-kindergartens only by age of construction. Information about the age distribution of buildings was taken from CBECS and HUD and applied to the data to give estimates of the number of schools by the age of the building.

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3. Problem Definition

This chapter begins by characterizing the lead contamination problem, including the various sources of exposure, presented in Section 3.1. This is followed by a summary of the regulatory background in Section 3.2. Section 3.3 discusses how market failure due to incomplete information and external costs result in inefficient levels of lead containment and control in renovation activities, requiring regulatory intervention. Section 3.4 describes how the rule will address these market failures.

3.1 Lead Contamination Problem

Despite recent reductions in air, water, and food contamination, important sources of lead exposure remain, due largely to the widespread presence of lead-based paint. Exposure to lead results in increased blood lead levels associated with various adverse health effects, including reductions in IQ and other negative cognitive effects, particularly in children. In addition, exposure to lead can result in a variety of adverse health effects in adults.

3.1.1 Exposure Sources

As described in Chapter 5 lead may cause adverse health effects in any individual, exposed at any stage of life (*in utero* through adulthood) (U.S. EPA 2005c). However, young children are particularly susceptible to lead hazards because their central nervous systems are rapidly developing, and because their behavior is likely to result in greater exposure to lead than older individuals experience.

Currently, the most significant high-dose source of lead exposure in children under school age is lead-based paint. Through the 1940's, paint manufacturers used lead as a primary ingredient in many oil-based interior and exterior house paints. During the 1950's and 1960's, the usage gradually decreased as new paints were developed, and in 1978 the Consumer Product Safety Commission (CPSC) ruled that paint used for residences, toys, furniture, and public areas must not contain more than 0.06% lead by weight. Nevertheless, about 50 percent of housing units and public and commercial buildings constructed before 1980 still contain lead-based paint (U.S. HUD 2000). Children's exposure to lead from lead-based paint is likely to be high when the paint is in a deteriorated state or is found on accessible, chewable, impact, or friction surfaces, making the lead paint available to children who ingest paint chips. This "pica" behavior appears to be rare, but is the likely cause of many of the highest blood lead levels observed in children. Renovation activities can create lead-based paint hazards for children by making paint chips more accessible for ingestion. These hazards can occur both within and outside the building unit being renovated.

In addition to being a source of direct exposure, lead-based paint can be the source of lead contamination in soil and dust. Children are exposed to lead from soil or dust in their homes as a result of typical hand-to-mouth activities. Lead-contaminated dust and soil are the major pathway through which most young children are exposed to lead from lead-based paint hazards. Renovation activities increase the level of lead dust in the facility and in the soil, thereby increasing the risk of lead ingestion in young children.

While occupational exposure is the primary exposure pathway to lead for adults, other common exposure pathways for teenagers and adults include gardening, housework, drinking water and certain hobbies such as creating objects from stained-glass and making pottery. Individuals (children, teenagers and adults) are also exposed to a variety of other lead sources, some of which are localized in nature.

Airborne lead is present in emissions from lead smelters, battery manufacturing plants, and solid waste incinerators. The phase-out of leaded gasoline has substantially reduced airborne lead. Drinking water may become contaminated with lead after it leaves the treatment plant. Although lead levels in drinking

water generally do not have a statistically significant effect on blood-lead concentrations as a result of regulations stemming from the 1986 Safe Drinking Water Act, water is still considered an important localized exposure source where lead solder and/or brass plumbing fixtures are present because of the high absorption rate of lead in water. Lead exposure through food ingestion has declined greatly due to the phase-out of lead-soldered food cans and public education. With these improvements in exposure from air, water, and food, lead-based paint remains as the largest widespread source of lead exposure.

3.1.2 Lead from Renovation Activities

EPA exposure data (EPA 1997) indicate that renovation activities potentially increase both short-term and long-term lead exposure levels. Lead concentrations are greatest in the area where the renovation work is performed, but lead does settle into other areas of the building and potentially the surrounding area, causing longer-term exposure. The study found that, with the exception of carpet removal and drilling into plaster, all renovation activities examined deposited significant amounts of lead onto the floors in the area where the work was being performed, ranging from 480 micrograms per square foot for sawing to 15,500 micrograms per square foot for paint removal. This lead may be ingested or inhaled by occupants if proper containment and clean-up practices are not used. The study found that sweeping and shop-vacuum clean-up, considered to be standard practice in the industry, reduced the total amount of lead available to occupants. However, as the distance from the activity increased, the cleanup left a higher percentage of the lead behind so that lead hazards remained following cleanup. These findings demonstrate that these practices do not adequately reduce risks from lead dust generated by renovation activities. Lead dust settled in carpeted areas or in soil is the most difficult to remove with simple broom and vacuum clean-up and thereby creates the longest lasting exposure pathway for facility occupants.

EPA conducted a field study in 2007 (Characterization of Dust Lead Levels after Renovation, Repair, and Painting Activities) (the ‘‘Dust Study’’) to characterize dust lead levels resulting from various renovation, repair, and painting activities (EPA 2007). This study was designed to compare environmental lead levels at appropriate stages after various types of renovation, repair, and painting preparation activities were performed on the interiors and exteriors of target housing units and child-occupied facilities. All of the jobs disturbed more than 2 square feet of lead-based paint, so they would not have been eligible for the minor maintenance exception. The renovation activities were conducted by local professional renovation firms, using personnel who received lead safe work practices training using the curriculum developed by EPA and HUD, ‘‘Lead Safety for Remodeling, Repair, and Painting’’ (EPA 2003a). The activities conducted represented a range of activities that would be permitted under the 2006 Proposal, including work practices that are restricted or prohibited for abatements under 40 CFR 745.227(e)(6). Of particular interest was the impact of using specific work practices that renovation firms would be required to use under the proposed rule, such as the use of plastic to contain the work area and a multi-step cleaning protocol, as opposed to more typical work practices.

In the Dust Study, 12 different interior and 12 different exterior renovation activities were performed at 7 vacant target housing units in Columbus, Ohio, and 8 vacant target housing units (including four apartments) in Pittsburgh, Pennsylvania. Three different interior and three different exterior renovation activities were conducted at a building representing a child-occupied facility, a vacant school in Columbus. The presence of lead-based paint was confirmed by laboratory analysis before a building was assigned a particular renovation activity or set of activities. Before interior renovation activities were performed, the floors and windowsills in the work area and adjacent rooms were cleaned. In most cases, pre-work cleaning resulted in dust lead levels on floors of less than 10 $\mu g/ft^2$; nearly all floors were less than 40 μg/ft2 before work started. Most windowsills that would be used for later sampling were cleaned to dust lead levels less than 250 μg/ft2. In the few cases where that level was not achieved on a

windowsill needed for sampling, dust collection trays were used. Interior renovation activities included the following jobs:

- Making cut-outs in the walls.
- Replacing a window from the inside.
- Removing paint with a high temperature (greater than 1100 degrees Fahrenheit) heat gun.
- Removing paint with a low temperature (less than 1100 degrees Fahrenheit) heat gun.
- Removing paint by dry scraping.
- Removing kitchen cabinets.
- Removing paint with a power planer.

To illustrate the impact of the containment plastic and the specialized cleaning and cleaning verification protocol that would be required by the 2006 Proposal, each activity was performed a minimum of four times:

- With the plastic containment described in the 2006 Proposal followed by the cleaning protocol described in the proposal.
- With the plastic containment described in the 2006 Proposal followed by dry sweeping and vacuuming with a shop vacuum.
- With no plastic containment followed by the cleaning protocol described in the 2006 Proposal.
- With no plastic containment followed by dry sweeping and vacuuming with a shop vacuum.

Dust samples were collected after the renovation work was completed, after cleaning, and after cleaning verification. If a building was being used again for the same job under different work practices, or for a completely different job, the unit was recleaned and retested prior to starting the next job. All buildings were cleaned and tested after the last job.

Exterior renovation activities performed as part of the study included the following:

- Replacing a door and doorway.
- Replacing fascia boards, soffits, and other trim.
- Removing paint with a high temperature (greater than 1100 degrees Fahrenheit) heat gun.
- Removing paint with a low temperature (less than 1100 degrees Fahrenheit) heat gun.
- Removing paint by dry scraping.
- Removing paint with a needle gun.
- Removing paint with power sanding or grinding.
- Removing paint with a torch or open flame.

For the exterior jobs, plastic sheeting was placed on the ground to catch the debris and dust from the job, in accordance with the requirements of the proposed rule. Additional plastic sheeting was laid out beneath

and beyond the ‘‘proposed rule’’ plastic. Trays to collect dust and debris were placed on top of and underneath the ‘‘proposed rule’’ plastic. Trays were also placed just outside of the ‘‘proposed rule’’ plastic to assess how far the dust was spreading. A vertical containment, as high as the work zone, was erected at the end of the additional plastic.

The use of the ‘‘proposed rule’’ plastic as a ground covering captured large amounts of leaded dust. For all job types except removing paint with a torch, there was a substantial difference between the amount of lead captured by the ‘‘proposed rule’’ plastic and the amount under the ‘‘proposed rule’’ plastic.

The 2008 final LRRP rule was supported by the Dust Study discussed above. Therefore, EPA conducted a peer review in accordance with OMB’s Final Information Quality Bulletin for Peer Review. EPA requested this review from the Clean Air Scientific Advisory Committee (CASAC) Lead Review Panel. The CASAC, which is comprised of seven members appointed by the EPA Administrator, was established under the Clean Air Act as an independent scientific advisory committee. The CASAC’s comments on the Dust Study, along with EPA’s responses, have been placed into the public docket for this action. More information on the CASAC consultation process, along with background documents, is available on EPA’s website at http://www.epa.gov/ lead/pubs/casac.htm.

According to the peer review report, the CASAC Panel found

> “. . .that the [Dust Study] was reasonably well-designed, considering the complexity of the problem, and that the report provided information not available from any other source. The study indicated that the rule cleaning procedures reduced the residual lead (Pb) remaining after a renovation more than did the baseline cleaning procedures. Another positive aspect of the Dust Study was that it described deviations from the protocol when they occurred. “

The CASAC Panel also contended that the limited data from residential housing units and child-occupied facilities included in the Dust Study, most likely do not represent a statistically valid sample of housing at the national level. They noted that there are aspects of the study that would underestimate the levels of lead-loadings while other aspects of the study would overestimate the loadings. EPA agrees that the Dust Study is not nationally representative of all housing. EPA notes that there are several reasons why this is the case, including the fact that all of the housing studied was built during 1925 or earlier, and a large number of the floors were in poor condition. A major purpose of the Dust Study was to assess the proposed work practices. A statistically valid sample of housing at the national level is not needed to assess the work practices. If anything, the Dust Study is conservative with respect to the age of housing because it studied older houses and therefore is appropriate for assessing the effectiveness of the work practices.

3.2 Regulatory Background

This section outlines the extensive history of lead-based paint regulations at the federal level. Childhood lead exposure continues to be a major public health problem among young children in the United States. Most children with blood lead levels in excess of CDC’s current level of concern have been exposed to lead in non-intact paint, interior settled dust, and dust and soil in and around deteriorating older housing (CDC 2004). The nature and extent of the problems associated with lead-based paint in housing units have been thoroughly investigated. Approximately 40% of all U.S. housing units (about 38 million homes) have some lead-based paint. Use of lead safe work practices during renovation can advance the goal of primary prevention of lead poisoning (CDC 2004).

The Federal Lead-based Paint Program.

Title X and the Federal goal

Primarily in response to the persistent health threat posed by lead-based paint, in 1992 Congress enacted Title X. Congress found that low-level lead poisoning was widespread among American children, affecting, at that time, as many as 3 million children under age 6; that the ingestion of household dust containing lead from deteriorating or abraded lead-based paint was the most common cause of lead poisoning in children; and that the health and development of children living in as many as 3.8 million American homes was endangered by chipping or peeling lead paint, or excessive amounts of lead-contaminated dust in their homes. Congress determined that the prior Federal response to this crisis was insufficient and established, in Title X, a national goal of eliminating lead-based paint hazards as expeditiously as possible. Congress decided that the Federal government would take a leadership role in building the infrastructure necessary to achieve this goal.

The stated purposes of Title X 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 current 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.
- To educate the public concerning the hazards and sources of lead-based paint poisoning and steps to reduce and eliminate such hazards (Residential Lead-Based Paint Hazard Reduction Act of 1992).

EPA's lead-based paint program

Under Title X, EPA is directed to take actions that can be divided into 4 key categories:

- Establishing a training and certification program for persons engaged in lead-based paint activities, accrediting training providers, establishing work practice standards for the safe, reliable, and effective identification and elimination of lead-based paint hazards, and developing a program to address exposure to lead-based paint hazards from renovation and remodeling activities.
- Ensuring that, for most housing constructed before 1978, lead-based paint information flows from sellers to purchasers, from landlords to tenants, and from renovators to owners and occupants.
- Establishing standards for identifying dangerous levels of lead in paint, dust and soil.

- Providing information on lead hazards to the public, including steps that people can take to protect themselves and their families from lead-based paint hazards. Each of these categories is discussed in more detail in the following sections.

a. Training and certification, accreditation, and work practice standards. Title X added a new title to TSCA entitled ''Title IV Lead Exposure Reduction.'' Most of EPA's responsibilities for addressing lead-based paint hazards can be found in this title, with section 402 being one source of the rulemaking authority to carry out these responsibilities. TSCA section 402(a) directs EPA to promulgate regulations covering lead-based paint activities to ensure persons performing these activities are properly trained, that training programs are accredited, and that contractors performing these activities are certified. These regulations must contain standards for performing lead-based paint activities, taking into account reliability, effectiveness, and safety.

On August 29, 1996, EPA promulgated final regulations under TSCA section 402(a) governing lead-based paint inspections, lead hazard screens, risk assessments, and abatements in target housing (U.S. EPA 1996). TSCA section 401 defines ''target housing'' as any housing constructed prior to 1978, except housing for the elderly or persons with disabilities (unless any child who is less than 6 years of age resides or is expected to reside in such housing for the elderly or persons with disabilities) or any 0-bedroom dwelling. These regulations also apply to ''child-occupied facilities,'' which are defined at 40 CFR 745.223 as buildings constructed before 1978, or portions of such buildings, where children under age 6 are regularly present. TSCA section 402 defines lead-based paint activities in target housing as inspections, risk assessments and abatements. The 1996 regulations cover lead-based paint abatement activities in target housing and child-occupied facilities, along with limited screening activities called lead hazard screens. The regulations also established an accreditation program for training providers and a certification program for individuals and firms performing these activities. Training providers who wish to provide lead-based paint training for the purposes of the Federal lead-based paint program must be accredited by EPA. Implementing regulations at 40 CFR 745.225 describe in detail the requirements for each course of study, how training programs must be operated, and the process for obtaining accreditation. Training programs must have a training manager with experience or education in a construction or environmental field, and a principal instructor with experience or education in a related field and education or experience in teaching adults. Training programs must also have adequate facilities and equipment for delivering the training. To become accredited, an application for accreditation must be submitted to EPA on behalf of the training program. The application must either include the course materials and syllabus, or a statement that EPA model materials or materials approved by an authorized State or Tribe will be used. The application must also include a description of the facilities and equipment that will be used, a copy of the test blueprint for each course, a description of the activities and procedures that will be used during the hands-on skills portion of each course, a copy of the quality control plan, and the correct amount of fees. If EPA finds that the program meets the regulatory requirements, it will accredit the training program for 4 years. To maintain accreditation, the training program must submit an application and the correct amount of fees every 4 years.

Individuals and firms that perform inspections, lead hazard screens, risk assessments, or abatements in target housing or child-occupied facilities must be certified. Certification requirements and the process for becoming certified are described in 40 CFR 745.226. A firm that wishes to become certified must submit an application, along with the correct amount of fees, attesting that it will use only certified individuals to perform lead-based paint activities and that it will follow the work practice standards in 40 CFR 745.227. An individual who wishes to become certified must take an accredited training course in at least one of the certified disciplines: Inspector, risk assessor, project designer, abatement worker, and

abatement supervisor. The risk assessor, project designer, and abatement supervisor disciplines have additional requirements for education or experience in a construction or environmental field. The inspector, risk assessor, and abatement supervisor disciplines also require the applicant to pass a certification examination administered by a third party.

The regulations at 40 CFR part 745, subpart L, also contain work practice standards for performing inspections, lead hazard screens, risk assessments and abatements in target housing and child-occupied facilities. The regulations contain specific requirements for conducting paint sampling during an inspection and specify information that must be gathered and samples that must be taken as part of a lead hazard screen or risk assessment. The requirements for abatements are also set forth in the regulations. When conducting abatements, an occupant protection plan must be prepared by a certified supervisor or project designer; certain work practices such as open-flame burning, machine sanding or abrasive blasting without high-efficiency exhaust control, dry scraping, and heat guns at high settings are prohibited; and a visual inspection and dust clearance sampling must be performed after the abatement is finished to ensure that the area is ready for re-occupancy. Any samples collected during any of these regulated lead-based paint activities must be analyzed by a laboratory recognized by EPA as being capable of analyzing paint chips, dust, and soil for lead. Requirements for inspection, lead hazard screen, risk assessment or abatement reports are also described in this section

Recognizing the importance of States and Territories in achieving the goal of eliminating lead-based paint hazards in housing, Congress specifically directed EPA to establish a model State program and a process for authorizing States to operate such programs in lieu of the Federal program. Concurrently with the subpart L rulemaking in 1996, EPA codified, at 40 CFR part 745, subpart Q, a model training and certification program and a process for enabling States, Territories, and Tribes to apply for authorization to administer their own lead-based paint activity programs. Providing Indian Tribes with this opportunity is consistent with EPA's Policy for the Administration of Environmental Programs on Indian Reservations (U.S. EPA 1984). EPA also provides grants under TSCA section 404 to States, Territories, and Tribes to assist them in developing and administering these programs, as well as programs implementing TSCA section 406(b). On June 9, 1999, the subpart L regulations were amended to include a fee schedule for training programs seeking EPA accreditation and for individuals and firms seeking EPA certification (U.S. EPA 1999). These fees were established as directed by TSCA section 402(a)(3), which requires EPA to recover the cost of administering and enforcing the lead-based paint activities requirements in unauthorized States. The most recent amendment to the subpart L regulations occurred on March 20, 2009 (U.S. EPA 2009).

In addition, Congress directed EPA, in TSCA section 405, to establish protocols, criteria, and minimum performance standards for analysis of lead in paint, dust, and soil. TSCA section 405 further directed EPA, in consultation with HHS, to develop a program to certify qualified laboratories. The National Lead Laboratory Accreditation Program (NLLAP) provides the public with a list of laboratories that have met EPA requirements and demonstrated the capability to accurately analyze paint chip, dust, or soil samples for lead. All laboratories recognized by NLLAP must pass on-site audits conducted by one of the two accrediting organizations currently participating in NLLAP, the American Industrial Hygiene Association (AIHA), and the American Association for Laboratory Accreditation. Recognized laboratories must also perform successfully on a continuing basis in the Environmental Lead Proficiency Analytical Testing (ELPAT) Program established by NIOSH, AIHA, and EPA.

More recently, the LRRP rule for target housing and COFs was promulgated in 2008 (73 FR 21692) and is codified in Part 745 of Title 40 of the Code of Federal Regulations (CFR). The rule was promulgated under the authority of §402(c) of the Toxic Substances Control Act (TSCA). Section IV of TSCA was

established by the Residential Lead-Based Paint Hazard Reduction Act of 1992, also known as Title X of the Housing and Community Development Act of 1992, Public Law 102-550.

The 2008 LRRP regulation requires entities that perform renovation, repair and painting work for compensation in buildings covered by the rule to become certified by EPA, ensure that their employees are trained as either renovators or workers, and use lead-safe work practices when disturbing lead-based paint.

b. Lead-based paint information for purchasers, renters, owners, and occupants of target housing. Another of EPA's responsibilities under Title X is to require that purchasers and tenants of target housing, as well as occupants of target housing and parents of children in COFs undergoing renovation are provided information on lead-based paint and lead-based paint hazards. As directed by TSCA section 406(a), CPSC, HUD, and EPA, in consultation with CDC, jointly developed a lead hazard information pamphlet entitled ''Protect Your Family From Lead in Your Home'' (''PYF'') (U.S. EPA et al 2003b). This pamphlet was designed to be distributed as part of the disclosure requirements of section 1018 of Title X and TSCA section 406(b), to provide home purchasers, renters, owners, and occupants with the information necessary to allow them to make informed choices when selecting housing to buy or rent, or deciding on home renovation projects. The pamphlet contains information on the health effects of lead, how exposure can occur, and steps that can be taken to reduce or eliminate the risk of exposure during various activities in the home.

Pursuant to the authority provided in section 1018 of Title X, on March 6, 1996, HUD and EPA jointly promulgated regulations requiring persons who are selling or leasing target housing to provide the PYF pamphlet and information on known lead-based paint and lead-based paint hazards in the housing to purchasers and renters (HUD and U.S. EPA 1996). These joint regulations, codified at 24 CFR part 35, subpart A, and 40 CFR part 745, subpart F, describe in detail the information that must be provided before the contract or lease is signed and require that sellers, landlords, and agents document compliance with the disclosure requirements in the contract to sell or lease the property. Title X does not provide for these requirements to be administered by States or Tribes in lieu of the Federal regulations. Therefore, HUD and EPA are responsible for administering and enforcing these disclosure obligations.

TSCA section 406(b) directs EPA to promulgate regulations requiring persons who perform home renovations for compensation to provide a lead hazard information pamphlet to owners and occupants of target housing being renovated. These regulations, promulgated on June 1, 1998, are codified at 40 CFR part 745, subpart E (U.S. EPA 1998). The term ''renovation'' is defined, at 40 CFR 745.83, as the modification of any existing structure, or portion of a structure, that results in the disturbance of painted surfaces. Lead-based paint abatement projects are specifically excluded, as are small projects that disturb 2 square feet or less of painted surfaces, emergency projects, and renovations affecting components that have been found to be free of lead-based paint, as that term is defined in the regulations, by a certified inspector or risk assessor. Like the regulations regarding disclosure during sales or leases, these regulations require the renovation firm to document compliance with the requirement to provide the owner and the occupant with the PYF pamphlet. One important difference from the disclosure requirements in section 1018 of Title X is that TSCA section 404 allows States to apply for, and receive authorization to administer, the TSCA section 406(b) requirements. Two States are currently authorized to operate this program.

c. Standards for lead in paint, dust, and soil. Another responsibility assigned to EPA by Title X is the development of standards for identifying dangerous levels of lead in paint, dust and soil. These standards, promulgated pursuant to TSCA section 403 on January 5, 2001 and codified at 40 CFR part 745, subpart

D, provide various Federal agencies, including HUD, and State, local and Tribal governments with uniform benchmarks on which to base decisions on remedial actions to safeguard children and the public from lead-based paint hazards (U.S. EPA 2001b). These standards also allow certified inspectors and risk assessors to easily determine whether a particular situation presents a lead-based paint hazard and whether to recommend remedial actions such as lead-based paint abatement, cleaning of dust, or removal of soil. The standards define lead-based paint hazards in target housing and child-occupied facilities as paint-lead, dust-lead, and soil-lead hazards. A paint-lead hazard is defined as any damaged or deteriorated lead-based paint, any chewable lead-based painted surface with evidence of teeth marks, or any lead-based paint on a friction surface if lead dust levels underneath the friction surface exceed the dust-lead hazard standards. A dust-lead hazard is surface dust that contains a mass-per-area concentration of lead equal to or exceeding 40 micrograms per square foot ($\mu g/ft^2$) on floors or 250 $\mu g/ft^2$on interior windowsills based on wipe samples. A soil-lead hazard is bare soil that contains total lead equal to or exceeding 400 parts per million ($\mu g/g$) in a play area or average of 1,200 parts per million of bare soil in the rest of the yard based on soil samples.

d. Public outreach and education. Among other things, TSCA section 405(d) directs EPA, along with the Agency for Toxic Substances and Disease Registry (ATSDR) and HUD, to sponsor public education and outreach activities to increase public awareness of the health effects of lead, the potential for exposures, the importance of screening children for elevated blood lead levels, and measures that can be taken to reduce or eliminate lead-based paint hazards. Accordingly, EPA has worked to provide the public with information and increase public awareness of such matters. To date, these activities have included web site management, development of public outreach strategies, development of partnership agreements, distribution of materials, participation in national conferences and exhibits, and developing hazard information documents (and other media, such as videos), as necessary to implement Title X. EPA has collaborated closely with other Federal agencies and its State, Tribal, and local government partners in developing outreach campaigns. EPA has also been involved in developing model tool kits of various educational tools to provide to partners, such as slogans and graphic materials for public buses, trains, and mass transit stations.

TSCA section 405(e) further directs EPA to establish, in connection with HUD, CDC, other Federal agencies, and State and local governments, a clearinghouse for information on lead-based paint and a hotline for the public to use for questions and requests for information on lead-based paint. This clearinghouse, the National Lead Information Center, handles approximately 50,000 calls per year, and disseminates up to 500,000 documents per year to the public.

Lead-based paint programs at other Federal agencies

In addition to EPA, other Federal agencies have important roles in achieving the goals of reducing or eliminating lead-based paint hazards in housing. Other agencies specifically assigned tasks in Title X include HUD, CDC, and OSHA.

The Federal agencies have long realized that they must work together to develop and implement Federal strategies for addressing lead-based paint hazards in order to be efficient and effective. In 1989, HUD and EPA formed an inter-agency task force to work through issues associated with lead-based paint abatement. The Federal Interagency Lead Based Paint Task Force has remained active throughout the years and continues to meet on a quarterly basis. Participating agencies include the Department of Defense, the Veterans Administration, the National Institute of Standards and Technology (NIST), the U.S. Public Health Service, the National Aeronautics and Space Administration (NASA), the United States Department of Agriculture (USDA), the Government Accountability Office (GAO), the National

Institute for Environmental Health Sciences (NIEHS), ATSDR, CDC, CPSC, NIOSH, OSHA, HUD, and EPA. This Task Force serves as an important forum for coordinating the strategic plans of the Federal agencies who have responsibilities under Title X or who have responsibilities for maintaining and disposing of property that may contain lead-based paint.

Title X assigned certain responsibilities to HUD. One of HUD's functions is the administration of the Lead-Based Paint Hazard Control Grant Program established by the Act. This program provides grants of $1 million to $3 million to State and local governments for control of lead-based paint hazards in privately owned, low-income owner-occupied and rental housing that is not receiving federal assistance. These grants are also designed to stimulate the development of a trained and certified hazard evaluation and control industry. Evaluation and hazard control work funded by the program must be conducted by either contractors who are certified by EPA or an EPA-approved State or Tribal program, or by contractors trained in lead-safe work practices, in the case of interim controls. Through these requirements, HUD hopes to create infrastructure that will last beyond the life of the grant. In awarding grants, HUD promotes the use of cost-effective approaches to hazard control that can be replicated across the nation. Since 1993, approximately $971 million has been awarded to over 200 local and State jurisdictions across the country. The work approved to date will lead to the control of lead-based paint hazards in more than 70,000 homes where young children reside or are expected to reside. Other HUD lead grant programs include the Lead Hazard Reduction Demonstration program, the Lead Elimination Action Program (LEAP), the Lead Outreach program and the Lead Technical Studies program.

HUD was also given regulatory authority over some aspects of lead based paint hazard control. As noted previously, on March 6, 1996, HUD and EPA jointly promulgated regulations requiring the disclosure of lead-based paint information during sale or lease transactions involving target housing. The HUD disclosure regulations are codified at 24 CFR part 35, subpart A. Subparts B through R of 24 CFR part 35 are known as the ''Lead Safe Housing Rule,'' initially promulgated on September 15, 1999, and updated in June 2004 (HUD 2004b). This rule was designed to protect young children from lead-based paint hazards in target housing that is being sold by the Federal government or receives financial assistance from the government. The requirements generally depend upon the level of assistance being provided, and may include such things as inspections, risk assessments, abatement, paint stabilization, or interim controls, which are temporary measures to reduce potential exposure to lead-based paint hazards. The emphasis is on reducing lead-based paint hazards, so, after paint is disturbed, a visual assessment for surface dust, debris, and residue and dust clearance testing is required to ensure that no dust lead hazards were created or left in the work area or, for rehabilitation projects of moderate or substantial scope, in the entire housing unit. More information on the Lead Safe Housing Rule is available on the HUD website at http://www.hud.gov/offices/lead.

Section 1017 of Title X required HUD to issue ''guidelines for the conduct of federally supported work involving risk assessments, inspections, interim controls, and abatement of lead-based paint hazards.'' In response to this directive, HUD completed the Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing (Guidelines), in June 1995 (HUD 1995). The Guidelines provide detailed, comprehensive, technical information on how to identify lead-based paint hazards in housing and how to control such hazards safely and efficiently.

Other core activities of HUD's lead-based paint program include providing technical assistance to housing authorities, nonprofit housing providers, local and State agencies, other Federal agencies, housing developers, inspectors, real estate professionals, contractors and financiers, and public health authorities; evaluating the hazard reduction methods used in the grant program to measure their effectiveness, cost

and safety; and maintaining a community outreach program in coordination with the other Federal agencies involved in lead-based paint hazard reduction.

CDC also provides significant funding for the prevention of childhood lead poisoning. CDC provides funding to support State, city and county programs in the areas of primary prevention, case management and screening, surveillance, strategic partnerships, and program evaluation. Since 2002, CDC has recommended that a blood lead level of 10 micrograms per deciliter (µg/dL) be used as a threshold for individual intervention (CDC 2002). Additional CDC recommendations address the type and intensity of individual intervention strategies that should be undertaken, depending upon the child's blood lead level. These strategies range from nutritional and educational interventions, along with more frequent testing, for a child with a blood lead level of 10–14 µg/dL, to medical and environmental interventions for children with blood lead levels above 45 µg/dL (CDC 2002). CDC has established a national surveillance system for children with elevated blood lead levels. In addition, CDC works with HUD and EPA to coordinate outreach and education campaigns.

OSHA is another agency with regulatory authority under Title X. As directed by the Act, OSHA promulgated an interim final standard on May 4, 1993, which regulates lead exposures in the construction industry (OSHA 1993). This standard, codified at 29 CFR 1926.62, limits worker exposures to 50 micrograms of lead per cubic meter of air averaged over an 8–hour workday. Employers must use a combination of engineering controls and work practices to reduce employee exposure as much as possible, using appropriate respiratory protection where necessary to achieve the exposure limit. Employees must receive training on the health effects of lead and how to limit exposure through proper work practices and personal protective equipment. Exposure monitoring and medical monitoring, including blood lead testing, are also required. This standard remains in effect and OSHA retains the authority to protect workers from occupational exposure to lead.

Many Federal agencies have been working to reduce or eliminate lead-based paint hazards in housing and to end lead poisoning. EPA, HUD, and other Federal agencies have been working for many years on the problem of lead-based paint hazards that can be created during renovation and remodeling activities in housing and child-occupied facilities. This rulemaking is an important component of the Federal strategy for eliminating lead poisoning.

3.3 Justification for Federal Regulations of Lead Exposure during Renovation

3.3.1 Market Failure

From an economic perspective, a necessary condition for regulations is the existence of inefficiency in the allocation of resources. This inefficiency is commonly labeled a market failure since the market is the mechanism assumed to make efficient resource allocations possible. A market failure can come from one or more of several sources. These include poorly defined property rights (such as negative externalities, common property resources, and public goods); imperfect markets for trading property rights (because of a lack of perfect information or of contingent markets; monopoly power; distortionary taxes and subsidies and other inappropriate government regulations); and the divergence of private and social discount rates.

The occurrence of any of these conditions justifies further inquiry into the need for government regulation to reduce inefficiencies in the allocation of society's resources. This section considers whether any of these conditions are linked to lead exposures resulting from renovation in target housing and public or commercial building COFs. If so, understanding the nature of the inefficiencies involved facilitates the design of more effective regulations. The specific regulatory approach considered here involves the removal of the opt-out provision (currently available for renovations in owner-occupied target housing

where no child under the age of 6 or pregnant woman resides and no COF operates), and a requirement that renovators provide owners and occupants with information documenting compliance with the training and work practice requirements of the LRRP rule.

Economic efficiency suggests that "lead-safe" renovation will occur as long as the property owners' willingness-to-pay for reduced lead risks exceeds the cost of reducing these risks. If the property owners are aware of the risks and of the availability and costs of reducing these risks, then arguably they might be able to accurately trade off risk and cost without the aid of government regulation. However, there are two arguments for why individual property owners may not trade off risk and cost efficiently.

Externalities and Public-Good Characteristics of Lead-Safe Renovation

A major cause of failure in the market for lead-safe renovations stems from externalities due to renovations disturbing lead-based paint that do not use lead-safe work practices because they occur in target housing units eligible for the opt-out provision. An efficient outcome is achieved when the marginal willingness-to-pay for a service is equivalent to the marginal cost of providing that service. Because the use of lead-safe work practices is likely to benefit not only the consumer of the renovation (the homeowner and his or her family members) but also residents of adjacent properties, future occupants, visitors, and children receiving child care on the premises, lead-safe renovation services are, in part, a public good. As such, even with perfect information, the maximum amount that the individual consumer of the renovation would be willing to pay for lead-safe work is likely to be lower than the total amount that that particular consumer plus the other beneficiaries (neighbors, future occupants, etc.) would be willing-to-pay for the service. For example, occupants of neighboring properties may also experience an increased exposure to lead and may be willing to pay to reduce or eliminate this exposure but may not be consulted by the property owner making the decision. As another example, children do not testify to their willingness-to-pay for risk reduction and rely on their parents' or the property owners' willingness-to-pay. Even if other parties were consulted, the transaction costs of reaching an agreement would be high, so that this would be an inefficient process.

An example of an externality can be found in an owner's decision about which contractor to hire to perform renovation in his or her housing unit. Contractors that provide lead-safe renovation services are likely to charge more for their work than establishments that do not use lead-safe practices. Lead-safe work practices may also increase the duration of the project because contractors need to take additional steps to prevent the spread of lead dust. Since the property owner pays for the renovation, but not necessarily for the consequences of all the resulting lead exposure, he or she is faced with powerful short-term incentives (lower cost and a faster turn-around) to hire a contractor that does not use lead-safe work practices. Other parties (such as residents of adjacent properties, future occupants, visitors, and children receiving child care and their parents) pay for the consequences of lead exposures, not the property owner. This externality results in a socially inefficient outcome of too little lead-safe renovation services being purchased.

A similar external cost problem also leads to inefficiencies on the supply side of this market. Renovators that use lead-safe work practices incur higher costs than other contractors who are faced with the incentives to keep their costs as low as possible. Similar to property owners, contractors may not incur the costs of consumer lead exposure resulting from unsafe renovation work.

Because the legal/liability system is not perfect, the contractor's financial responsibilities (in terms of costs related to the customer's lead exposure) are not clear and consistently enforced. The same situation occurs with respect to a property owner's responsibilities to residents of adjacent properties, future

occupants, visitors, and child-care customers. This is likely to result in an inefficient outcome of either too little lead-safe renovation services being consumed.

Inadequate Information

Another cause of failure in the market for lead-safe work practices is due to inadequate information. Correct information is an important prerequisite to the demand for containment and clean-up practices that reduce lead exposure during renovation projects. In deciding whether lead-safe work practices or well-trained contractors are worth the extra cost, the property owner has to know whether there is lead in the work area, what risks are implied by having renovation done in areas with lead-based paint, the significance of these risks, what can be accomplished in reducing those risks through specific containment and clean-up practices, and how much these practices cost.

Misinformation can lead to inefficient outcomes. Without knowing there is a lead problem, or how renovation might create lead hazards, the owner will have too low a demand for proper work practices and may be unwilling to pay additional costs for contractors who voluntarily abide by these containment and clean-up standards. Furthermore, a great deal of uncertainty can exist if the consumer is unsure about the quality of lead-safe renovation services being purchased and their likely benefits. If consumers do not have any guarantee that contractor are qualified to identify and control lead-based paint hazards, demand for these services is likely to be lower than in the presence of such a guarantee. On the supply side, contractors may be unaware of the risks they are creating and the methods they can use to reduce risks of lead exposure.

Impacts of the Regulation on Demand for Lead-Safe Renovation Services in Opt-out Housing

A consumer's demand for renovation services is a function of the price of these services, the characteristics of the services (e.g., quality, lead safety etc.), and the characteristics of consumers. Assume that all renovation services are identical except that some are performed using lead-safe containment and clean-up practices and some are not. Assume for illustration purposes that there is only one consumer and one supplier in the market. Of the services that are performed not using these lead-safe practices, some are done by the supplier, while others are do-it-yourself projects performed by the consumer. The general market failure relationships discussed above are illustrated in Exhibit 3-1 as three markets for close substitutes. Figure (a) represents the market for lead-safe renovation projects, Figure (b) represents the professional market for "standard practice" renovations that do not use lead-safe work practices, and Figure (c) represents the do-it-yourself market for "standard practice" renovations. In each market, S_0 represents the supply of renovation services and D_0 represents the demand for renovation services in the baseline with incomplete information. Note that, moving from left to right, each supply curve is lower than the prior one, corresponding to the lower cost in terms of materials and time combined. The area under the demand curve in each market represents the consumer's willingness-to-pay for renovation services.

Exhibit 3-1: Impact of Regulation on Markets for Renovation/Remodeling Services in Opt-out Housing

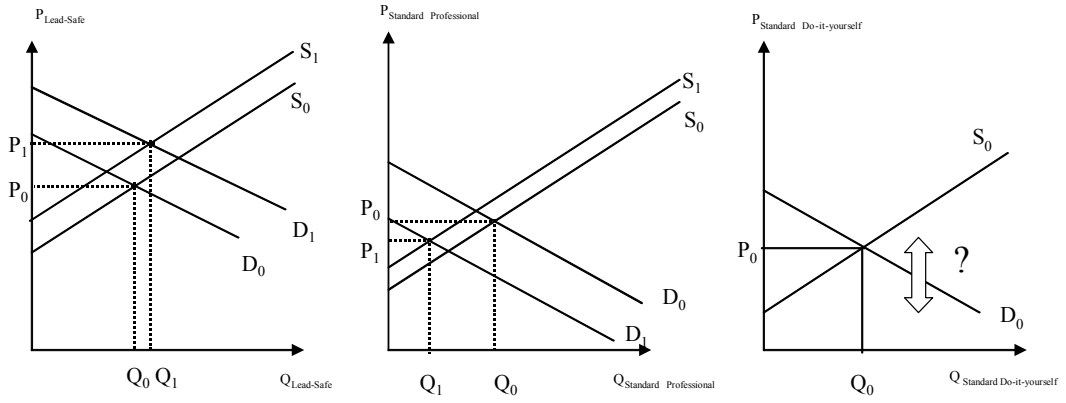


Figure (a) Market with Lead-Safe Work Practices

Figure (b) Professional Market with "Standard" Work Practices

Figure (c) Do-it-Yourself Market with "Standard" Work Practices

The LRRP program alters the nature of these three markets by providing information to the consumer and contractor about the risk associated with lead-based paint renovation activities and by requiring lead-safe containment and clean-up practices for professional projects. The implementation of the LRRP program will help to establish a more structured market for lead-safe renovation services. Prior to the LRRP program, consumers of renovation services generally had no guarantee that a contractor who claimed to provide lead-safe renovation services would actually perform the project in a lead-safe manner. The implementation of work practice standards and training/certification requirements is likely to increase consumer confidence in the quality of the work provided by certified contractors, increasing their willingness-to-pay for these services.

EPA's targeted outreach program is also likely to increase demand for lead-safe renovation services by raising consumer awareness about the dangers of unsafe work. Although contractors that currently provide well-trained staff and perform lead-safe work practices are expected to find it in their vested interest to provide the kinds of information cited above, this possibility has not closed the information gaps for the public. One impediment may be public uncertainty about the reliability of information that contractors themselves provide. Their information may be considered unreliable because consumers are not fully competent to assess the lead contamination and what needs to be done, because the businesses are subject to moral hazard (which occurs, for example, because businesses have a financial interest in minimizing their work practice costs), or both. Since many property owners may lack easy access to independent sources of information to motivate their decisions, doing nothing may be the likely response. With the implementation of the LRRP program, however, consumers are more likely to avoid the dangers posed by unsafe renovation and hire a qualified contractor to perform the work in a lead-safe manner.

The increased demand discussed above is shown by an upward shift of the demand curve in Figure (a) from D_0 to D_1 and an associated increase in price. Simultaneously, the demand for "standard practice" renovation services decreases with an associated decrease in price. Given scarce resources for enforcement, it is expected that some "standard practice" professional work will continue, even in properties where there is the potential for lead exposure. The effect of the regulation on the do-it-yourself market is ambiguous. Some property owners that might have hired a professional to perform "standard practice" renovation work in the baseline may decide to perform this work themselves rather than pay the additional costs for lead-safe work practices. This would shift the supply curve back up. On the other

hand, with increased information, property owners that would have performed do-it-yourself "standard" practice" renovation in the baseline may decide to either forgo renovation altogether or hire a lead-safe professional, thus reducing do-it-yourself demand.

Impacts of the Regulation on the Supply of Lead-Safe Renovation Services

The regulation will increase both the costs of supplying lead-safe services and standard services. In Figures (a) and (b), S_1 represents the supply of services with the regulations. A contractor that already uses lead-safe practices will also incur the costs of training, certification and cleaning verification. A contractor that continues to provide standard (not lead-safe) renovation services will have higher costs of operation due to potential enforcement actions, and potentially higher liability. The relative size of the shifts in the two submarkets will affect the final changes in quantity and price of both lead-safe and standard renovation services.

The net impact on the quantity of renovation projects performed is also ambiguous. If all property owners are willing to pay the full amount for lead-safe work practices, then the total quantity performed across all three markets will remain constant but the average price will rise. However, if some property owners are not willing to pay for the risk reduction they may chose to forgo renovation services altogether, resulting in a net decline in renovation services provided after regulation.[1]

Conclusions

As demonstrated in this review, due to inadequate information and the existence of externalities, the quantity of lead-safe RRP services currently provided is likely to be inefficiently low. The results of the market failures discussed in this review are significant in both qualitative and quantitative terms. Childhood lead exposure continues to be a major public health problem among young children in the United States. During 1999 through 2002, approximately 310,000 children aged 1 to 5 years, had blood-lead levels greater than 10 μg/dL, despite the removal of lead from gasoline and the banning of lead-based paint in 1978 (CDC 2005). Most children with blood-lead levels in excess of CDC's current level of concern have been exposed to lead in non-intact paint, interior settled dust, and dust and soil in and around deteriorating older housing or other buildings where they spend time. According to the Center for Disease Control (CDC), "renovation and remodeling activities that disturb lead-based paint can create substantial amounts of lead dust in the home; such dust can then be inhaled or ingested by children" (CDC 1997). An insufficient number of lead-based paint interventions have occurred to remove the dangers posed by uncontrolled renovation activities; renovation activity thus continues to pose a significant risk of lead exposure.

3.3.2 Justification for Regulation at the Federal Level

In the Residential Lead-Based Paint Hazard Reduction Act of 1992 (Title X), the United States Congress stated that the elimination of lead-based paint hazards was a national goal. Under §402, Congress directed EPA to promulgate regulations governing lead-based paint activities to ensure that individuals are properly trained, that training programs are accredited, and that contractors engaged in such activities are certified; and to promulgate guidelines for the conduct of such renovation and remodeling activities which may create a risk of exposure to dangerous levels of lead. Accordingly, the 2008 LRRP rule

[1] The amount by which price and quantity change in each of these markets is a function of both the amount by which the supply and/or demand functions shift and the relative elasticities of the two functions. See Appendix 3A for a discussion of how these factors affect the price of renovation services and the quantity provided by the market. Appendix 3B presents price elasticity estimates for construction and RRP.

established training, certification and accreditation requirements, as well as work practice requirements for renovation work in target housing and COFs.

The rule revises the LRRP program by removing the opt-out provision in the 2008 LRRP rule. The rule also requires renovation firms to provide owners and occupants with a copy of the records demonstrating compliance with the training and work practice requirements of the LRRP rule. Since both of these provisions revise the existing Federal RRP regulation, it is appropriate that the changes be made at the Federal level, instead of the state or local level.

3.4 Approaches for Reducing Lead Exposure Resulting from Renovation

This section examines how the information provision and the mandatory training and work practice requirements in the rule address the market failures discussed in the previous section.

3.4.1 Information Provision

Information provision will occur in several ways under the LRRP program, in conjunction with other sections of Title X. Consumers will be directly informed about lead-based paint hazards and risks associated with renovation work through educational programs and through the expanded notification requirements. The aim of these programs will be to educate the property owner about the risks associated with lead-based paint and lead-based paint hazards and having renovation work done in areas where these are present, the significance of these risks, and how specific work practices can reduce those risks. In addition, requiring training of professionals who carry out renovation projects will provide these individuals information about the hazards of lead exposure and the use of appropriate procedures to reduce exposure during their work. Similarly, the entity certification process will act as an indirect form of information provision to the consumer by assuring them that the services they are purchasing will reduce or eliminate lead exposure.

The rule addresses the market failure due to inadequate information in two ways. First, removing the opt-out provision will bring renovations in these housing units under the purview of the LRRP program, which assures consumers that firms are certified and renovation staff are trained and qualified to minimize exposure to lead-based paint hazards created during renovations. Second, requiring renovators to provide owners and occupants with a record of the steps taken to comply with the requirements of the LRRP program (using the checklist or other means) can facilitate a review and discussion between the parties of how well the renovator complied with the work practice requirements in the LRRP program. Both of these information provision activities are described below.

Effect of Removing the Opt-Out Provision

The objective of removing the opt-out provision is to reduce exposure to lead dust generated by renovation projects and thereby protect children and adults from the health hazards posed by lead. Due to the nature of the problem, uncertainty currently exists on the part of consumers about the quality of lead-safe renovation services and their likely benefits. The lack of information regarding the benefits of and the lack of confidence in the quality of a good or service generally leads to a lower demand and a lower willingness-to-pay for that good or service. Thus, if consumers of renovation services are not aware of the dangers posed by lead dust generated during renovation, or if they are not confident that a contractor who claims to use lead-safe work practices has been properly trained, they may not be willing to pay the additional costs of contractors who voluntarily abide by these work practice standards. Removing the opt-out provision will bring renovations in these housing units under the purview of the LRRP program, which assures consumers that firms are certified and renovation staff are trained and qualified to

minimize exposure to lead-based paint hazards created during renovations. This provision of information will act as an important instrument in alleviating the problems contributing to undue lead exposure. An example of the market failure stemming from inadequate information is presented in the previous section and is shown graphically in Exhibit 3-1.

An additional information flow will occur under these regulations. The teaching of safe work practices to contractors and other personnel performing RRP work in opt-out housing will provide them with information they need to undertake renovation activities in ways that will minimize exposure to the occupants of the building and others. The training course will also provide information about the hazards associated with lead and renovation activities, which contractors will pass along to their clients. This provision of information is likely to increase the demand for lead-safe work practices and assist in eliminating the market failure that currently exists due to incomplete or misinformation.

Effect of Requiring Checklist Provision

The rule's requirement for renovators to provide the owner and occupant with a record of the steps taken to comply with the requirements of the LRRP program is one of several information provision requirements under Title X. For example, the rule will function in conjunction with EPA's pre-renovation education rule, promulgated under TSCA section 406(b), that requires renovators to provide owners and occupants of target housing and COFs with a lead hazard information pamphlet before conducting renovations. The pamphlet that renovators must provide (entitled *Renovate Right: Important Lead Hazard Information for Families, Child Care Providers and Schools*) covers topics including the potential health effects resulting from lead exposure; how to prepare for a renovation; the work practices that contractors must follow (containment, cleaning, cleaning verification, etc.); and what to look during the job and after the job is done.

The rule requires renovators to provide a copy of the checklist (or other information documenting the steps taken to comply with the requirements of the LRRP program) when the final invoice for the renovation is delivered, or within 30 days of the completion of the renovation, whichever is earlier. Because the owner will receive the information *prior* to making the final payment for the work, he or she can use this information in a discussion with the renovator about any differences between the work practices required in the rule and those identified on the checklist as having been completed, or between the work practices that the renovator identified on the checklist and those that the owner observed being used. If there were any deficiencies in the contractor's work practices, the two parties may then be able to negotiate a resolution to address them. For example, if the renovator failed to appropriately contain the work area, he or she may agree to have the dust levels checked through dust wipe sampling, and (depending on the results) to perform additional cleaning in order to decrease dust lead levels. Or owners may want to perform additional cleaning on their own.

In situations where the occupant is not the owner (i.e., in a rental unit), the occupant may be in a better position than the homeowner to note whether the renovator followed all of the steps noted on the checklist. Because the renovator also provides the occupant with a copy of the checklist, the occupant can raise with the owner any discrepancies between what the occupant observed and what the completed checklist says. The owner can then take the steps outlined above.

Requiring the renovator to provide the owner and occupant with a record of the steps taken to comply with the LRRP program creates an additional incentive for the renovator to comply. A renovator is more likely to adhere to all of the work practice requirements knowing that a consumer with a copy of the completed checklist will be in a better position to evaluate whether the work followed the requirements.

A mandatory information provision requirement is useful for renovators as well as consumers, since it provides renovators with an affirmative indication that they have followed the work practice requirements in the rule. Having the option of using a checklist developed and suggested by EPA (instead of using a checklist that has been developed by private parties) may address possible questions of whether the checklist renovators are using is sufficient and appropriate.

EPA's version of the checklist is short (one page long) and is written in simple and clear language. The information provided by the renovator is supplied in checkboxes or in short fill-in-the-blank answers. Thus, the information is provided in a format the owners and occupants can readily understand. Because renovators must provide the checklist prior to final payment for the work, owners will receive the information in a timely fashion. This provides them with the ability to act on the information in an appropriate manner.

If renovators were not mandated to provide this information to consumers, responsible renovators might theoretically provide it voluntarily (although renovators who are not as responsible are unlikely to provide this information voluntarily). But there is no evidence that even responsible renovators are doing this. EPA's analyses for this rule and for the 2008 LRRP rule assumes that some of the work practices required by the LRRP program are already used in a fraction of the renovations in the baseline (that is, without the LRRP program applying). If renovators were interested in voluntarily providing consumers with information similar to that on the checklist, then presumably some of them would already be doing it (i.e., providing consumers with documentation of the types of containment, cleaning, and other work practices they are using in the baseline). However, there has been no indication that renovators are providing owners with documentation of the work practices used, much less that renovators are providing documentation comparing the work practices used with the suite of work practices required by the LRRP program. The failure of the marketplace to provide this information on its own means that owners and occupants may not be able to react appropriately to avoid or prevent risks from lead-based paint.

The rule does not require owners and occupants to read the checklist or to take further actions to reduce lead-based paint hazards. Thus, the extent to which lead exposure is reduced (beyond the expected increase in the compliance rate discussed above) depends upon how participants in the transaction respond to the information provision required by the rule. Neither the costs nor benefits of these responses can be quantified because doing so would require predicting the behavior of the parties, which is influenced by many factors unique to each individual situation. Data are not available to estimate the behavior changes.

3.4.2 Mandatory Training and Work Practice Requirements

The information provision described above will aid in reducing the extent of the market failure that currently exists for lead-safe renovation services. However, relying solely on information provision is unlikely to be sufficient to correct the market failure because of the nature of the lead paint problem. The lead in lead-based paint cannot be seen on visual inspection, so the owner and occupant do not know if lead is present and whether a lead exposure hazard exists. Likewise, the adverse health effects are not noticeable for several years, and the source may not be recognized. In such situations, education may not be sufficient and other mechanisms are needed to ensure that if a potential risk exists, it is suitably addressed. The LRRP program introduces other mechanisms for the elimination of lead-based paint hazards during renovation work. These include training requirements for personnel engaged in renovation work, and the use of standard practices for the containment and cleanup of lead dust and debris generated during the project, and the prohibition or restriction of certain high-hazard techniques. The rule

requires the use of these work practices in all target housing by removing the opt-out provision from the LRRP program.

Appendix 3A: The Role of Elasticities in Determining the Impacts of a Rule

EPA is often faced with deciding on a regulatory policy in the absence of good information about the likely effects of the policy on consumers and producers. In particular, data on the own-price elasticity of supply and demand often are uncertain. This appendix provides background information on the likely effects of own-price elasticity of demand and supply on the outcomes of EPA's regulatory efforts. The bulk of the discussion focuses on the case of perfect competition, not because the majority of markets EPA is likely to affect will exhibit competitive behavior, but simply because the theory is clearly defined in this case. However, this appendix also examines the likely impacts of relaxing the assumption of perfect competition. It focuses on two general classes of regulatory options: regulations that alter the market outcome by imposing additional costs upon producers, and regulations that alter the market by providing information to consumers.

3A.1 Elasticities of Supply and Demand

The market equilibrium for a commodity (e.g., purchasing renovation, remodeling or painting (RRP) work that uses lead-safe work practices) is determined by the intersection of the aggregate demand and supply curves. The aggregate demand curve depicts consumer behavior and is based on consumer income and preferences. Likewise, the aggregate supply curve describes the behavior of producers in the market, and is dependent upon the costs of production. At market equilibrium, the price is referred to as market clearing. In other words, at this price, the quantity demanded by consumers and supplied by producers are equal and neither the consumer nor producer has any incentive to move away from this steady state as long as current demand and supply conditions prevail.

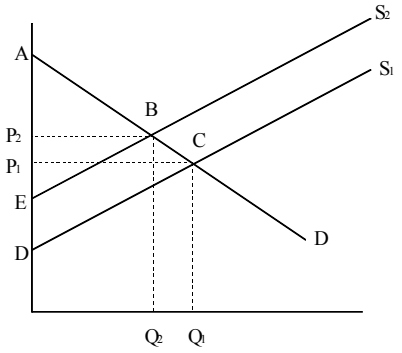
However, when demand and supply conditions do change, for example when new information causes consumers to adjust their preferences and thus shift the demand curve, or changes in input prices affect costs of production and shift the supply curve, the market gravitates to a new equilibrium. This new equilibrium is represented by a new combination of market clearing price and quantity. The magnitude of the change in price and quantity is dependent not only upon the extent of the shift in the demand or supply curve, but also on the own-price elasticity of demand and supply for the commodity.

The own-price elasticity of demand is defined as the ratio of the percent change in quantity demanded to the percent change in price, and is reflected in the slope of the demand curve, similarly for the own-price elasticity of supply. By determining the level of change in price and quantity, the elasticities of the two curves also determine the distribution of the burden or benefit between the consumer and producer resulting from a change in equilibrium conditions. Analyzing changes in consumer and producer surpluses provides a means for quantifying such distributional changes.

Figure 3A-1 below provides a hypothetical example of how the effects of regulation may impact consumer and producer surpluses. In the baseline, the supply curve is represented by S_1, and producers supply Q_1 at a price P_1. On all the inframarginal units supplied, producers receive a price above the cost of production. The difference between the price and the cost of production represents the producer surplus resulting from supplying Q_1 at price P_1 (triangle P_1CD). Similarly, in the baseline consumers demand quantity Q_1 at price P_1. For all the inframarginal units demanded, consumers would be willing to pay more than that price and thus receive a surplus. The difference between what consumers are willing to pay as measured by the height of the demand curve, and what they have to pay is the consumer surplus (triangle ACP_1).

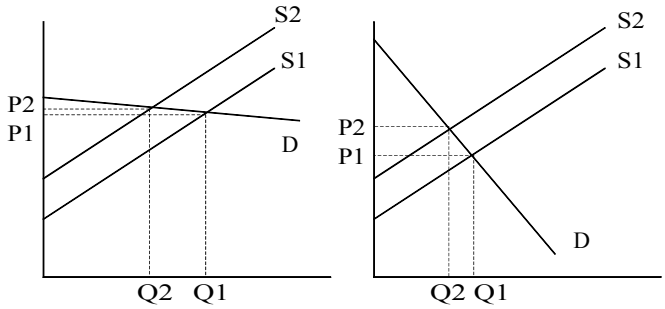
So what are the effects of regulation? In Figure 3A-1, the upward shift in the supply curve to S_2 (say from a rise in production costs due to the implementation of the RRP rule which requires use of the more costly lead-safe work practices) results in a new equilibrium at the point B, with a new market price of P_2 and quantity of Q_2. Note that producer surplus decreases from P_1CD to EBP_2 and the consumer surplus also decreases from ACP_1 to ABP_2. Thus, in the arbitrary case drawn in Figure 3A-1, the social costs of the regulation are born by both consumers and producers of the pollution-generating good. This result turns out to be a function of the way the supply and demand curves have been drawn, and the distribution of costs between consumers and producers depends on the slope (elasticity) of the demand and supply curves.

Figure 3A-1: Effect on consumer and producer surplus due to a supply curve shift



In general, for a given production cost increase, the more elastic the demand curve, the greater the inability on the part of the producers to pass the additional costs of production on to the consumers. As shown in Figure 3A-2 (a) and 3A-2 (b) below, the differing slopes of the demand curve lead to differential impacts on the consumer and producer surplus. In Figure 3A-2 (a) demand for the good is relatively price elastic, while in Figure 3A-2 (b) the good has a relatively inelastic demand. Notice that when demand is less elastic, the price increase resulting from a shift in supply is greater and consumers bear a greater share of the loss in consumer surplus. On the other hand, with a more elastic demand, the overall price increase is smaller and the share of total costs born by producers is larger.

Figure 3A-2(a) Figure 3A-2(b)
2(a): Effect of a change in input prices when demand is elastic
2(b): Effect of a change in input prices when demand is inelastic



The elasticity of demand is determined in general by the existence of suitable substitutes for a commodity. If several commodities exist in the market that are considered to be close substitutes for each other, then a consumer is likely to have a great deal of choice available to him while making his consumption decision. This being the case, if the price of the commodity that he is presently consuming happens to rise, he is easily able to reduce his current consumption level of that commodity and switch over to consuming more of one of the substitutes. This flexibility limits the ability of the producer to pass on the burden of the cost increase on to the consumer. Thus, the availability of close substitutes in the market explains why the demand curve for a commodity will be relatively elastic, and why the rise in price will be relatively small. On the other hand, if substitutes are lacking for a commodity that experiences a price increase (and it is not a luxury good), then the consumer has little choice but to carry on consuming similar quantities of the same product. Thus, in this situation he will have to shoulder a larger share of the increased costs by paying a much higher price, and this rigidity in his consumption behavior explains the inelastic nature of the demand curve for that commodity.

Recognizing that most markets are not perfectly competitive, product differentiation allows firms to charge prices higher than marginal costs and charge different prices for similar goods. The degree to which producers can pass on the cost of production depends heavily on the degree to which they can convince consumers that their product is different from other products. In its limit this argument is just a restatement of the fact that markets with lower elasticities of demand will experience higher price increases. If "market demand" is defined to be the demand for a single brand of good, then the number of substitutes for the good affects its demand elasticity and thus affects the degree to which the producer can pass on cost increases. If the firm can convince consumers that the product is distinct then it in essence lowers the elasticity of demand for its product.

The own price elasticity of supply, on the other hand, is dependent on the degree of specialization of inputs. If the inputs are highly specialized or firms are locked into long-term contracts then firms in this industry can be left with substantial sunk investments creating high transition costs which are reflected in an inelastic supply curve. However, if supply is highly elastic then firms can easily switch production to other uses and minimize the effect of the demand shock. In essence the elasticity of supply measures the amount of resources lost or tied up indefinitely when consumption patterns change suddenly.

The EPA seeks to reduce hazards from lead-based paint by two separate pathways of regulatory impact. First, it hopes to reduce exposure to lead-based paint by regulating the "method of production" of RRP work in opt-out housing by establishing standards for such activities and through requiring certifications and/or training. This is likely to result in an increase in the "costs of production" of RRP work thereby affecting the supply curve for such activities. Second, the rule will provide information to consumers. In this case EPA is likely to alter the market outcomes by changing the demand for products (lead-safe and non lead-safe work practices). To the extent that the demand and supply of RRP work will be affected by the rule, one must consider the price elasticities involved to determine the distributive impact of the rule on consumers and producers.

An important factor on which the price elasticity will depend is the number of substitutes that exist for the RRP service that is sought in the market. As previously explained, the greater the number of available substitutes, the more elastic the demand and lesser the burden of a production cost increase likely to fall on the consumer. Under this rule three classes of substitutes may be said to exist for RRP services. These are (1) professionals using lead-safe work practices, (2) professionals using non lead-safe work practices, and (3) the do-it-yourself jobs. Thus, a certain amount of flexibility is available to the consumer when it comes to hiring RRP services.

Currently a sizeable number of RRP firms may not necessarily be following lead-safe work practices thereby limiting the size of the class of firms that do so. However, with the implementation of the rule, a much larger number of firms are expected to adhere to these practices in the future, thus enlarging the size of this class. In addition, this increase in the number of professionals using lead-safe work practices will also have a geographical impact. Presently, the limited number of professionals who use lead-safe work practices are concentrated in a select number of locations where state and local regulations have fostered their development. As a result, in many parts of the country the choice of hiring "lead-safe" professionals currently does not exist. But this situation will change as a larger number of firms switch to lead-safe work practices once the rule come into effect.

However, if the increase in production costs from the rule is extremely high such a large transition of firms from using lead-unsafe to lead-safe work practices may not occur. This is because the cheaper option of using non-certified (non lead-safe work practice using) RRP workers or doing the work yourself will limit the ability of the certified (lead-safe work practice using) professional to charge the consumer for all or a large portion of this significant cost increase. In this situation a large number of lead-unsafe firms may remain in existence. Thus, one may assume that as long as an appreciable difference exists between "costs of production" of lead-safe and non lead-safe work practices, firms of both types will continue to exist. The continued existence of firms using non lead-safe practices also depends on the extent and effectiveness of enforcement activities. The greater the cost differential between lead-safe and non lead-safe practices, the greater the need for enforcement activities.

In addition to the number of substitutes, the closeness of substitutes in their ability to replace one another needs to be judged. The important question is whether RRP work done by uncertified professionals and the do-it-yourself efforts are substantially less safe than the services of certified professionals. To the extent an appreciable difference exists between the quality of service (in terms of preventing or reducing lead-based paint hazards) provided by the two groups, they will not be perceived as close substitutes for each other and their demand curves will not be as elastic as they would have been if they were considered close substitutes. In such a situation, consumers feel that a sufficiently differentiated product is being offered by the two groups, and thus their choice is limited.

This judgment on the degree of closeness of substitutes will to some extent depend upon the importance that lead safety holds with the property owner compared to other priorities. To the extent that the priority assigned to lead exposure is relatively small, the uncertified professionals and do-it-yourself jobs will tend to be seen as closer substitutes for certified professionals, than if lead-based paint hazards are perceived as a larger threat by the property owner. Thus, the elasticity of demand will also vary according to owner priorities, and in this regard, the informational aspect of the rule may in fact assist in raising more awareness, resulting in lead safety being assigned a higher priority.

Of a related nature, the firm certification aspect of the rule is likely to increase consumer ability to differentiate between the services being offered by the three classes of substitutes. The certification process will create a distinct divide which will permit the property owner to get a better appreciation of the varied benefits to be gained from the alternatives at hand. This is likely to reduce to some extent the perceived closeness of the substitutes and thereby make the demand more inelastic for each class of RRP service.

3A.2 How Price Elasticity of Demand Affects the RRP Rule

As discussed above, EPA foresees two separate pathways by which the rule will take effect; increasing costs of production leading to a shift in supply and provision of information to consumers leading to a shift in demand. The way these two effects will play out and the role that price elasticities will play in the adjustment of prices and quantities under the two scenarios is discussed below.

3A.2.1 Effect of Rule on the Cost of Production (Supply Shift)

EPA seeks to reduce exposure to lead-based paint hazards by the introduction of lead-safe work practices during RRP work. These practices involve the use of increased precautions in situations where lead-based paint hazards may potentially be created during RRP work, and as a result costs of RRP work are likely to increase above current levels. Since producers seek to maximize profits and in the baseline will produce goods using the lowest-cost combination of inputs, a rule requiring producers to change their input mix will necessarily increase the cost of production. Thus, one impact of the rule will be to increase the production costs, leading the supply curve to shift upward and to the left.

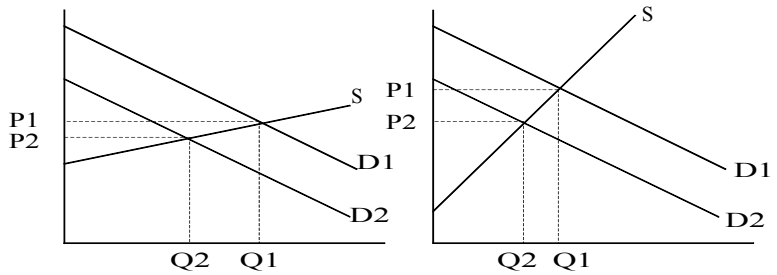
Figures 3A-2(a) and 3A-2(b) demonstrate the distributional affects of such a hypothetical shift in supply in markets with different elasticities of demand. The price increase is much higher (P1 to P2) and the decrease in quantity demanded is much lower (Q1 to Q2) with a given shift in supply when demand is less elastic (as shown in Figure 3A-2(b)) as compared to the elastic demand scenario in Figure 3A-2(a). Thus, the consumers bear a higher share of the total social cost from the regulation (represented by the relatively larger decrease in the consumer surplus compared to that in the producer surplus). On the other hand, Figure 3A-2(a) shows that the higher the elasticity of demand, the lower the overall price increase, the larger the reduction in quantity demanded, and thus the larger the share of total costs to be born by producers (represented similarly by the larger decrease in producer surplus as compared to the consumer surplus).

3A.2.2 Effect of Rule on the Provision of Information to Consumers (Demand Shift)

The alternative regulatory approach is to provide information to consumers in the hopes that they will make more environmentally friendly consumption choices. In this case EPA alters the market outcomes by changing the demand for products. Figures 3A-3(a) and 3A-3(b) depict such a hypothetical example. In these cases the commodity in question (non lead-safe work practices) has negative environmental effects (byproducts). By educating consumers about these byproducts and alternative products that have lower levels of adverse effects (lead-safe work practices), EPA can change consumer preferences and shift demand for the "bad product" inward and to the left. This lower demand curve would more accurately reflect the true "social" marginal benefits of consuming the product.

What are the likely distributional and efficiency effects of this type of regulatory policy? Figures 3A-3(a) and 3A-3(b) reveal that under both scenarios (for an elastic and inelastic supply curve), the downward shift in the demand curve will lead to a decrease in price and quantity demanded of the commodity. However, in the case of an elastic supply curve when the transition costs associated with switching to the production of other products is relatively low, the decrease in price of the commodity is smaller and the decrease in quantity demanded larger, as compared to the changes in the case of an inelastic supply curve involving high transition costs. Restated in terms of changes in producer and consumer surpluses, the producer surplus is reduced under each scenario, but the elastic supply curve causes a relatively smaller burden to fall on the producer than the inelastic supply curve. Similarly, the consumer receives a reduction in social benefit under each scenario; however, the magnitude of this reduction is larger under the inelastic supply curve case.

Figure 3A-3(a) **Figure 3A-3(b)**
3(a): Effects of a regulation-induced change in demand when supply is elastic
3(b): Effects of a regulation-induced change in demand when supply is inelastic



3A.2.3 Application to Renovation

In the rule, EPA is both affecting production and providing information. The likely effects of the regulation on prices and welfare are difficult to discuss without more accurate information on the supply and demand elasticities. However, some general observations are warranted.

The welfare effects of the regulation will likely be driven by the supply side rather than the demand side. This is because the elasticity of supply for RRP services is likely to be relatively higher than the elasticity of demand. Supply elasticities are expected to be relatively high because there are relatively few barriers to entering or leaving this industry. Little capital equipment or specialized labor skills are needed for RRP work, and what is needed is easily transferred from non-compliant renovation to "lead-safe" projects. On the demand side, there are two primary categories of RRP events – those of a maintenance character and those of an improvement character. Maintenance activities usually cannot be postponed and thus are not particularly sensitive to price. Improvement projects, however, can more easily be postponed and thus tend to be more price elastic. Complicating matters, however, are the existence of different categories of purchasers. Some place a high premium on quality and timeliness, while others actively seek low prices. Appendix 3B discusses some of the empirical evidence on elasticities of demand and supply.

However, the analysis does not suggest that the education factor is unimportant. If the regulation is not accompanied by education efforts and enforcement, then EPA could unintentionally drive up demand for non-compliant renovation projects creating additional welfare losses. These losses are the result of the fact that if consumers were aware of the lead paint issues their true marginal valuation for the non-compliant projects is lower than the price of these projects. Thus, if enforcement is not perfect, education is essential. EPA can compensate for the fact that it is raising the costs of lead-free renovation on the supply side by educating consumers on the environmental effects of non-compliant renovations thereby making these cheaper, non-compliant projects less attractive.

Appendix 3B: Elasticities of Demand and Supply for Housing / Renovation Services

As described in Chapter 3 and Appendix 3A, the impact of increases in the cost of RRP services on demand for RRP will depend on both the size of the cost increase and the elasticity of demand for these services. Likewise, the impact on the supply of RRP services will depend on both the size of the cost increase and the elasticity of supply for these services. These impacts are expressed in terms of changes in price and in the quantity of services purchased. Chapter 4 estimates the cost increases due to the requirements of the various regulatory options, based on the increased labor and materials costs of complying with the containment and clean-up requirements, as well as the training and certification costs imposed by the requirements. This appendix reviews the existing literature on residential demand elasticities.

Unfortunately, RRP has received relatively little attention by housing economists. While there are many studies that estimate elasticities for new construction, these studies have only limited applicability to renovation and remodeling. The income elasticity of demand for housing is generally estimated to be somewhat inelastic (in the 1.0 to 0.8 range). This is consistent with housing being a necessity – expenditures on housing do not increase as rapidly as income (Green and Malpezzi 2003). Demand for housing is also considered to be somewhat price inelastic, with generally accepted values either in the range of -0.5 to -1.0 or -0.75 to -1.2 (Mayo 1981, Malpezzi and Maclennan 2001, Ellwood and Polinski 1979). One study is available that estimated a renovation demand elasticity (Gyourko and Saiz 2003). This study found renovation demand to be very inelastic, with an elasticity estimated to be –0.28.

On the other hand, housing supply appears to be very elastic – consistent with the highly competitive nature of the residential construction market and the large number of small contractors. Because it is very easy to enter (and to leave) the construction business, supply is very responsive to changes in prices, especially in the long run.[2] Based on the literature surveyed, estimates of housing supply elasticities tend to range from 1.0 to 4.0, but a couple of studies found elasticities as high as 13 or higher (DiPasquale and Wheaton 1994, Topel and Rosen 1988, Blackley 1999, Malpezzi and Maclennan 2001). No elasticity numbers specific to the supply of renovation services could be found.

Several characteristics of RRP tend to make its demand more price elastic than the demand for housing in general. For example:

- The existence of close substitutes to compliant RRP. These substitutes include:
  - Do-It-Yourself RRP –owners of buildings may be tempted to do their own RRP work without proper training and certification.
  - Firms that do not complying with the regulations. These regulations may be difficult to enforce against contractors, particularly the large number of small contractors who may be hard to identify and monitor.
  - Reductions in the scope of the projects, or postponement of the projects, to compensate for the price increase. Purchasers can reduce other RRP-related costs by substituting lower-priced fixtures/finishes and/or less extensive remodeling.
- Many RRP projects are discretionary. The price elasticity of discretionary projects is likely to be higher than replacement projects (e.g. new roof). For discretionary RRP projects, it is relatively

[2] Note – stock adjustment models give lower elasticities than flow models. Malpezzi and Maclennan (2001).

easy for the purchaser to reduce the scale/scope of the project, postpone the project, or never do it.

Offsetting these characteristics that foster higher elasticities of demand, are ones that foster lower elasticities. The major one is that the product purchased cannot be separated from the firm providing the product, which is true of all services. In addition to the various RRP events analyzed in the subsequent chapters, RRP firms themselves are relatively differentiated. Some firms specialize in high-end, complicated projects (e.g. elaborate new kitchens) while other firms specialize in performing small routine tasks (repainting apartments at tenant turn-over). Some firms only work in historic or Victorian homes, while others will work on any type of home. Some firms do only one type of project (e.g. replacing siding) while other firms will do any and all types of RRP work. This differentiation results in lower demand elasticities, because producers may not be considered particularly close substitutes.

- To the extent that lead-safe work can be distinguished from non-lead-safe work, a higher price can be charged for it.
- Many contractors already employ lead-safe practices (or at least control the dispersion of dust and clean well before leaving). The regulations will serve to reduce this differentiation.

Second, the nature of RRP projects may also reduce price competition. For relatively small jobs, property owners frequently will not get multiple bids – the assumed cost of the job does not warrant the effort. In this case, the compliance cost can be passed on without fear of losing the work. In the case of large jobs, where owners will get bids, compliance costs will make up a relatively small proportion of the total cost and, again, passing on the costs may be easy.

Characteristics of the purchaser of the RRP services may also affect their demand price elasticity. High-income purchasers are likely to be less price sensitive than low-income purchasers. In addition, owners of rental properties may be more price sensitive than owner occupants because they have different objective functions. Owner-occupants operate so as to maximize their utility (their enjoyment of the house) and asset growth is likely to enter their decision as a secondary factor. Owners of rental housing, on the other hand, are assumed to be maximizing their profits. It is reasonable to expect that the optimal level of capital of an absentee landlord's rental building is lower than that of an owner-occupier's house, since the landlord's marginal rent revenue from renovations is likely to be less than the homeowner's marginal utility.

Because of the lack of detailed price elasticity estimates for RRP, the analysis in Chapters 4, 5 and 6 does not incorporate any reduction in professional RRP activities in response to the cost increases resulting from the regulation.

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4. Costs of the Lead, Renovation, Repair, and Painting Rule Revisions

The revisions to the LRRP program include: (1) the removal of the opt-out provision for owner-occupied target housing without either children under the age of 6 or a pregnant woman in residence, and (2) an additional requirement that the renovator provide a copy of their recordkeeping checklist to owners and occupants of renovated structures.

The costs associated with the revisions to the §402(c) Lead, Renovation, Repair, and Painting (LRRP) Rule are divided into four categories for the purposes of this analysis: (1) work practice costs, (2) training costs, (3) certification costs (which include the firm's paperwork burden and EPA administrative and enforcement costs), and (4) recordkeeping checklist provision costs. The costs associated with the first three components are all attributable to the elimination of the opt-out provision, which will extend the 2008 LRRP requirements to additional housing units. In addition to the work practice costs associated with the RRP events in these housing units, this change is expected to result in more individuals and firms seeking training and certification. The fourth component, recordkeeping checklist provision costs, applies to all housing units regulated under the 2008 LRRP rule as well as the additional housing units that would no longer be eligible for the opt-out provision.

The general approach of the analysis is to first estimate the number of affected activities or entities and then estimate the incremental regulatory cost per-activity or entity affected. Finally, the incremental costs and the number of affected activities and entities are combined to estimate the total costs. The analysis estimates the total costs associated with the first three years of regulation and then extrapolates to the costs of the regulation over a fifty year period—estimated with three and seven percent discount rates.

The chapter is organized as follows: Section 4.1 defines the regulatory options considered in this analysis; Section 4.2 estimates the number of regulated renovation, repair, and painting events under the various regulatory scenarios; Section 4.3 presents the estimated costs of using the required work practices; Section 4.4 presents the estimated number of firms, renovators, and workers seeking training and certification; Section 4.5 presents the incremental training costs; Section 4.6 presents the estimated certification, administrative and enforcement cost estimates; Section 4.7 presents the recordkeeping checklist provision cost estimates; Section 4.8 presents the total costs of the regulation; and Section 4.9 presents the total costs associated with various alternative regulatory options.

4.1 Definitions of Options

This economic analysis considers various regulatory options. The effective date for the recordkeeping checklist requirement is June 2010 under all options. However, options A through D differ in terms of the effective dates of the elimination of the opt-out provision. In addition, the economic analysis considers four options with varying work practice requirements, Options E1 through E4. Table 4-1 summarizes the options considered in this analysis; they are described in more detail below.

Options A and D both have effective dates of June 2010 for the elimination of the opt-out provision, but Option A does not phase in the opt-out elimination while Option D limits opt-out elimination to pre-1960 structures during Phase 1 of the regulation and expands the requirements to structures built between 1960 and 1978 in Phase 2, which has an effective date of June 2011. Options B and C have effective dates of January 2011 and June 2011 for the elimination of the opt-out provision, respectively and neither option phases in this requirement.

Options E1 through E4, analyzed in Section 4.9, have the same effective dates and universe of regulated structures as Option A, but consider alternative work practice requirements. Option E1 has the same containment requirements as specified in 40 CFR 745.85, but does not include any cleaning or cleaning

verification work practices. Option E2 has the same cleaning and cleaning verification requirements as specified in 40 CFR 745.85, but does not include any containment work practices. Option E3 has the same cleaning requirements as specified in 40 CFR 745.85, but does not include any containment or cleaning verification work practices. Option E4 has the same containment, cleaning and cleaning verification requirements as specified in 40 CFR 745.85, but does not restrict or prohibit any paint removal practices.

Table 4-1: Options Included in Economic Analysis

Option	Effective Dates and Scope For Opt-Out Elimination*	Containment, Cleaning, and Cleaning Verification Requirements	Paint Removal Practices Restricted or Prohibited
A	June 2010, no phase-in	Yes	Yes
B	January 2011, no phase-in	Yes	Yes
C	June 2011, no phase-in	Yes	Yes
D	June 2010 for pre-1960 housing, June 2011 for housing built between 1960 and 1978	Yes	Yes
E1	June 2010, no phase-in	Containment Only	Yes
E2	June 2010, no phase-in	Cleaning and Cleaning Verification Only	Yes
E3	June 2010, no phase-in	Cleaning Only	Yes
E4	June 2010, no phase-in	Yes	No

*The effective date for the recordkeeping checklist requirement is June 2010 under all options.

4.1.1 Affected Universe

The term "target housing" is defined in TSCA Section 401 as any housing constructed before 1978, except housing for the elderly or persons with disabilities (unless any child under 6 resides or is expected to reside in such housing) or any 0-bedroom dwelling. A child-occupied facility (COF) is defined as ''a building, or portion of a building, constructed prior to 1978, visited regularly by the same child, under the age of six, on at least 2 different days within any week (Sunday through Saturday period), provided that each day's visit lasts at least 3 hours and the combined weekly visits last at least 6 hours, and the combined annual visits last at least 60 hours. Child-occupied facilities may include, but are not limited to, day-care centers, preschools and kindergarten classrooms" as follows:

- **Kindergartens:** Located in public and private schools.

- **Pre-Schools and Daycare centers:** Organized (licensed) facilities located in public or commercial buildings.
- **Family daycare:** Organized (licensed) daycare facilities located in the provider's home.
- **Informal daycare:** Informal (i.e. not licensed) day care providers, including relatives and non-relatives. Some of these providers may be paid for their services.

Some COFs are also target housing (e.g., daycare facilities located in the provider's home). The 2008 LRRP rule applied to rental units, all target housing COFs, and all owner-occupied target housing units where a child under the age of 6 resides within the vintage categories specified above. The 2008 LRRP rule provided an opt-out provision for owner-occupied target housing units that are not COFs and where no child under the age of 6 or pregnant woman resides. The revisions to the LRRP program include the removal of this opt-out provision and an additional requirement that the renovator provide a copy of their recordkeeping checklist to owners and occupants of renovated structures.

4.1.2 Containment, Cleaning, and Verification Standards

The containment, cleaning, and verification standards discussed in this section are the same for Options A-D as for the 2008 LRRP rule. Options with alternative work practice are considered in section 4.9 of this analysis.

4.1.3 Occupant protection

Under Title 40 of the Code of Federal Regulations (CFR), Section 745.85(a)(1), work areas must be clearly defined with signs warning occupants and other persons not involved in renovation activities to remain outside of the work area. These signs must be posted before beginning the renovation and must remain in place until the renovation has been completed and the work area has been verified to have been adequately cleaned. If warning signs have been posted in accordance with HUD's Lead Safe Housing Rule (24 CFR §35.1345(b)(2)) or OSHA's Lead in Construction Standard (29 CFR §1926.62(m)), additional signs are not required by this proposal.

4.1.4 Containing the work area

Under 40 CFR §745.85(a)(2), a firm must contain the work area so that no visible dust or debris leaves the work area while the renovation is being performed. Containment refers to methods of preventing leaded dust from migrating beyond the work area. It includes everything from the simple use of disposable plastic drop cloths to the sealing of openings with plastic sheeting.

4.1.4.1 Interior renovations

Under 40 CFR §745.85(a)(2)(ii), a firm must take the necessary work site preparation steps in order to prevent dust and debris from leaving the work area. Renovation projects generate varying amounts of leaded dust, paint chips, and other lead-contaminated materials depending on the type of work, area affected, and applied work methods. For example, repairing a small area of damaged drywall would likely generate less lead-contaminated dust and debris than sanding a large area in preparation for painting.

4.1.4.2 Exterior renovations

Under 40 CFR §745.85(a)(2)(ii), a firm preparing the work area for an external renovation must close all doors and windows within and below the area undergoing renovation and to cover the ground with plastic sheeting or other disposable impermeable material extending out from the edge of the structure a sufficient distance to collect falling paint debris. In addition, doors within the work area that must be

used while the job is being performed must be covered with plastic sheeting to prevent dust and debris from entering the building.

4.1.5 Waste from renovations

Renovation projects can generate a considerable amount of waste material. Lead-contaminated building components and work area debris must be handled carefully to prevent the release of lead-contaminated dust and debris. Under 40 CFR §745.85(a)(3), a firm must contain the waste from renovation activities to prevent releases of dust and debris before the waste is removed from the work area for storage or disposal. If a chute is used to remove waste from the work area, it must be covered. At the conclusion of each work day and at the conclusion of the renovation, waste that has been collected from renovation activities must be stored under containment, or behind a barrier that prevents release of dust and debris out of the work area and prevents access to dust and debris.

In addition, transporting lead-based paint waste in uncovered vehicles is a possible source of releases of paint chips or dust. Therefore, lead-based paint waste from RRP activities must be transported under containment that prevents identifiable releases (e.g., inside a plastic garbage bag).

4.1.6 Cleaning the work area

Under 40 CFR §745.85(a)(4), a firm must clean the work area until no visible dust, debris, or residue remains. The firm must also conduct a more thorough, specialized cleaning, which would remove both visible debris and dust particles too small to be seen by the naked eye.

4.1.7 Cleaning verification

Under 40 CFR §745.85(b), a firm must conduct an additional cleaning verification step following the visual inspection. This step involves wiping the windowsills and floors with specialized cleaning cloths and comparing them to a cleaning verification card developed and distributed, or otherwise approved, by EPA for the purpose of determining, through comparison of disposable cleaning cloths with the card, whether post renovation cleaning has been properly completed.

4.1.8 Exceptions

As defined in 40 CFR §745.83, minor repair and maintenance activities (including minor electrical work and plumbing) are not considered renovations and are not subject to the work practice requirements described above if they disrupt 6 square feet or less of a painted surface per room for interior renovations or 20 square feet or less for exterior renovations. Such activities are only considered minor maintenance if they do not involve prohibited or restricted practices, window replacement, or demolition of painted surface areas.

Under 40 CFR §745.82, the work practice requirements of the rule do not apply to renovations that only affect painted components that a certified inspector or risk assessor has determined do not contain regulated lead-based paint (at least 1.0 mg/cm^2 or 0.5% by weight lead). Furthermore, the work practice requirements do not apply to renovations that only affect painted components that have been demonstrated to be free of regulated lead-based paint through the use of an EPA-recognized test kit by a certified renovator. Test kits for LBP that are currently available have false positive rates that range from 47 percent to 78 percent. EPA believes that by the end of 2010, improved test kits will be developed that will have a false positive rate of 10 percent or less.

4.2 Estimating the Number of Regulated Renovation, Repair, and Painting Events

4.2.1 Estimating the Number of Regulated Renovation, Repair, and Painting Events in Target Housing

To achieve the rule's objective of controlling lead exposure through containment, cleanup, and verification, most of the compliance costs associated with the RRP rule's work practices pertain to the room or area where the renovation work is performed. Therefore, this analysis defines a regulated event as any group of renovation tasks where two or more square feet of a painted surface are disturbed in a specific room or area of a housing unit. The 2003 American Housing Survey (AHS) is the primary data source for the estimates of regulated RRP events that occur in owner-occupied housing. The 1995 Property Owners and Managers Survey (POMS) is the primary data source utilized for estimating the number of regulated events in renter-occupied housing.

Following the methodology from the economic analysis of the 2008 LRRP rule (EPA 2008), event counts are estimated separately by housing type (single-family or multi-family) and tenure of occupant (owner or renter). The housing units affected by the elimination of the opt-out provision include both single-family and multi-family owner-occupied units.[1] Since single-family owner-occupied units have larger average sizes compared to multi-family owner-occupied units, separate work practice compliance costs are estimated for these two types of housing units. Since all rental units are ineligible for the opt-out provision under the 2008 LRRP rule, no work practice costs, training costs, or certification costs are associated with these units under the LRRP rule revision. However, recordkeeping checklist provision costs are estimated for events in all housing types, since this provision affects both the units regulated under the 2008 LRRP rule and the units that will be regulated under the removal of the opt-out provision.

Available renovation data do not include information specific enough to determine when a renovation task disturbs a painted surface or when renovation tasks are performed together in the same room or area. Thus, it was necessary to make some assumptions about which types of renovation tasks are likely to disturb painted surfaces and which sets of tasks are likely to be performed together as part of one renovation project. Note that the counts of exterior events for multi-family housing units are adjusted to correspond to building-specific compliance costs. [2]

4.2.1.1 Data Sources

U.S. Census: American Housing Survey

According to the U.S. Census (2005g):

The survey is conducted by the Bureau of the Census for the Department of Housing and Urban Development (HUD).

The American Housing Survey (AHS) collects data on the Nation's housing including apartments, single-family homes, mobile homes, vacant housing units, household characteristics, income, housing and neighborhood quality, housing costs, equipment and fuels, size of housing unit, and recent moves. National data are collected in odd numbered years. Data for each of 47 selected Metropolitan Areas are collected currently about every six years.

[1] Multi-family owner-occupied units include rental properties where the owner resides in one of the units, owner-occupied condo units, and owner-occupied co-op units.

[2] For example, when siding is replaced on the outside of a three-unit building, the analysis accounts for this as one siding replacement event rather than the siding replacement outside of three units.

The surveys utilized in this analysis, 1997 and 2003, have sample sizes of 45,932 and 55,452, respectively. Of the housing units sampled, 33,549 and 35,996, for the 1997 and 2003 surveys respectively, have at least one bedroom, are not public housing, receive no rent subsidies, and were built before 1980. The 2003 AHS groups housing units built in the 1970's as units built between 1970-74 or 1975-1979, so this analysis counts all housing units built before 1980 in the pre-1978 regulated universe.

The sample weights provided by the U.S. Census for analyzing the AHS data were designed so that estimates using the provided sample weights would represent the national housing population. However, the U.S. Census weights were not designed to correct for underreporting within housing units—such as information reported on occupants living in the housing units. Since there is underreporting within-housing units, estimates of the number of individuals calculated using the U.S. Census weights results in lower population estimates than those estimated using other U.S. Census population data sources. In addition, according to Harvard's Joint Center for Housing Studies (personal communication with Kermit Baker, August 2005), it appears that the 2003 survey labels too many housing units as vacant; these units are actually occupied by individuals that did not respond to the survey. To correct for this bias, the Joint Center for Housing Studies has adjusted the weights provided by the U.S. Census for the 2003 AHS. These adjusted weights provided by the Joint Center for Housing Studies are utilized for all of the calculations using the 2003 AHS in this analysis; population estimates calculated from the AHS are more closely aligned with other U.S. Census population estimates when calculated with these adjusted weights.

U.S. Census: Property Owners and Managers Survey

According to the U.S. Census (2005h):

The Property Owners and Managers Survey (POMS) was designed to learn more about rental housing and its providers. The purpose was to gain a better understanding of the property owners and managers on whom the nation depends to provide affordable rental housing and what motivates their rental and maintenance policies. Survey interviews were conducted between November 1995 and June 1996.

A nationwide sample of approximately 16,300 housing units which were rented or vacant-for-rent in the 1993 American Housing Survey National Sample (AHS-N) was selected and a questionnaire was mailed to the property owner, manager, or other agent of the owner of each property containing a selected unit. Detailed information was collected on maintenance, management practices, tenant policy, financial aspects of rental property ownership, owner characteristics, and related topics.

POMS Sample Areas

The addresses included in the POMS sample were limited to counties and independent cities in the 438 sampling areas used for the Census Bureau's 1993 American Housing Survey (AHS) National Sample.

Units Included

A unit (and the property containing the unit) was included in the survey if it was a privately owned rental unit in the 1993 AHS-N and was still a rental at the time of the POMS (November 1995 to June 1996). A unit was considered a rental if it was either rented for cash rent, occupied by someone other than the owner without payment of cash rent, or vacant but available for rent.

Since the POMS survey is relatively old (1995), this analysis first calculates the percentage of rental-housing units performing renovations according to the POMS and then applies these percentages to the corresponding number of rental-housing units in 2003 according to calculations using the AHS. This approach is described in greater detail in the section below.

4.2.1.2 Number of Regulated Events in Owner-Occupied Housing Units

The 2003 AHS is the primary data source used for estimating the number of RRP events in owner-occupied housing for which compliance costs will be incurred. The 1997 AHS is also used for estimating the number of RRP events since it contains some more specific renovation information that was not included in the 2003 survey. AHS respondents report information about the ages of householders who are defined in the survey as persons who live or sleep there most of the time. Thus, child-occupied households are defined as those households with a householder under the age of 6 at the time of the RRP. Child-occupied households are estimated to be households with a householder between the ages of one and seven at the time of the survey since it is assumed that any RRP reported occurred a year earlier (RRP performed up to two years earlier may be reported). It follows that a household is defined as being occupied by a pregnant woman if there is a woman of childbearing age and a child who is under the age of one at the time of the survey. This section describes how the numbers of events are estimated from the renovation module of the AHS and the methodology for estimating the number of Interior Painting and Exterior Painting events using data from the (one-time) 1997 lead paint module of the AHS.

AHS Renovation Tasks

The 2003 AHS allows respondents to report 40 different renovation tasks; this analysis categorized 24 of these 40 as tasks that may disturb more than 6 square feet or more per room of a painted surface for interior renovations, or 20 square feet or more for exterior renovations. Since tasks performed within two years of the survey can be reported, it is assumed that half occurred in the first year and half occurred in the second (i.e. the total number of events counted for the two year period is divided by two). Since do-it-yourself RRP is not covered by the rule, only tasks that are reported to be performed by professionals are included in the analysis.

Table 4-2 lists these 24 AHS renovation tasks by their event category. Note that while the respondents do not specifically report whether or not painted surfaces were disturbed, the survey instrument instructed them to only include major work.[3] This analysis groups the 24 AHS tasks into seven event categories (bathroom event, kitchen event, addition event, window/door event, wall-disturbing event, whole exterior event, contained exterior event) based on the room or area where each AHS renovation task is likely to be performed.

When a household reported multiple tasks to AHS that fall under the same EPA event category, it is assumed that these tasks are performed together in the same area of the housing unit. Therefore, one set of compliance costs are assumed to apply to each event. For example, if a household reported to AHS that they replaced their air conditioning system and replaced their heating system, this analysis assumes that they would incur the compliance costs associated with one wall-disturbing event. Compliance costs are dependent on the size of the work area. Thus, when a household reported a wall-disturbing task to AHS that is not specific to a particular room as well as a room-specific task—e.g. remodeling the kitchen (specific to the kitchen) and replacing water pipes (not room-specific)—this analysis accounts for this as one event with a work area that includes the room in which a room-specific task was reported. However, if a household reported tasks to AHS corresponding to multiple room-specific events (such as remodeling the kitchen and bathroom), these are counted as separate events. .

As shown in Table 4-2 and discussed above, some tasks reported to AHS are not necessarily confined to a specific room or area of the unit. Most of these tasks are likely to involve disturbing a wall or the ceiling

[3]Specifically, the survey instrument instructed respondents with the following language: "We are only interested in jobs that were MAJOR alterations or improvements, such as rewiring, a new roof, new windows or doors. Do NOT include minor repairs or other routine maintenance." This analysis assumes that jobs that were not reported to AHS would qualify for the minor maintenance exception under the LRRP rule.

(e.g., replacing wiring or pipes); in these cases, the tasks are assigned to a wall-disturbing event. Window or door replacement tasks are assigned to their own event category, because (as described in Section 4.2.1.5) there is a higher likelihood that windows and doors contain lead-based paint (LBP), and this analysis accounts for the likelihood of LBP by component type.

As stated above, the 2003 AHS did not explicitly ask respondents whether a renovation task involved disturbing a painted surface. Therefore, in order to estimate the number of events subject to the rule's requirements, this analysis makes assumptions about which tasks might disturb paint. In general, when a tasked reported to AHS will sometimes involve disturbing a painted surface, it is assumed that compliance costs are incurred each time that task is reported to AHS. For example, replacing internal water pipes will sometimes, but not always, require disturbing painted walls to access old pipes and replace them with new ones. However, the analysis makes no adjustment to the AHS data to account for the instances where no painted surfaces are disturbed or when a job will qualify for the minor maintenance exception[4]. Sufficient data for making such an adjustment are not available. Thus, these assumptions may lead to an overestimate of the number of regulated events.

In the case of adding or replacing heating equipment (AHS task 58) and/or central air conditioning equipment (AHS task 57)—Heating Ventilation and Air Conditioning (HVAC) tasks—it is assumed that only a fraction of these HVAC tasks require disturbing a painted surface. In addition, 18 percent of the households reporting tasks listed in Table 4-2 to AHS reported at least one HVAC task without reporting any other wall-disturbing task. Therefore, assuming that all HVAC work disturbs painted surfaces likely results in a substantial overestimate of wall-disturbing events that disturb LBP and are subject to the LRRP rule.

The percentages of HVAC tasks that are assumed to disturb painted surfaces are estimated using the 1997 AHS. Unlike the 2003 AHS, the 1997 AHS distinguishes between installing new HVAC equipment and replacing existing equipment. Since disturbing a painted surface is most likely to occur while performing work on the HVAC ducts (which often are behind painted walls), it is assumed that this occurs when new systems are installed but not when existing systems are replaced.[5]

In addition to the seven event definitions in Table 4-2, the analysis estimates costs for Interior Painting events and Exterior Painting events. The remodeling module of the 2003 AHS data does not cover these types of activities but the 1997 AHS did, so data from the 1997 (one-time) lead module are utilized to estimate the number of these events.

[4] Jobs that disturb 6 square feet or less of a painted surface per room for interior renovations or 20 square feet or less for exterior renovations; and do not involve prohibited or restricted practices, window replacement, or demolition of painted surface areas.

[5] When heating equipment work (but not air conditioning work) is reported, 7 percent and 9 percent of these tasks involve adding a new system for single- and multi-family units, respectively. When air conditioning equipment work (but not heating work) is reported, 36 percent and 17 percent of these tasks involve adding a new system for single- and multi-family units, respectively. When both heating and air-conditioning equipment work is reported, 52 percent and 29 percent of the households install a new system for single- and multi-family units, respectively.

Table 4-2: Renovation Events Used in the Analysis and Corresponding 1997 and 2003 AHS Renovation Tasks		
EPA Renovation Event	**2003 AHS Task ID**	**AHS Task Description**
Bathroom Event	71	Remodeled bathroom
Kitchen Event	72	Remodeled Kitchen
Addition Event	7	Added Bathroom onto home
	8	Added Kitchen onto home
	9	Added Bedroom onto home
	10	Added other inside room onto home
	35	Bedroom created through structural changes
	36	Other room created through structural changes
	73	Bathroom created through structural changes
Window/Door Event	45	Added/Replaced doors/windows to home
Wall-Disturbing Event	40	Added/replaced internal water pipes in home
	42	Added/replaced electrical wiring, fuse boxes, or breaker switches in home
	47	Added/Replaced plumbing fixtures in home
	55	Installed paneling or ceiling tiles
	57	Added/replaced central air conditioning
	58	Added/replaced built-in heating equipment
	64	Other major improvements or repairs (up to three could be reported)
	74	Added/replaced security system in home
Whole Exterior Event	38	Added/replaced siding on home
Contained Exterior Event	11	Added attached garage onto home
	12	Added porch onto home
	13	Added deck onto home
	14	Added carport onto home
	69	Added/replaced shed, detached garage, or other building
Interior Painting	*	Interior Painting
Exterior Painting	*	Exterior Painting
* Not reported in 2003 AHS.		

Interior Painting Events

In the 1997 AHS, respondents were asked two questions related to painting activities that are used to estimate the number of Interior Painting events. Respondents were asked:

- Was there any painting done on the inside of the unit?
- Before painting, did anyone sand or scrape off any of the old paint?

The number of painting events involving sanding or scraping is important because painting without sanding, scraping, or other substrate preparation does not qualify as disturbing LBP and is not subject to the LRRP rule.

In contrast with the other AHS renovation questions, respondents were not asked to specify whether the work was performed by a professional. Thus, obtaining a count of the number of Interior Painting events is not as simple as adding up the number of respondents that answered yes to both of these questions. It is also necessary to estimate: (1) how many of the respondents that had painting done with sanding or scraping hired a professional to do the work, and (2) how many of these events occur in conjunction with other professional events reported (so the analysis does not double count if, for example, someone painted with sanding or scraping in their kitchen and reported both painting with sanding or scraping and remodeling their kitchen).

This analysis assumes that 44 percent of the interior painting with sanding and scraping reported in AHS was performed by professionals. An Angie's List (Bucksot 2006) online poll found that 44 percent of respondents reported that they hired professionals to perform painting rather than doing it themselves. Since Angie's List is used to find professional contractors it seems likely that respondents would be more likely to hire professionals than the general population. Thus, this assumption may lead to an overstatement of the number of interior painting events that are subject to the rule.

Exterior Painting Events

This analysis assumes that exteriors of 100 percent of homes with some paint on their exterior are painted with sanding or scraping every eight years.[6] Since data on the percentage of homes with some paint on their exteriors are not available, it is assumed that 75 percent of all pre-1978 homes have some exterior paint; this assumption is based on data from HUD's (2001) *National Survey of Dust Lead Hazards and Allergens in Housing*, which indicates that 70 percent of pre-1960 homes have some lead paint on their exterior. Not all pre-1960 homes have exterior paint. But of those that do, nearly all have at least some exterior lead-based paint. Since nearly all exterior painted surfaces on pre-1960 homes are likely to have some lead paint, it was assumed that slightly more, 75 percent, of all pre-1978 homes have exterior painted surfaces. The annual number of Exterior Painting events is estimated as one eighth of the number of regulated structures with exterior paint.

4.2.1.3 Number of Regulated Events in Renter-Occupied Housing Units

The 1995 POMS is the primary data source used for estimating the number of RRP events in renter occupied housing where compliance costs will be incurred. Renter occupied units are only affected by the rule's additional recordkeeping checklist requirement. The 1997 and 2003 AHS are also used for estimating the number of renter-occupied RRP events, since these data contain more current estimates of the number of potentially regulated households as well as some other information not available from the POMS.

This section first describes how the POMS data are used to obtain the annual percentage of renter-occupied housing units where there is a regulated RRP event. Second, it describes the methods employed for combining the percentages estimated from the POMS and the AHS data to obtain an estimate of regulated RRP events in renter-occupied units for the first year the rule is in effect.

POMS Data

The POMS data generally has less detail then the AHS but is still the best source of renter-occupied renovation information available. The POMS asked property owners or managers about 12 or 13 types of maintenance and repair activities (for single-family and multi-family units respectively) and about 11 types of capital improvements that may have been made to their properties. It is likely that 12 of these

[6] According to the Painting and Decorating Council, exteriors of homes are usually painted every 4-12 years; thus, the analysis uses the midpoint, eight, for estimating the number of Exterior Painting events.

maintenance, repair, or upgrade activities require disturbing painted surfaces; these activities are listed in Table 4-3 according to the event category that they are classified by in this analysis.

The percentage of units where at least one of the RRP activities listed under each event was performed is calculated separately for single- and multi-family units. This is because the average square footage of these two groups of housing differs, and the estimated costs for many of the work practices required by the rule depend on the size of the work area. Similar to the owner-occupied event estimates, when multiple tasks are reported in POMS, this analysis assumes that these tasks are performed together in the same area. Therefore, the compliance costs are estimated based on those costs associated with the task with the largest work area. Unlike in the AHS data, POMS respondents were not asked whether sanding or scraping was performed before painting (and painting without sanding or scraping is not subject to the rule's requirements). Therefore, it is assumed that 40 percent of the households reporting interior painting are subject to the rule's requirements based on the percentage of rental households that reported sanding or scraping before painting in the AHS.[7]

In POMS, questions about capital improvements were asked about the entire property rather than about a specific unit. To account for this difference, it was assumed that a specific unit was worked on 40% of the time an upgrade was reported for a property. Since properties average about three units each, this assumption results in more renovation compared to the assumption that upgrades are performed on one unit at a time. The assumption utilized in this analysis results in renovation frequencies in multi-family properties that are similar to those estimated for single-family properties.

Window or door replacement tasks are assigned to their own event category, because (as described in Section 4.2.1.5 there is a higher likelihood that windows and doors contain LBP, and this analysis accounts for the likelihood of LBP by component type. Since POMS does not ask respondents about replacing windows or doors, the frequency for these tasks is assumed to be the same in rental units as was reported in AHS for owner-occupied units. Therefore, it is assumed that 3.7 and 3.4 percent of renter-occupied single- and multi-family units, respectively, replace windows or doors each year. Since these improvements are likely to be reported in the POMS data as "other major upgrades," this analysis adjusts downward the numbers of "other major upgrade" tasks that are reported in POMS to reflect this. Since 10 and 14.8 percent of owner-occupied single- and multi-family units, respectively, reported other major upgrades, 37 and 23 percent of "other major upgrades" reported in the POMS are assumed to be window or door replacements, for single- and multi-family units respectively.[8]

Similar to the methodology for the owner-occupied RRP event estimates, it is assumed that HVAC related activities do not always incur compliance costs. The analysis assumes that compliance costs are incurred 28 percent and 15 percent of the time for single- and multi-family units respectively, which is the percentage of the time new equipment is installed when HVAC work is performed in owner-occupied units according to the 1997 AHS.

[7] The 40 percent of rental units that reported sanding or scraping before painting in AHS compares to the 35 percent of owner-occupied units that reported sanding or scraping before painting in AHS.

[8] 37% = 3.7%/10% and 23% = 3.4%/14.8%.

Table 4-3: Renovation Events Used in the Analysis and Corresponding 1995 POMS RRP Activities	
EPA Event Category	**POMS Task**
Interior Painting Event	Any Interior Painting in 1995
Bathroom Event	Upgraded Bathroom in 1995
Kitchen Event	Upgraded Kitchen in 1995
Wall-Disturbing Event	Unit Rewired in 1995
	Other major repairs in 1995[a]
	Upgraded Plumbing in 1995
	Upgraded Security System in 1995
	Other Major Upgrade in 1995
	Repaired Heat or AC in 1995
	Upgraded Heat in 1995
	Upgraded AC in 1995
	Other Major Upgrade in 1995[a]
Exterior Painting Event	Any Exterior Painting in 1995 (single-family units only)
Whole Exterior	**
Contained Exterior	**

[a] Some 'Other Major Upgrades' are counted as wall-disturbing events, others are counted as Window/Door Replacement events. See text above for a description of how the task is apportioned.

** Not reported in POMS. Assumed to occur with the same frequency as in owner-occupied units reported in AHS.

4.2.1.4 Extrapolating from the POMS and AHS Data

After calculating the percentages of rental units where RRP was performed in the event categories listed in Table 4-3, the number of renter-occupied events in these categories are calculated by applying the event frequencies calculated with the 1995 POMS data to the number of rental-units according to the 2003 AHS. It is assumed that Whole Exterior events and Contained Exterior events occur in rental units with the same frequency as they do in owner-occupied units (since data on these types of events are not available in the POMS). Additional tasks reported in the AHS data but not the POMS data are not estimated for rental units since these renovation activities are fairly uncommon in rental units and likely to already be reported as "other major upgrade" and counted as a wall-disturbing event.

Estimating the Number of Target Housing Events Affected by the Removal of the Opt-out Provision

The LRRP revisions remove the opt-out provision from the LRRP rule for certain owner-occupied housing units. Owner-occupied target housing units where a child under the age of six or a pregnant woman resides, rental units, and COFs (including owner-occupied target housing units that qualify as COFs) would not be affected by the elimination of the opt-out provision because these units were not eligible for this provision under the 2008 LRRP rule.

The number of housing units that would be affected by the elimination of the opt-out provision is estimated by taking the number of owner-occupied housing units and subtracting the number of owner-occupied target housing units that: (1) have a child under the age of six or pregnant woman in residence, or (2) are COFs.

Owner-occupied housing units with a child under the age of six or pregnant woman in residence

The 2003 AHS data identifies owner-occupied housing units where a child under the age of six or a pregnant woman resides. AHS respondents report information about the ages of householders, who are defined by the survey as persons who live or sleep there most of the time. Thus, child-occupied households are defined as those households with a householder under the age of 6 at the time of the RRP. Child-occupied households are estimated as households with a householder between the ages of one and seven at the time of the survey since it is assumed that any RRP reported occurred a year earlier (RRP performed up to two years earlier may be reported). It follows that a household is defined as being occupied by a pregnant woman if there is a woman of childbearing age and a child who is under the age of one in the household at the time of the survey.

Owner-Occupied housing units that are COFs

COFs in target housing include family daycare providers and the homes of family, friends, and neighbors who regularly care for someone else's children. The estimated number of target housing COFs includes care provided with and without compensation and relies primarily on estimates of the size of the childcare workforce (Center for the Child Care Workforce 2002). The Center for the Child Care Workforce (2002) report includes: (1) data on family child care providers caring for unrelated children in their own homes, (2) paid relatives and non-relatives providing child care, and (3) unpaid relatives and non-relatives providing child care.

The number of target housing COFs is projected based on estimates of the caregiver workforce in the Center for the Child Care Workforce (2002) report. Based on a Wilder Research Center report, it is assumed that 10 percent of family child care providers caring for unrelated children in their own homes employ 2 workers (Wilder Research Center 2001, p.16). For the remaining childcare providers, one worker is assumed per location. Based on 2003 American Housing Survey data for the general population of housing, it is assumed that 65 percent of these housing units were built before 1978.

The number of target housing units where child care is provised was also adjusted to exclude those units that are already included in the RRP rule universe because care is provided in a child's own home, or where the units do not qualify as COFs because less than six hours of care per-week is provided[9]. In addition, the number of target housing COFs that are not eligible for the opt-out provision under the 2008 LRRP rule because they are rental units or have a child under the age of six or pregnant woman in residence must be estimated to avoid double counting. The basis for these adjustments is discussed below.

Care Provided in Child's Own Home

It is assumed that 22 percent of relatives and non-relatives (paid or unpaid) providing care provide it in the child's home based on a Wilder Research Center (2005, p.28) report on the results of the 2004 Minnesota Statewide Household Child Care Survey.

Less Than Six Hours of Care Per-Week is Provided

Of those providing care in their own home, it is assumed that 27 percent of relatives and non-relatives (paid or unpaid) provide care for less than six hours a week (Wilder Research Center 2005, p.28). All family daycare providers caring for unrelated children in their own homes are assumed to care for at least one child for more than six hours a week.

[9] There is not sufficient data to adjust for the other COF criteria that the building is visited at least 2 different days within any week, that each day's visits lasts at least 3 hours, or that the combined annual visits last at least 60 hours.

Caregiver Lives in a Rental Unit

It is assumed that family, friend, and neighbor caregivers have the same likelihood of living in a rental unit as the general population of target housing occupants (39 percent).

Caregiver has a Child Under Six Living With Them

Based on the January 2006 Current Population Survey (U.S. Bureau of Labor Statistics 2006), 16 percent of Child Care Workers have children under six. Thus, it is assumed that 16 percent of in-home family daycare providers (formal care providers) caring for unrelated children in their own homes have children under the age of six. Based on the Wilder Research Center (2005, p.19) report, 57.5 percent of family, friend, and neighbor caregivers (informal care providers) have children under the age of 12. Thus it is assumed that half as many, or 29 percent, have children under the age of six.

Table 4-4 presents the estimated number of target housing COF units regulated under the 2008 LRRP rule.

Table 4-4: Number of Owner-Occupied Pre-1978 Target Housing Units Regulated Under 2008 LRRP Rule (Excluding Rental Units and Units Where a Child Under 6 or Pregnant Woman Resides)

Type of Care [a]	Number of Target Housing COFs (thousands)[b]	*In child's own home*	*Less than 6-hours per-week*	*Post-78*	*In rental unit*	*Child under 6 resides*	*Pregnant woman resides*	Total Adjustment[c]	Total Regulated Units (thousands) [d]
Paid In-Home Family Daycare	**591**	n.a.	n.a.	35%	n.a.	16%	1.1%	**55%**	**319**
Paid Relative Care	**804**	22%	27%	35%	39%	29%	1.1%	**84%**	**128**
Unpaid Relative and Non-Relative Care	**2,354**	22%	27%	35%	39%	29%	1.1%	**84%**	**376**
Total (Pre-78)									**824**
Total (Pre-60) [e]									**424**

a. Paid In-Home Family Daycare refers to formal licensed daycare located in the provider's home. Paid relative care is when family members are paid to care for the child in the family member's home (unlicensed care). Unpaid relative and non-relative care refers to informal unpaid care provided at the homes of family, friends or neighbors (unlicensed care).

b. Based on the size of the childcare workforce (Center for the Child Care Workforce 2002), assuming 1.1 workers per location for paid in-home family daycare and 1 worker per location for other types of care.

c. Calculated as one minus the product of one minus the adjustments. e.g., for the first row, 55% = 100% - (100%-35%)*(100%-16%)*(100%-1.1%).

d. Components may not sum to totals due to rounding. Not adjusted for compliance rates.

e. Adjusted based on the total number of target housing units by vintage.

Source: U.S. Census Bureau 1995, 1997, and 2003; EPA Calculations.

Target Housing Units Affected by the Removal of the Opt-out Provision

As described in Table 4-4, there are about 824,000 target housing COFs where no child under the age of six or a pregnant woman resides. Thus, of the 47,080,000 owner occupied housing units (see Section 2.8 of Chapter 2):

- A child under six resides or pregnant woman resides in 6,370,000 units (see Section 2.8 of Chapter 2)
- About 824,000 units are COFs where no child under the age of six or pregnant woman resides (see Table 4-4)

Therefore, about 39,886,000 units would be affected by the elimination of the opt-out provision.[10] The frequency of RRP events in these housing units is estimated using the 2003 AHS data as described in section 4.2.1.2.

4.2.1.5 Likelihood of Positive Test Kit Result for LBP

It is assumed that all certified renovators use a test kit for LBP before performing any RRP, given that performing this relatively inexpensive test may allow the renovator to avoid the costs of using Lead-Safe Work Practices (LSWP) that are required when LBP is disturbed. Since LBP is most likely to be found on certain components of housing units—and therefore most likely to be disturbed during certain types of renovations—the analysis accounts for this by estimating LBP likelihoods specific to each event type. These LBP likelihoods are estimated using data from HUD's 2000 National Survey of Lead and Allergens in Housing (HUD 2001).[11] The survey has information on approximately 630 housing units built before 1978 including data on the presence of LBP in certain rooms (e.g. kitchen) and on certain components or surfaces (e.g. floors, walls, ceilings, doors and windows).

The probability that LBP is disturbed during a RRP event is estimated as the probability of LBP in any of the rooms where RRP is performed or on any of the components that might be disturbed during the RRP event. This assumption leads to an upward bias in the estimates of the number of events where LSWP are required. For example, if there is LBP in the kitchen, it is assumed that a kitchen remodeling will disturb LBP. However, the LBP component(s) will not necessarily always be disturbed. For example, the LBP in the kitchen may be on the window trim, but the renovation may not disturb the window trim. Unfortunately, there is no reasonable basis for correcting this bias using currently available data. For the purposes of this analysis, data from HUD (2001) are used to estimate event-specific likelihoods of positive test kit results based on the estimated likelihood of disturbing LBP for each event type, as described in Table 4-5.

[10] 39,886,000 = 47,080,000 – 6,370,000 – 824,000.

[11] In addition to the likelihood of the presence of lead-based paint varying by age of housing, there is evidence that the concentration of lead in the paint varies by the age of housing. A review of the data in HUD 2000 is presented in EPA 2005c. This document is available in the docket for this rulemaking.

Table 4-5: Types of Estimates Used for Calculating the Likelihood of Disturbing LBP for Each Event Type	
Event Type	**Estimate of Likelihood of Disturbing LBP**
Kitchen	Likelihood of LBP in the kitchen
Bathroom	Likelihood of LBP in "other room" (up to two "other rooms" were inspected for LBP in each housing unit; these rooms might be bathrooms, living rooms, dens, or laundry rooms)
Additions	Likelihood of LBP on the interior or exterior of the unit (since these events typically require some demolition of the interior and exterior)
Wall-Disturbing	Likelihood of LBP on any walls, floors or ceilings of the housing unit
Window/Door Replacement	Likelihood of LBP anywhere on the interior or exterior of windows and doors
Interior Painting	Likelihood of LBP anywhere in interior of unit
Whole Exterior	Likelihood of LBP anywhere on exterior of unit
Contained Exterior	Likelihood of LBP anywhere on exterior walls of unit (since Contained Exterior events—such as replacing a porch—are likely to disturb exterior walls, but not very likely to disturb other exterior components such as windows
Exterior Painting	Likelihood of LBP anywhere on exterior of unit
EPA estimated LBP Likelihoods with room and component/surface specific data from HUD (2001).	

Test kits for LBP that are currently available have false positive rates that range from 47 percent to 78 percent. This analysis assumes a false positive rate of 63 percent, the midpoint, for the first year following rule implementation. This analysis assumes that an improved test kit that will have a false positive rate of 10 percent or less will be in use by June 2011.[12] A false negative rate of 5 percent is also assumed for both the current and improved test kits. Thus, the likelihood of a positive test kit result in the first year is estimated as 95 percent of the likelihood of LBP, plus 63 percent of the percentage of homes without LBP. In the second year, the likelihood of a positive test kit result is estimated as 95 percent of the likelihood of LBP plus 10 percent of the percentage of homes without LBP. Table 4-6 shows the likelihoods of LBP that are used to estimate the percentage of events where LBP is disturbed.

Table 4-6: Likelihood of LBP									
Year Built	**Kitchen**	**Bathroom**	**Addition**	**Wall-Disturbing**	**Window/ Door**	**Interior Painting**	**Whole Exterior**	**Contained Exterior**	**Exterior Painting**
Likelihood of LBP									
Pre-1930	53%	34%	87%	40%	81%	79%	70%	55%	70%
1930-1949	45%	27%	75%	25%	71%	64%	70%	35%	70%
1950-1959	23%	12%	67%	16%	56%	38%	55%	27%	55%
1960-1979	6%	4%	22%	5%	14%	14%	13%	10%	13%
Source: EPA calculations using HUD (2001)									

In cases where a household performed more than one interior event, the likelihood of disturbing LBP is estimated as the likelihood of LBP anywhere in the interior of the unit. There are two exceptions to this: (1) when one of the events is an Addition, the Addition likelihood is used, and (2) when the sum of the

[12] EPA believes that the sensitivity of test kits can be adjusted so the results reliably correspond to one of the two Federal standards for lead-based paint (1.0 mg/cm^2 and 0.5% by weight). EPA is working on the development of test kits that accurately identify both the presence and absence of lead in paint at levels that exceed the Federal standards. EPA is confident that improved test kits can be commercially available by September 2010, although for ease of computation, this analysis does not assume they will be in use until June 2011.

individual event probabilities is less than the likelihood of LBP anywhere in the interior of the unit, the sum of the event probabilities is used. These simplifying assumptions are necessary because the data are not sufficient for calculating the joint probabilities that would be necessary for relaxing this assumption. As a result, the estimates of the number of events where LSWP will be used are biased upward. That is, for a housing unit performing multiple interior events, it is assumed that if there is LBP in the housing unit, all the interior events in that unit require LSWP. However, the LBP component(s) may be disturbed only in certain areas throughout the house, requiring less containment than is assumed. Similar to the assumptions pertaining to households performing multiple interior events, for households performing multiple exterior events the likelihood of disturbing LBP is assumed to be the maximum likelihood for the events performed. Unlike for interior events, this is always the same as the largest and most costly exterior event that determines the housing unit's exterior compliance costs.

4.2.1.6 Event Sizes

For interior events, the average square footage of particular rooms was determined by taking the average square footage of the whole unit from the AHS and reviewing house plans for homes of similar square footage (Homestyles.com 2002). The work area sizes for wall-disturbing events were estimated as follows:

Table 4-7: Kitchen and Bathroom Event Size Definitions

Bathroom (one bathroom-sized work area)	One average work area size. *48 Square Feet.*
Kitchen (one kitchen-sized work area)	One average work area size: *160, 120, and 80 Square Feet for single-family-owner, single-family-renter, and multi-family units, respectively.*

Table 4-8: Wall-Disturbing Event Size Definitions	
Small (bathroom-sized)	Where bathrooms were or were **not** remodeled, kitchens were **not** remodeled, rooms were **not** added, and **less than 3** of the following tasks were performed: (1) Added/Replaced Internal Water Pipes In Home, (2) Added/Replaced Plumbing Fixtures In Home, (3) Added/Replaced Electrical Wiring To Home, (4) Installed Paneling Or Ceiling Tiles, (5) Added/Replaced Central Air Conditioning, (6) Added/Replaced Built-In Heating Equipment, (7) Added/Replaced Security System In Home, (8) HVAC work; Or where **one room was added**, bathrooms were **not** remodeled, kitchens were **not** remodeled, and **less than 3** of the following tasks were performed: (1) Added/Replaced Internal Water Pipes In Home, (2) Added/Replaced Plumbing Fixtures In Home, (3) Added/Replaced Electrical Wiring To Home, (4) Installed Paneling Or Ceiling Tiles, (5) Added/Replaced Central Air Conditioning, (6) Added/Replaced Built-In Heating Equipment, (7) Added/Replaced Security System In Home, (8) HVAC work *48 Square Feet.*
Medium (kitchen-sized)	Where bathrooms were **not** remodeled, kitchens **were or were not** remodeled, rooms were **not** added, and **less than 3** of the following tasks were performed: (1) Added/Replaced Internal Water Pipes In Home, (2) Added/Replaced Plumbing Fixtures In Home, (3) Added/Replaced Electrical Wiring To Home, (4) Installed Paneling Or Ceiling Tiles, (5) Added/Replaced Central Air Conditioning, (6) Added/Replaced Built-In Heating Equipment, (7) Added/Replaced Security System In Home, (8) HVAC work; Or where **one room was added**, bathrooms were **not** remodeled, kitchens were **not** remodeled, and **3 or mor**e of the following tasks were performed: (1) Added/Replaced Internal Water Pipes In Home, (2) Added/Replaced Plumbing Fixtures In Home, (3) Added/Replaced Electrical Wiring To Home, (4) Installed Paneling Or Ceiling Tiles, (5) Added/Replaced Central Air Conditioning, (6) Added/Replaced Built-In Heating Equipment, (7) Added/Replaced Security System In Home, (8) HVAC work *160, 120, and 80 Square Feet for single-family-owner, single-family-renter, and multi-family units, respectively.*
Large (size of a bathroom and kitchen)	Where **bathrooms and kitchens were remodeled**, rooms were **not** added, and **at least 1** of the following tasks were performed: (1) Added/Replaced Internal Water Pipes In Home, (2) Added/Replaced Plumbing Fixtures In Home, (3) Added/Replaced Electrical Wiring To Home, (4) Installed Paneling Or Ceiling Tiles, (5) Added/Replaced Central Air Conditioning, (6) Added/Replaced Built-In Heating Equipment, (7) Added/Replaced Security System In Home, (8) HVAC work; Or where **at least two rooms were added** and at **least 1** of the following tasks were performed: (1) Added/Replaced Internal Water Pipes In Home, (2) Added/Replaced Plumbing Fixtures In Home, (3) Added/Replaced Electrical Wiring To Home, (4) Installed Paneling Or Ceiling Tiles, (5) Added/Replaced Central Air Conditioning, (6) Added/Replaced Built-In Heating Equipment, (7) Added/Replaced Security System In Home, (8) HVAC work *208, 168, and 128 Square Feet for single-family-owner, single-family-renter, and multi-family units, respectively.*

Table 4-9: Addition Event Size Definitions	
Small (bathroom-sized)	Where **one room was added**, and **fewer than three** of the following tasks were performed: (1) Added/Replaced Internal Water Pipes In Home, (2) Added/Replaced Plumbing Fixtures In Home, (3) Added/Replaced Electrical Wiring To Home, (4) Installed Paneling Or Ceiling Tiles, (5) Added/Replaced Central Air Conditioning, (6) Added/Replaced Built-In Heating Equipment, (7) Added/Replaced Security System In Home, (8) HVAC work, (9) Remodeled Bathroom, (10) Remodeled Kitchen. *48 Square Feet.*
Medium (kitchen-sized)	Where **one room was added**, and **three or more** of the following tasks were performed: (1) Added/Replaced Internal Water Pipes In Home, (2) Added/Replaced Plumbing Fixtures In Home, (3) Added/Replaced Electrical Wiring To Home, (4) Installed Paneling Or Ceiling Tiles, (5) Added/Replaced Central Air Conditioning, (6) Added/Replaced Built-In Heating Equipment, (7) Added/Replaced Security System In Home, (8) HVAC work, (9) Remodeled Bathroom, (10) Remodeled Kitchen. *160, 120, and 80 Square Feet for single-family-owner, single-family-renter, and multi-family units, respectively.*
Large (size of a bathroom and kitchen)	Where **more than one** room was added. *208, 168, and 128 Square Feet for single-family-owner, single-family-renter, and multi-family units, respectively.*

Table 4-10: Interior Painting Event Size Definitions	
Small (square root of 25% of the square footage times 5 feet)	Accounts for one third of all interior painting events. The square root of 25% of the total square footage times 5 feet is equivalent to the area along one wall and five feet out. *112, 96, and 84 Square Feet for single-family-owner, single-family-renter, and multi-family units, respectively.*
Medium (midpoint between small and large sized)	Accounts for one third of all interior painting events. *308, 232, and 184 Square Feet for single-family-owner, single-family-renter, and multi-family units, respectively.*
Large (25% of the total unit square footage)	Accounts for one third of all interior painting events. *504, 368, and 284 Square Feet for single-family-owner, single-family-renter, and multi-family units, respectively.*

Table 4-11: Window/Door Replacement Event Size Definitions	
Small (square root of a kitchen-sized work area times 5 feet)	Accounts for one third of window/door replacement events. In the 1997 AHS respondents who reported replacing windows or doors also reported how many windows and doors they repaired or replaced. These respondents were divided into three groups according to how many doors and windows they reported replacing. The average numbers or doors and windows reported repaired or replaced were 1, 3, and 12 for these three groups. The work area for replacing one window/door is assumed to be along one wall and five feet out, estimated as the square root of 25% of a kitchen-sized work area times 5 feet. *63, 55, and 45 Square Feet for single-family-owner, single-family-renter, and multi-family units, respectively.*
Medium (kitchen-sized work area)	Accounts for one third of window/door replacement events. In the 1997 AHS respondents who reported replacing windows or doors also reported how many windows and doors they repaired or replaced. These respondents were divided into three groups according to how many doors and windows they reported replacing. The average numbers or doors and windows reported repaired or replaced were 1, 3, and 12 for these three groups. The work area for replacing three windows/doors is assumed to be the size of a typical room (i.e., kitchen-sized). *160, 120, and 80 Square Feet for single-family-owner, single-family-renter, and multi-family units, respectively.*
Large (the size of 4 Rooms)	Accounts for one third of window/door replacement events. In the 1997 AHS respondents who reported replacing windows or doors also reported how many windows and doors they repaired or replaced. These respondents were divided into three groups according to how many doors and windows they reported replacing. The average numbers or doors and windows reported repaired or replaced were 1, 3, and 12 for these three groups. The work area for replacing 12 windows is assumed to be the size of 4 typical rooms (i.e., four times kitchen-size). *640, 480, and 320 Square Feet for single-family-owner, single-family-renter, and multi-family units, respectively.*

Table 4-12: Exterior Event Size Definitions	
1-Wall Exterior Painting	The perimeter estimates were calculated following the procedure used in EPA's Economic Analysis for the TSCA Section 403 rule (EPA 2000b). It was assumed that the home is rectangular with a front to side ratio of 2:3 and an average first floor area of 1,390 sq. feet.[a] This assumption leads to a perimeter of 152 feet for a single-family owner occupied home. The perimeter of a single-family renter unit was estimated to be 130 feet, which assumes that the proportion of a single-family renter unit has the same proportion of total square footage to square footage of the first floor of a single-family owner unit. The perimeter of a multi-family housing structure (which contains an average of units) was calculated assuming the first-floor area was three times as large as a single-family unit. This perimeter estimate is 264 feet. A 1-Wall Exterior Painting Event is assumed to be ¼ of the full perimeter.
4-Wall Exterior Painting and Whole Exterior Renovation Events	The perimeter estimates were calculated following the procedure used in EPA's Economic Analysis for the TSCA Section 403 rule (EPA 2000b). It was assumed that the home is rectangular with a front to side ratio of 2:3 and an average first floor area of 1,390 sq. feet.[a] This assumption leads to a perimeter of 152 feet for a single-family owner occupied home. The perimeter of a single-family renter unit was estimated to be 130 feet, which assumes that the proportion of a single-family renter unit has the same proportion of total square footage to square footage of the first floor of a single-family owner unit. The perimeter of a multi-family housing structure (which contains an average of 3 units) was calculated assuming the first-floor area was three times as large as a single-family unit. This perimeter estimate is 264 feet.
Contained Exterior Renovation Events	The structures in a Contained Exterior event are outside the main body of the house and the structural work and contamination is primarily outdoors. The perimeter of a contained exterior structure (such as a garage) is estimated to be 60 feet (10'×20'). Containment is necessary along the entire perimeter of a detached structure. However, it is assumed that less containment is required for attached contained exterior structures, which are assumed to be attached to the main structure of the house along a 20 foot side of the detached contained exterior structure. The analysis assumes half are attached structures and half are detached structures.
[a] Estimated based on information from http://www.dreamhomesource.com (2005) on the average size of the first floor of nine 2,000 square foot two stories homes (1,280 sq. feet). The weighted average of a first floor was calculated using 2003 AHS data which shows that 85% of single-family housing units are two stories high and the remaining 15% of homes are one story (i.e., first floor is 2,016 sq. feet).	

4.2.1.7 Estimated Number of RRP Events in the First and Second Years

The numbers of regulated events are estimated using the methodology outlined above along with the assumption that 75 percent of the RRP events subject to the rule's requirements comply with the requirements. This assumption is based on compliance rates observed for the Occupational Safety and Health Administration's (OSHA) regulations for the construction industry (Gilkeya 2003 and Weil 1999). The variation in the number of regulated events in compliance under the different options reflects the variation in the regulated universe.

Table 4-13 through Table 4-16 present the numbers of RRP events potentially affected by the removal of the opt-out provision by type of event, for the first and second year the rule is in effect. Note that Option C does not go into effect until the second year, so this option does not affect any events in the first year. Each table shows the total number of events where compliance costs are incurred, labeled "All Events." "All Events" include all the events where a test kit was used to test for LBP. The columns labeled "LBP Events" include all the events where test kits correctly identified that LBP was present; it does not include events where there was a false positive or a false negative test kit result. The columns labeled "LSWP Events" include all events where there was a positive test kit result – including false positives. The LSWP event estimate is the estimated number of events where compliance costs associated with cleaning, containment, and verification are incurred. Table 4-17 through Table 4-19 present the likelihoods of events where LBP is correctly identified as well as those where there was a positive test kit result (LSWP Events).

Table 4-13: Option A: First Year (thousands)

	All Events With Costs			LBP Events			LSWP Events		
	SF-O	Multi-O	Total	SF-O	Multi-O	Total	SF-O	Multi-O	Total
Bath	252	18	269	60	5	65	179	13	192
Kit	255	22	277	74	6	81	186	16	202
Ad-S	54	1	55	24	0	25	42	1	43
Ad-M	21	0	21	10	0	10	16	0	16
Ad-L	83	1	84	39	0	39	65	1	66
Wl-S	840	45	885	125	8	132	571	31	602
Wl-M	47	3	51	12	1	13	34	2	36
Wl-L	0	0	0	0	0	0	0	0	0
WD-S	221	7	228	85	3	88	168	6	173
WD-M	256	10	267	101	5	106	195	8	204
WD-L	341	17	358	138	8	147	261	13	275
IP-S	573	39	612	238	17	255	441	30	471
IP-M	322	23	345	133	10	143	248	18	266
IP-L	272	20	292	112	9	120	209	16	225
EP	2,682	146	2,828	1,008	54	1,062	2,029	110	2,139
C Ext	347	0	347	89	0	89	249	0	249
W Ext	337	15	352	129	7	136	256	12	268
Total	**6,904**	**368**	**7,272**	**2,376**	**135**	**2,510**	**5,150**	**277**	**5,427**

Notes: Events where compliance costs are incurred include those that are: (1) subject to the rule's requirements, and (2) in compliance. Thus, this includes some events where LSWP are not required because a test kit indicates that LBP is not present. It excludes the 25% of regulated events that are assumed to be noncompliant. A "-" indicates that zero events were estimated; a "0" indicates that fewer than 500 events were estimated. All Events With Costs include those where there is a negative test kit result for LBP. LBP Events include all the events where test kits correctly identified that LBP was present; it does not include events where there was a false positive or a false negative test kit result. LSWP events include all events with test kit results that are positive for LBP, including false positive results. See Table 4-1 for options descriptions. Note that the number of LSWP events is equal to the number of LBP events (which exclude false negatives) plus the number of false positive events; i.e., (LSWP Events) = (LBP Events) + ((All Events With Costs) – (LBP Events)/0.95) * (False Positive Rate).

Abbreviations:
SF-O = Single-Family Owner-Occupied Unit; Multi-O = Multi-Family Owner-Occupied Unit; Kit = Kitchen Event; Bath = Bathroom Event; Ad-S = Small Addition; Ad-M = Medium Addition; Ad-L = Large Addition; Wl-S = Small Wall-Disturbing Event; Wl-M = Medium Wall-Disturbing Event; Wl-L = Large Wall-Disturbing Event; WD-S = Small Window or Door Replacement Event; WD-M = Medium Window or Door Replacement Event; WD-L = Large Window or Door Replacement Event; IP-S = Small Interior Painting; IP-M = Medium Interior Painting; IP-L = Large Interior Painting; EP = Exterior Painting; C Ext = Contained Exterior Event; W Ext = Whole Exterior Event.

Table 4-14: Option B: First Year (thousands)

	All Events With Costs			LBP Events			LSWP Events		
	SF-O	Multi-O	Total	SF-O	Multi-O	Total	SF-O	Multi-O	Total
Bath	126	9	135	30	2	32	89	6	96
Kit	127	11	139	37	3	40	93	8	101
Ad-S	27	0	27	12	0	12	21	0	21
Ad-M	10	0	10	5	0	5	8	0	8
Ad-L	42	1	42	19	0	19	33	0	33
Wl-S	420	23	443	62	4	66	286	16	301
Wl-M	24	2	25	6	1	7	17	1	18
Wl-L	0	0	0	0	0	0	0	0	0
WD-S	111	4	114	42	2	44	84	3	87
WD-M	128	5	133	51	2	53	98	4	102
WD-L	171	8	179	69	4	73	131	7	137
IP-S	286	19	306	119	9	127	220	15	236
IP-M	161	11	173	66	5	71	124	9	133
IP-L	136	10	146	56	4	60	105	8	112
EP	1,341	73	1,414	504	27	531	1,015	55	1,070
C Ext	173	0	173	45	0	45	124	0	124
W Ext	168	7	176	65	4	68	128	6	134
Total	**3,452**	**184**	**3,636**	**1,188**	**67**	**1,255**	**2,575**	**138**	**2,713**

Notes: Events where compliance costs are incurred include those that are: (1) subject to the rule's requirements, and (2) in compliance. Thus, this includes some events where LSWP are not required because a test kit indicates that LBP is not present. It excludes the 25% of regulated events that are assumed to be noncompliant. A "-" indicates that zero events were estimated; a "0" indicates that fewer than 500 events were estimated. All Events With Costs include those where there is a negative test kit result for LBP. LBP Events include all the events where test kits correctly identified that LBP was present; it does not include events where there was a false positive or a false negative test kit result. LSWP events include all events with test kit results that are positive for LBP, including false positive results. See Table 4-1 for options descriptions. Note that the number of LSWP events is equal to the number of LBP events (which exclude false negatives) plus the number of false positive events; i.e., (LSWP Events) = (LBP Events) + ((All Events With Costs) – (LBP Events)/0.95) * (False Positive Rate).

Abbreviations:
SF-O = Single-Family Owner-Occupied Unit; Multi-O = Multi-Family Owner-Occupied Unit; Kit = Kitchen Event; Bath = Bathroom Event; Ad-S = Small Addition; Ad-M = Medium Addition; Ad-L = Large Addition; Wl-S = Small Wall-Disturbing Event; Wl-M = Medium Wall-Disturbing Event; Wl-L = Large Wall-Disturbing Event; WD-S = Small Window or Door Replacement Event; WD-M = Medium Window or Door Replacement Event; WD-L = Large Window or Door Replacement Event; IP-S = Small Interior Painting; IP-M = Medium Interior Painting; IP-L = Large Interior Painting; EP = Exterior Painting; C Ext = Contained Exterior Event; W Ext = Whole Exterior Event.

Table 4-15: Option D: First Year (thousands)

	All Events With Costs			LBP Events			LSWP Events		
	SF-O	Multi-O	Total	SF-O	Multi-O	Total	SF-O	Multi-O	Total
Bath	111	8	119	48	4	52	87	6	93
Kit	115	9	124	60	5	65	93	7	100
Ad-S	25	1	25	18	0	18	22	1	22
Ad-M	11	0	11	8	0	8	10	0	10
Ad-L	41	0	41	30	0	30	36	0	36
Wl-S	414	21	436	105	7	112	296	16	312
Wl-M	28	3	31	11	1	12	21	2	23
Wl-L	0	0	0	0	0	0	0	0	0
WD-S	109	4	113	69	3	72	92	3	95
WD-M	131	6	137	84	4	88	111	5	116
WD-L	179	11	190	115	8	123	152	9	161
IP-S	355	23	379	207	15	222	294	20	313
IP-M	199	13	212	115	9	124	164	11	175
IP-L	168	12	180	97	7	105	138	10	148
EP	1,386	71	1,457	853	45	898	1,161	60	1,220
C Ext	178	0	178	72	0	72	137	0	137
W Ext	179	10	189	110	7	117	150	9	158
Total	**3,630**	**191**	**3,821**	**2,004**	**115**	**2,119**	**2,962**	**159**	**3,121**

Notes: Events where compliance costs are incurred include those that are: (1) subject to the rule's requirements, and (2) in compliance. Thus, this includes some events where LSWP are not required because a test kit indicates that LBP is not present. It excludes the 25% of regulated events that are assumed to be noncompliant. A "-" indicates that zero events were estimated; a "0" indicates that fewer than 500 events were estimated. All Events With Costs include those where there is a negative test kit result for LBP. LBP Events" include all the events where test kits correctly identified that LBP was present; it does not include events where there was a false positive or a false negative test kit result. LSWP events include all events with test kit results that are positive for LBP, including false positive results. See Table 4-1 for options descriptions. Note that the number of LSWP events is equal to the number of LBP events (which exclude false negatives) plus the number of false positive events; i.e., (LSWP Events) = (LBP Events) + ((All Events With Costs) – (LBP Events)/0.95) * (False Positive Rate).

Abbreviations:
SF-O = Single-Family Owner-Occupied Unit; Multi-O = Multi-Family Owner-Occupied Unit; Kit = Kitchen Event; Bath = Bathroom Event; Ad-S = Small Addition; Ad-M = Medium Addition; Ad-L = Large Addition; Wl-S = Small Wall-Disturbing Event; Wl-M = Medium Wall-Disturbing Event; Wl-L = Large Wall-Disturbing Event; WD-S = Small Window or Door Replacement Event; WD-M = Medium Window or Door Replacement Event; WD-L = Large Window or Door Replacement Event; IP-S = Small Interior Painting; IP-M = Medium Interior Painting; IP-L = Large Interior Painting; EP = Exterior Painting; C Ext = Contained Exterior Event; W Ext = Whole Exterior Event.

Table 4-16: Option A, B, C, and D: Second Year (thousands)

	All Events With Costs			LBP Events			LSWP Events		
	SF-O	Multi-O	Total	SF-O	Multi-O	Total	SF-O	Multi-O	Total
Bath	250	18	268	60	5	64	78	6	84
Kit	254	22	276	74	6	80	92	8	99
Ad-S	54	1	55	24	0	25	27	0	27
Ad-M	21	0	21	10	0	10	11	0	11
Ad-L	83	1	84	38	0	39	43	0	43
Wl-S	837	45	882	124	8	132	195	11	206
Wl-M	47	3	50	12	1	13	16	1	17
Wl-L	0	0	0	0	0	0	0	0	0
WD-S	220	7	227	84	3	88	97	4	101
WD-M	255	10	266	101	5	105	116	5	121
WD-L	340	17	356	138	8	146	157	9	167
IP-S	571	39	609	237	17	254	269	19	288
IP-M	321	23	344	132	10	142	150	11	162
IP-L	271	20	291	111	9	120	127	10	136
EP	2,671	145	2,817	1,004	54	1,058	1,165	63	1,228
C Ext	346	0	346	89	0	89	114	0	114
W Ext	336	15	350	129	7	136	149	8	156
Total	**6,876**	**366**	**7,242**	**2,366**	**134**	**2,500**	**2,804**	**157**	**2,961**

Notes: Events where compliance costs are incurred include those that are: (1) subject to the rule's requirements, and (2) in compliance. Thus, this includes some events where LSWP are not required because a test kit indicates that LBP is not present. It excludes the 25% of regulated events that are assumed to be noncompliant. A "-" indicates that zero events were estimated; a "0" indicates that fewer than 500 events were estimated. All Events With Costs include those where there is a negative test kit result for LBP. LBP Events include all the events where test kits correctly identified that LBP was present; it does not include events where there was a false positive or a false negative test kit result. LSWP events include all events with test kit results that are positive for LBP, including false positive results. See Table 4-1 for options descriptions. Note that the number of LSWP events is equal to the number of LBP events (which exclude false negatives) plus the number of false positive events; i.e., (LSWP Events) = (LBP Events) + ((All Events With Costs) – (LBP Events)/0.95) * (False Positive Rate).

Abbreviations:
SF-O = Single-Family Owner-Occupied Unit; Multi-O = Multi-Family Owner-Occupied Unit; Kit = Kitchen Event; Bath = Bathroom Event; Ad-S = Small Addition; Ad-M = Medium Addition; Ad-L = Large Addition; Wl-S = Small Wall-Disturbing Event; Wl-M = Medium Wall-Disturbing Event; Wl-L = Large Wall-Disturbing Event; WD-S = Small Window or Door Replacement Event; WD-M = Medium Window or Door Replacement Event; WD-L = Large Window or Door Replacement Event; IP-S = Small Interior Painting; IP-M = Medium Interior Painting; IP-L = Large Interior Painting; EP = Exterior Painting; C Ext = Contained Exterior Event; W Ext = Whole Exterior Event.

Table 4-17: Likelihoods of LBP and LSWP –Options A and B, First Year

	LBP Events			LSWP Events		
	SF-O	Multi-O	Total	SF-O	Multi-O	Total
Bath	24%	26%	24%	71%	72%	71%
Kit	29%	28%	29%	73%	73%	73%
Ad-S	45%	82%	45%	78%	91%	78%
Ad-M	47%	-	47%	79%	-	79%
Ad-L	46%	21%	46%	79%	70%	78%
Wl-S	15%	17%	15%	68%	69%	68%
Wl-M	26%	39%	27%	72%	76%	72%
Wl-L	-	-	-	-	-	-
WD-S	38%	45%	39%	76%	78%	76%
WD-M	39%	47%	40%	76%	79%	76%
WD-L	41%	50%	41%	77%	80%	77%
IP-S	42%	44%	42%	77%	78%	77%
IP-M	41%	44%	41%	77%	78%	77%
IP-L	41%	43%	41%	77%	78%	77%
EP	38%	37%	38%	76%	76%	76%
C Ext	26%	-	26%	72%	-	72%
W Ext	38%	48%	39%	76%	79%	76%
Total	**34%**	**37%**	**35%**	**75%**	**75%**	**75%**

Notes: Events where compliance costs are incurred include those that are: (1) subject to the rule's requirements, and (2) in compliance. Thus, this includes some events where LSWP are not required because a test kit indicates that LBP is not present. It excludes the 25% of regulated events that are assumed to be noncompliant. A "-" indicates that zero events were estimated; a "0" indicates that fewer than 500 events were estimated. All Events With Costs include those where there is a negative test kit result for LBP. LBP Events include all the events where test kits correctly identified that LBP was present; it does not include events where there was a false positive or a false negative test kit result. LSWP events include all events with test kit results that are positive for LBP, including false positive results. See Table 4-1 for options descriptions. Note that the number of LSWP events is equal to the number of LBP events (which exclude false negatives) plus the number of false positive events; i.e., (LSWP Events) = (LBP Events) + ((All Events With Costs) – (LBP Events)/0.95) * (False Positive Rate).

Abbreviations:
SF-O = Single-Family Owner-Occupied Unit; Multi-O = Multi-Family Owner-Occupied Unit; Kit = Kitchen Event; Bath = Bathroom Event; Ad-S = Small Addition; Ad-M = Medium Addition; Ad-L = Large Addition; Wl-S = Small Wall-Disturbing Event; Wl-M = Medium Wall-Disturbing Event; Wl-L = Large Wall-Disturbing Event; WD-S = Small Window or Door Replacement Event; WD-M = Medium Window or Door Replacement Event; WD-L = Large Window or Door Replacement Event; IP-S = Small Interior Painting; IP-M = Medium Interior Painting; IP-L = Large Interior Painting; EP = Exterior Painting; C Ext = Contained Exterior Event; W Ext = Whole Exterior Event.

Table 4-18: Likelihoods of LBP and LSWP –Option D, First Year

	LBP Events			LSWP Events		
	SF-O	Multi-O	Total	SF-O	Multi-O	Total
Bath	43%	47%	44%	78%	79%	78%
Kit	52%	57%	53%	81%	82%	81%
Ad-S	73%	82%	73%	88%	91%	88%
Ad-M	69%	-	69%	86%	-	86%
Ad-L	72%	-	72%	87%	-	87%
Wl-S	25%	31%	26%	72%	73%	72%
Wl-M	39%	43%	39%	76%	78%	76%
Wl-L	-	-	-	-	-	-
WD-S	64%	70%	64%	84%	87%	85%
WD-M	64%	70%	64%	85%	87%	85%
WD-L	64%	71%	65%	85%	87%	85%
IP-S	58%	64%	59%	83%	85%	83%
IP-M	58%	66%	59%	83%	85%	83%
IP-L	58%	64%	58%	82%	85%	83%
EP	62%	64%	62%	84%	85%	84%
C Ext	41%	-	41%	77%	-	77%
W Ext	62%	65%	62%	84%	85%	84%
Total	**55%**	**60%**	**55%**	**82%**	**83%**	**82%**

Notes: Events where compliance costs are incurred include those that are: (1) subject to the rule's requirements, and (2) in compliance. Thus, this includes some events where LSWP are not required because a test kit indicates that LBP is not present. It excludes the 25% of regulated events that are assumed to be noncompliant. A "-" indicates that zero events were estimated; a "0" indicates that fewer than 500 events were estimated. All Events With Costs include those where there is a negative test kit result for LBP. LBP Events include all the events where test kits correctly identified that LBP was present; it does not include events where there was a false positive or a false negative test kit result. LSWP events include all events with test kit results that are positive for LBP, including false positive results. See Table 4-1 for options descriptions. Note that the number of LSWP events is equal to the number of LBP events (which exclude false negatives) plus the number of false positive events; i.e., (LSWP Events) = (LBP Events) + ((All Events With Costs) – (LBP Events)/0.95) * (False Positive Rate).

Abbreviations:
SF-O = Single-Family Owner-Occupied Unit; Multi-O = Multi-Family Owner-Occupied Unit; Kit = Kitchen Event; Bath = Bathroom Event; Ad-S = Small Addition; Ad-M = Medium Addition; Ad-L = Large Addition; Wl-S = Small Wall-Disturbing Event; Wl-M = Medium Wall-Disturbing Event; Wl-L = Large Wall-Disturbing Event; WD-S = Small Window or Door Replacement Event; WD-M = Medium Window or Door Replacement Event; WD-L = Large Window or Door Replacement Event; IP-S = Small Interior Painting; IP-M = Medium Interior Painting; IP-L = Large Interior Painting; EP = Exterior Painting; C Ext = Contained Exterior Event; W Ext = Whole Exterior Event.

Table 4-19: Likelihoods of LBP and LSWP –Options A, B, C, and D, Second Year

	LBP Events			LSWP Events		
	SF-O	Multi-O	Total	SF-O	Multi-O	Total
Bath	24%	26%	24%	31%	33%	31%
Kit	29%	28%	29%	36%	35%	36%
Ad-S	45%	82%	45%	50%	84%	50%
Ad-M	47%	-	47%	52%	-	52%
Ad-L	46%	21%	46%	51%	29%	51%
Wl-S	15%	17%	15%	23%	25%	23%
Wl-M	26%	39%	27%	33%	45%	34%
Wl-L	-	-	-	-	-	-
WD-S	38%	45%	39%	44%	50%	44%
WD-M	39%	47%	40%	45%	52%	46%
WD-L	41%	50%	41%	46%	55%	47%
IP-S	42%	44%	42%	47%	50%	47%
IP-M	41%	44%	41%	47%	49%	47%
IP-L	41%	43%	41%	47%	49%	47%
EP	38%	37%	38%	44%	43%	44%
C Ext	26%	-	26%	33%	-	33%
W Ext	38%	48%	39%	44%	53%	45%
Total	**34%**	**37%**	**35%**	**41%**	**43%**	**41%**

Notes: Events where compliance costs are incurred include those that are: (1) subject to the rule's requirements, and (2) in compliance. Thus, this includes some events where LSWP are not required because a test kit indicates that LBP is not present. It excludes the 25% of regulated events that are assumed to be noncompliant. A "-" indicates that zero events were estimated; a "0" indicates that fewer than 500 events were estimated. All Events With Costs include those where there is a negative test kit result for LBP. LBP Events include all the events where test kits correctly identified that LBP was present; it does not include events where there was a false positive or a false negative test kit result. LSWP events include all events with test kit results that are positive for LBP, including false positive results. See Table 4-1 for options descriptions. Note that the number of LSWP events is equal to the number of LBP events (which exclude false negatives) plus the number of false positive events; i.e., (LSWP Events) = (LBP Events) + ((All Events With Costs) – (LBP Events)/0.95) * (False Positive Rate).

Abbreviations:
SF-O = Single-Family Owner-Occupied Unit; Multi-O = Multi-Family Owner-Occupied Unit; Kit = Kitchen Event; Bath = Bathroom Event; Ad-S = Small Addition; Ad-M = Medium Addition; Ad-L = Large Addition; Wl-S = Small Wall-Disturbing Event; Wl-M = Medium Wall-Disturbing Event; Wl-L = Large Wall-Disturbing Event; WD-S = Small Window or Door Replacement Event; WD-M = Medium Window or Door Replacement Event; WD-L = Large Window or Door Replacement Event; IP-S = Small Interior Painting; IP-M = Medium Interior Painting; IP-L = Large Interior Painting; EP = Exterior Painting; C Ext = Contained Exterior Event; W Ext = Whole Exterior Event.

4.2.2 Estimating the Number of Regulated Renovation, Repair, and Painting Events in COFs in Public or Commercial Buildings

This section describes the methodology for estimating the number of events in daycare centers, pre-schools and kindergartens—i.e., COFs in public or commercial buildings. Events in these structures are all regulated under the existing LRRP program. Events in these structures, however, will be affected by the rule's requirement to provide the recordkeeping checklist to owners or occupants.

4.2.2.1 Data Sources

This section provides a brief summary of the primary data sources used to estimate the number of RRP events in COFs in public or commercial buildings.

HUD's (2003) First National Health Survey of Child Care Centers

HUD's (2003) First National Environmental Health Survey of Child Care Centers was conducted under the sponsorship of the Department of Housing and Urban Development (HUD), the Environmental Protection Agency (EPA), and the Consumer Product Safety Commission (CPSC) to assess children's potential exposure to lead, allergens, and pesticides in licensed child care centers. The survey data were collected in 2001 and were published in 2003; they include data on 98 childcare centers that are known to have been built before 1978. Note that while the data only includes child care centers, some of these centers are located in schools and the information on lead likelihoods, characteristics of classrooms, and the frequencies of painting are extrapolated to elementary schools with pre-schools or kindergartens. This survey can be used to estimate lead levels in dust, paint, and soil in childcare centers. This analysis uses these data to estimate: (1) likelihoods of LBP on various components that might be disturbed during RRP, (2) various characteristics of the rooms and buildings (such as the size and number of rooms, windows, and doors), and (3) the frequency of interior painting, exterior painting, and cleaning.

Whitestone (2006) Building Maintenance and Repair Cost Reference 2006-2007

Whitestone Research is a commercial service that provides data on the frequency of different types of maintenance activities and their costs, for use by building managers and investors. For over 50 building types (including both elementary schools and childcare centers), Whitestone defines a typical building and lists the building components they are likely to contain (e.g. type of windows, type of interior and exterior wall coverings, type of heating system, etc.). Whitestone lists the frequency and type of repairs each building component will need, including replacements. The Whitestone data can be used to estimate the types and frequency of RRP work for COFs in public or commercial buildings.

4.2.2.2 Description of Methodology for Estimating the Number of RRP Events in COFs in Public or Commercial Buildings

The basic steps for estimating the number of events are:

1. Estimate the number of COFs (rooms and buildings),
2. Estimate the frequency of performing an event,
3. Estimate the likelihood that an event will be covered by the rule (disturbing paint).
4. Combine the results of the above four steps to estimate: (1) annual number of buildings and classrooms where more than six square feet of a painted surface per room is disturbed for interior renovations, or twenty square feet for exterior renovations.

The methodology for performing these steps is described below in more detail.

Step 1: Estimate the Number of Public or Commercial Building COFs (rooms and centers)

Based on the number of daycare centers reported to be located in schools according to the HUD (2003) data, 22 percent of the estimated 115,000 centers are estimated to be located in elementary schools. Thus, these 25,300 daycare centers are assumed to be accounted for in the estimated 40,190 elementary schools with pre-schools and kindergartens. Although an additional 1,421 pre-schools are located in schools without kindergarten programs (such as middle or high schools), these pre-schools are included in the count of daycare centers for the purposes of the total cost analysis. In summary, there are 40,190 elementary schools with pre-schools and kindergartens, 37,049 elementary schools with kindergartens but no pre-school and 89,261 daycare centers (see Section 2.9 of Chapter 2).[13] Using data from the Commercial Buildings Energy Consumption Survey (CBECS) for education buildings (DOE 2003), it was estimated that 58 percent of buildings were built prior to 1978. The HUD (2003) data was used to estimate the relative number of pre-1960 buildings.

This analysis considers three categories of COFs in public or commercial buildings: (1) daycare centers, (2) elementary schools with kindergartens only, and (3) elementary schools with kindergartens and pre-schools. The analysis distinguishes between these types of buildings because they have different sizes and thus different compliance costs. The number of childcare center classrooms was estimated using the HUD (2003) data. The estimated numbers of pre-kindergarten and kindergarten classrooms per building are 3.8 and 6.7 for elementary schools with kindergartens and elementary schools with pre-schools and kindergartens, respectively. The number of pre-school classrooms per building was estimated based on the number of pre-kindergarten schools and classes reported in the *NCES Prekindergarten in U.S. Public Schools 2000-2001 Report* (U.S. Department of Education 2003). The number of kindergarten classrooms per building was estimated based on the number of kindergarten schools and classes reported in the *Full-Day and Half-Day Kindergarten in the United States 1998-1999* (U.S. Department of Education 2003). In addition, this analysis accounts for RRP events in spaces other than classrooms in the public or commercial buildings that might be visited by children under the age of six on a regular basis (libraries, cafeterias, gyms, etc.).

Spaces in Addition To Regular Kindergarten and Pre-Kindergarten Classrooms Regularly Visited by Children Under Age Six

At least for part of the year, children under the age of 6 are in first grade. In addition, in some schools children under the age of 6 might use other rooms on a regular basis, including libraries, cafeterias, gyms, computer rooms, and music and/or art rooms.

According to NCES's 2005 *After-School Programs and Activities Survey of the National Household Education Surveys Program* data, just under 0.5 percent of all first graders are 5 years old. Thus there are nearly 19,000 first graders who are age 5 (NCES 2005). The survey collected age data as of December 31st of 2004 and as such does not include children who turned 6 after the start of the school year in September but before the end of December. Thus it is thus likely that this figure underestimates the number of children who are 5 years old when they enter first grade. While the total number of five year olds in first grade is relatively small, any class with one of these children is subject to the rule.

Unlike for pre-kindergartens or kindergartens, there is no data on the number of first grade classrooms in the United States. The number of first grade classrooms was estimated based on student enrollment and the average number of first graders in a typical classroom. Data on the average number of students in first grade were obtained from four states – Texas, New Hampshire, New York, and Illinois (Texas Education

[13] The 89,261 daycare centers include 1,421 schools with pre-kindergarten but no kindergarten, and 87,840 daycare centers located outside of schools (see Section 2.9 of Chapter 2).

Agency 1999; New Hampshire Department of Education 2006; New York State Office of the State Comptroller 2005; ASU 2007). The number of students per classroom reported in these states ranged from 18 to 21.6, with an average of 20 students per classroom. To estimate the total number of first grade classrooms, the total number of first graders (3,663,005 in public schools + 439,510 in private schools) was divided by the average of 20 students per first-grade class. The resulting number of classrooms (205,126) was divided by the total number of schools with a first grade (51,572 public schools + 22,362 private schools) to estimate the average number of classrooms per school.[14] Based on these calculations, there is an average of 2.8 first grade classrooms per school.

Data were not available on the amount of the school day or week that kindergartners and first graders spend outside of their primary classroom or the rooms they visit. Nor were data available on the average size of these rooms in older elementary schools. Thus the following assumptions were made:

Gyms are about the size of 5 classrooms. This estimate is based on the assumption that most elementary school gyms will accommodate a basketball court. A basketball court is 3,108 square feet and an average classroom is 729 square feet (ProDunkHoops 2006; HUD 2003). Thus, a basketball court is about 4.25 classrooms, which was rounded up to 5 to accommodate bleachers, etc.

- Cafeterias are about the same size as an elementary school gym.
- Elementary school libraries are about the size of 2 classrooms
- Students were also assumed to regularly spend time in at least one other classroom (e.g. computer room, music or art room).

Estimates were generated using data on the percentage of public elementary schools that have various non-classroom facilities as follows:

- Cafeteria 98%[15] (NCES 2006g)
- Library 95% (NCES 2004)
- Gymnasium 80% (NCES 2007)

Using these percentages and the classroom-equivalent sizes for rooms specified above, the equivalent of an additional 12 rooms was assumed to be covered by the rule because children under the age of 6 use them in addition to their regular classrooms. The calculation is:

98% * (1 cafeteria)*(5 classroom equivalents) + 95% * (1 library)*(2 classroom equivalents) + 80% * (1 gym)*(5 classroom equivalents) + (1 extra room) = 12 classroom equivalents.

[14] The numbers of first graders in public and private schools were drawn from NCES's *Overview of Public Elementary and Secondary Students, Staff, Schools, School Districts, Revenues, and Expenditures: School Year 2004-2005 and Fiscal Year 2004* (NCES 2006a) and *Characteristics of Private Schools in the United States: Results From the 2003-2004 Private School Universe Survey* (NCES 2006e), respectively. The numbers of public and private schools with first grades were calculated using NCES's *Common Core of Data Public Elementary/Secondary School Universe Survey Data, 2004-2005* (NCES 2006b) and *2003-2004 Private School Universe Survey Data (NCES 2006f),* respectively.

[15] This figure is based on the number of schools providing food services in a cafeteria or lunch room. Since many elementary schools use the gymnasium as a lunch room, there may be substantial overlap between cafeterias and gymnasiums. Also, in some schools children do not eat in the cafeteria until 1st grade. Thus, this may overestimate the areas in schools potentially impacted by the rule.

In addition, an average of 2.8 first grade classrooms are assumed to be covered by the rule, making the average total number of additional classroom equivalents 14.8. The estimated numbers of pre-kindergarten and kindergarten classrooms per building are 3.8 and 6.7 for elementary schools with kindergartens and elementary schools with pre-schools and kindergartens, respectively. Thus, the average numbers of classrooms and classroom equivalents covered under the rule are 18.6 and 21.5 for elementary schools with kindergartens and elementary schools with pre-schools and kindergartens, respectively.

The resulting estimates of the number of regulated daycare centers and elementary schools with preschools or kindergartens, as well as the number of regulated classrooms in these buildings are presented in Table 4-20.

Table 4-20: Number of Regulated Buildings and Classrooms, by Building Type and Year Built

	Daycare Centers		**Elementary Schools with Kindergartens Only**		**Elementary Schools with Pre-Schools and Kindergartens**	
	Buildings	*Classrooms*	*Buildings*	*Classrooms*	*Buildings*	*Classrooms*
Pre-1978	51,771	170,472	21,488	399,685	23,310	501,169
Pre-1960	28,687	103,566	11,907	242,817	12,917	304,471

*The stock of public or commercial buildings is assumed to decline by 0.41% per year. That rate was calculated using the average annual compound rate of change in the pre-1980 housing stock using data from the 1990 and 2000 Decennial Census (U.S. Census Bureau 1990 and 2000c).
Source: Calculated using HUD 2003 data.

Step 2: Estimate the frequency of performing an event

Interior Painting

When asked how often they repainted the interior, respondents to the HUD (2003) survey could respond: (1) every 1 to 4 years, (2) every 5 to 10 years, or (3) every 10 to 20 years. The average frequency of painting was estimated using the midpoints for these ranges (weighted averages were calculated using the buildings' survey weight). On average, building interiors are painted every 4.4 years. It is assumed that 35 percent involve sanding and/or scraping before painting, based on data for housing units (EPA 2006).

Exterior Painting

When asked how often they repainted the exterior, respondents to the HUD (2003) survey could respond: (1) every 1 to 4 years, (2) every 5 to 10 years, or (3) every 10 to 20 years. The average frequency of painting was estimated using the midpoints for these ranges (weighted averages were calculated using the building's survey weight); on average, buildings paint their exterior every 7 years. Thus, the analysis assumes that buildings with exterior paint (about 90 percent of the buildings have exterior paint) are painted every seven years. It is assumed that the exterior is always sanded or scraped before painting (EPA 2006).

Wall Disturbing Events

The number of events where walls are disturbed is considered separately from those events that generally disturb trim, doors, and windows, which have higher likelihoods of LBP. The number of wall disturbing events is estimated using the Whitestone Maintenance and Repair (M&R) Cost Reference. The Whitestone M&R Cost Reference provides information on the frequency of a wide variety of maintenance and repair activities. As described in their Preface, the book is intended for two audiences.

> "The first group has a common need to know the long-term M&R costs of specific buildings. This group consists of analysts, developers, architects, bankers, investors and

> others who must account for M&R costs that, over a 50-year building lifetime, can easily exceed the cost of construction. … The second audience consists of facility managers and all those responsible for estimating and justifying facility maintenance budgets."

The bulk of the reference is composed of detailed lists of building components and M&R tasks, along with their average size, frequency of the M&R tasks, trade involved (e.g. plumber, carpenter) and estimated cost. The reference also provides building profiles for 56 different building types, including childcare centers and elementary schools. Each profile lists the typical building components for that building type and then generates a 50-year stream of expenditures that cover these building components.

The number of wall disturbing events is estimated based on the following categories of RRP events:

- Replace Plumbing Pipes and Fixtures
- Replace HVAC Systems
- Replace Electrical System and Fixtures

Using the frequencies of major renewal and replacement tasks that are likely to disturb lead-based paint for the building components described in the childcare center and elementary school profiles, this analysis developed the assumed frequency of RRP events shown in Table 4-21.

Table 4-21: Frequency of Wall Disturbing RRP Events

Category of RRP Event and Whitestone Components and Frequencies Used to Estimate Frequency of RRP Events	Assumed Average Frequency of Performing RRP Event	Resulting Total Number of RRP Events per Classroom per Year
RRP Event - Replace Plumbing Pipes and Fixtures Pipe & Fittings, 3/4" Copper, Cold Water Replace 10' section every 20 years, replace all pipes and fittings every 25 years. Pipe & Fittings, 3/4" Copper, Hot Water Replace 10' section every 13 years, replace all pipes and fittings every 25 years. Pipe & Fittings, 2" Copper, Cold Water Replace 10' section every 20 years, replace all pipes and fittings every 25 years. Pipe & Fittings, 6" Cast Iron Replace 10' section every 13 years, replace all pipes and fittings every 75 years. Pipe & Fittings, 10" Cast Iron Replace 10' section every 13 years, replace all pipes and fittings every 75 years. Pipe & Fittings, 4" DWV PVC Replace 10' section every 10 years, replace all pipes and fittings every 30 years.	Since replacing 10' sections of pipes is done as often as once every 10 years, the analysis assumes 1 job per classroom every 10 years – ½ are assumed to be large and ½ are assumed to be small (0.05 small jobs and 0.05 large jobs per year)	Each of the 4 categories is considered a separate event. Aggregating the frequencies provides annual averages of: 0.34 jobs, composed of: 0.23 small jobs 0.11 large jobs where a small job disturbs paint on one wall of a classroom, and a large job disturbs paint on all four walls.
RRP Event - Replace HVAC Systems Pipes & Fittings, 4" Steel, Gas Replace 10' section every 12 years, replace all pipes and fittings every 75 years.	Rounding to the nearest 10 years, it is assumed that there is 1 job per classroom every 10 years. Since 10' sections are replaced about every 10 years and all pipes and fittings are replaced about every 80 years, it is assumed that 1/8 are large jobs and 7/8 are small jobs. (0.0875 small jobs and 0.0125 large jobs per year)	
RRP Event - Replace Electrical System and Fixtures Fluorescent Lighting Fixture, 160 W Replace every 20 Years	1 job per classroom every 20 years, assumed to be large* (0.05 large jobs per year)	
RRP Event - Unscheduled Maintenance	Assumes a small job is performed in 1 out of every 11 classrooms each year. This is equivalent to one job per building on average.	

* All unplanned maintenance events are assumed to be small jobs.

Source: Derived from Whitestone M&R Reference (2006).

Because historical data on M&R activities for wall disturbing events in these buildings are not available, and to simplify the calculations, it is assumed that the RRP events are evenly spread over the population of buildings. In other words, if a plumbing replacement job typically occurs once every 10 years, the

analysis assumes that one-tenth of the buildings experience this RRP event in any given year. Thus in any given year, it is assumed that plumbing is replaced in 10 percent of buildings, HVAC systems are replaced in 10 percent of buildings and electrical systems are replaced in 5 percent of buildings. If multiple jobs are occurring in the same building, the analysis assumes they occur at different times in the year and thus each incurs its own work practice costs. To the extent that these events are actually occurring at the same time, the analysis overestimates the work practice costs. The Whitestone data does not include information on the frequency of unscheduled maintenance events. Instead, this analysis assumes that 1 out of 11 classrooms have an unscheduled maintenance job performed in a given year – this is approximately one job per building. The number of unscheduled maintenance events is based on an assumption, and not on empirical data.

Window and Door Replacement Events

The number of events where windows and doors are disturbed is also estimated using the Whitestone M&R Cost Reference, which listed the frequency with which door and window types typically found in elementary schools and daycare centers must be replaced—about every 20 years. Thus, in any given year, windows and doors are assumed to be replaced in 5 percent of buildings.

Step 3: Estimate the likelihood that an event will be affected by the rule (disturbing paint)

The next step is to estimate how many events in public or commercial building COFs disturb painted surfaces and therefore would be affected by the recordkeeping checklist provision requirement of the LRRP rule revision. This analysis considers four types of events for public or commercial buildings: (1) Interior Painting, (2) Exterior Painting, (3) Window Replacement, and (4) Wall Disturbing Events (e.g., plumbing, electrical). It is estimated that 35 percent of interior painting jobs involve disturbing painted surfaces (i.e., sanding and/or scraping before painting), based on data for housing units (EPA 2006). All other event types are always assumed to disturb painted surfaces.

Step 4: Combine the results

The number of affected classrooms or buildings is multiplied by the frequency of renovation activities that disturb painted surfaces to yield the number of events in public or commercial buildings where the recordkeeping checklist will have to be provided by the renovator. These results are presented in Table 4-22.

Table 4-22: Summary of the Number of Public or Commercial Building COF Events

	Events Where Recordkeeping Checklist is Provided				
	Interior Painting	Exterior Painting	Window and Door Disturbing Events	Wall Disturbing Events	All Events
	Year 1				
Daycare Centers	10,244	4,989	6,393	42,427	64,053
Kindergartens Only	24,018	2,071	14,989	99,473	140,551
Kindergartens and Pre-Schools	30,116	2,246	18,795	124,730	175,887
All Public or commercial building COFs	**64,378**	**9,306**	**40,177**	**266,630**	**380,491**
	Year 2*				
Daycare Centers	10,202	4,969	6,367	42,253	63,790
Kindergartens Only	23,920	2,063	14,928	99,065	139,975
Kindergartens and Pre-Schools	29,993	2,237	18,718	124,219	175,166
All Public or commercial building COFs	**64,114**	**9,268**	**40,012**	**265,537**	**378,931**

Note: Following EPA (2008), it is assumed that 75 percent of COFs comply with the rule.

**The stock of public or commercial buildings is assumed to decline by 0.41% per year. That rate was calculated using the average annual compound rate of change in the pre-1980 housing stock using data from the 1990 and 2000 Decennial Census (U.S. Census Bureau 1990 and 2000c).*

4.3 Work Practice Compliance Costs

RRP projects generate varying amounts of leaded dust, paint chips, and other lead-contaminated materials depending on the type of work, size of area affected, and work methods used. For example, repairing a small area of damaged drywall is likely to generate less lead-contaminated dust and debris than sanding a large area in preparation for painting. Because of this variability, the size of the area that must be isolated and the containment methods used will vary from project to project. Large renovation projects could involve one or more rooms and potentially encompass an entire home or building while small projects may involve a portion of a room or a building's exterior. The necessary work area preparations will depend on the size of the surface(s) being disturbed, the method used in disturbing the surface, and the building layout. The certified renovator assigned to a renovation would weigh all of these factors in determining the appropriate work area size for that particular situation. For example, repairing a small area of damaged drywall would probably require a smaller work area while demolition work would probably require a larger work area in order to prevent the migration of dust and debris from the work area.

Note that the costs of the action as estimated in the Economic Analysis are expressed in 2005 dollars. To express values in terms of current dollars, the Implicit Price Deflator for Gross Domestic Product as determined by the Bureau of Economic Analysis can be consulted for an indication of how nominal prices for goods and services produced in the economy have changed over time. From 2005 to the second quarter of 2009, the implicit price deflator increased from 100 to 109.753, a difference of approximately 10 percent (BEA 2009).

4.3.1 LBP Test Kit Compliance Costs

It is assumed that spot test kits are used to test for LBP before each RRP event where a lead inspection has not been performed; they are inexpensive to use and a negative result will allow the renovator to forgo the more costly containment, cleaning and verification requirements. Lead test kits currently can be

purchased in bulk at a cost of approximately $0.50 per test. It is assumed that the renovator will take an average of four samples, because some jobs may disturb multiple components (walls, trim, windows, etc.) or multiple rooms, and testing four samples will require about 15 minutes of a certified renovator's time. The loaded wage rate for certified renovators is $31.64/hour[16]. Thus, testing using the test kits is estimated to cost $10 per event (15 minutes * $31.64/hour + 4 test kits * $0.50/test = $10).

RRP purchasers may choose to have x-ray fluorescence (XRF) testing conducted to detect the presence of LBP instead of using a test kit. XRF testing has the advantage of having lower false positive rates but the testing cost per event is much higher than a test kit. Therefore, it is assumed that test kits are used in lieu of XRF testing.

4.3.2 Containment, Cleaning, and Verification

The containment and cleaning practices covered in the cost estimates are:[17]

For large interior events:

- Remove or cover all objects in the room where the renovation will be performed including furniture, rugs, and window coverings.
- Close and cover all ducts opening into the room with taped-down plastic sheeting or other impermeable material.
- Close windows and doors in the work area. Doors must be covered with plastic sheeting or other impermeable material. Doors used as an entrance to the work area must be covered with plastic sheeting or other impermeable material in a manner that allows workers to pass through while confining dust and debris to the work area.[18]
- Cover the floor with taped-down plastic sheeting or other impermeable material. Place a tack pad at the edge of the sheeting at the entrance to the room. Cover paths through the rest of the buildings used by persons performing the renovation with plastic sheeting or other impermeable material.

For small interior events:

- Remove or cover all objects within five feet of the work area, including furniture, rugs, and window coverings.
- Close all windows, doors, and ducts within five feet of the work area. Cover ducts with plastic sheeting or other impermeable material.
- Cover the floor within five feet of the work area with taped-down plastic sheeting or other impermeable material.
- Wear disposable shoe covers and vacuum clothes.

[16] Wages are based on U.S. Bureau of Labor Statistics (2005a) data, from the occupational employment statistics series. All wages are fully loaded to account for fringe benefits with an average fringe rate for the construction industry of 23.5 percent. Certified renovators' fully loaded wages ($31.64/hour) are estimated from the wages earned by First-Line Supervisors/Managers of Construction Trades and Extraction Workers (Occupation 47-1011) who work in the residential building construction industry. Workers' loaded wages ($16.94/hour) are estimated from the wages of Construction Laborers who work in the residential building construction industry (Occupation 47-2061).

[17] For the purposes of simplifying the modeling of the costs, some of the work practices described here are slightly different than those practices required by the rule. The costs of these practices are expected to be representative of the practices required by the rule.

[18] This analysis assumes that contractors will meet the entrance door requirement by creating an airlock using two sheets of plastic.

For large and small exterior events:

- Cover the ground with plastic sheeting or other disposable impermeable material extending out from the edge of the structure a sufficient distance to collect falling paint debris.
- Ensure that doors within the work area that must be used while the job is being performed are covered with plastic sheeting or other impermeable material in a manner that allows workers to pass through while confining dust and debris to the work area.

For all events:

- Post signs warning occupants and other persons not involved in renovation activities to remain outside of the work area.
- Isolate the work area so that no visible dust or debris leaves the work area while the renovation is being performed.
- Contain waste from renovation activities to prevent releases of dust and debris before the waste is removed from the work area for storage or disposal.
- At the conclusion of each workday, store waste from renovation activities under containment, in an enclosure, or behind a barrier that prevents release of dust and debris and prevents access to dust and debris.
- Pick up all paint chips and debris.
- Remove plastic sheeting from objects in the work area and the floor or ground. Mist the sheeting before folding it, fold the dirty side inward and tape shut to seal. Dispose of the sheeting as waste.

Additional Cleaning for interior events

- Clean all objects and surfaces in and around the work area for interior events in the following manner, cleaning from higher to lower:
    a. Thoroughly vacuum all surfaces and objects in the work area, including furniture and fixtures, with a vacuum equipped with a high-efficiency particulate air (HEPA) filter. Where feasible, floor surfaces underneath a rug or carpeting must also be thoroughly vacuumed with a HEPA vacuum.
    b. Wipe all surfaces and objects in the work area with a damp cloth (except for walls, ceilings, carpeted surfaces and upholstered surfaces).
    c. Mop uncarpeted floors thoroughly, using a two-bucket mopping method that keeps the wash water separate from the rinse water, or using a wet mopping system.

Post-renovation cleaning verification for interior events:

- A certified renovator must perform a visual inspection to determine if visible amounts of dust, debris or residue are still present. If visible amounts of dust, debris or residue are present, these conditions must be eliminated by re-cleaning and another visual inspection must be performed.
- After a successful visual inspection, a certified renovator must:
    a. Wipe uncarpeted floors within the work area with a disposable wet cleaning cloth. The cloth must remain damp at all times while it is being used to wipe the floor for post-cleaning verification. If the floor surface within the work area is greater than 40 square feet, the floor within the area must be divided into roughly equal sections that are less than 40 square feet. Wipe each such section separately with a new disposable cleaning cloth. If the cloths used to wipe each section of the floor within the work area match the cleaning verification card, that section of the floor has been adequately cleaned.
    b. If the cloth used to wipe a particular section of floor does not match the cleaning verification card, re-clean that section of the floor using the two-bucket mopping method. Then wipe that section of the floor using a new wet cleaning cloth. If the

cloth matches the cleaning verification card, that section of the floor has been adequately cleaned.

c. If the second cloth used to wipe a particular floor section does not match the cleaning verification card, re-clean that section of the floor using the two-bucket mopping method described above and allow the entire floor within the work area to dry completely. After the entire floor within the work area has completely dried, wipe the floor with electrostatic cleaning cloths until a cloth that has wiped the entire floor matches the cleaning verification card.[19]
d. Wipe the windowsills in the work area following the same protocol as used for floors but with one wet-wipe per-windowsill.
e. When the area passes the post-renovation cleaning verification, remove the warning signs.

Post-renovation cleaning verification for exterior events:

- A certified renovator must perform a visual inspection to determine if visible amounts of dust, debris or residue are still present. If visible amounts of dust, debris or residue are present, these conditions must be eliminated by re-cleaning and another visual inspection must be performed. When the area passes the visual inspection, remove the warning signs.

4.3.3 Cost of Each Containment and Cleaning Practice

The primary source of information on the cost of containment and cleaning practices, equipment, and materials was the Means CostWorks Repair & Remodeling Cost Data (R.S. Means 2005). The data are designed to help contractors estimate the cost of a renovation project. The database provides the total labor and material costs of different renovation components on a unit basis. Most of the unit costs taken from the R.S. Means database utilized in this analysis were for an asbestos abatement project, which requires much more elaborate containment and clean up than required under the analyzed options. The R.S. Means labor estimates have been adjusted downwards to reflect the less stringent requirements of the LRRP rule. Depending on the type of activity, the unit may be a square foot, each item, or some other measure. Table 4-23 and Table 4-24 show the material costs, labor requirements and total cost for the containment and cleaning practices for interior events and exterior events, respectively.

[19] It is assumed that a second cleaning is required 30 percent of the time and a third cleaning is required 2 percent of the time.

Table 4-23: Unit Costs of RRP Interior Activities (2005$)				
Cost Type	**Material Cost**	**Units**	**Labor Hours**	**Total Cost[a]**
Containment				
Sign	$0.11[b]	Ea.	0	$0.11
Floors (labor): Cover surfaces with polyethylene sheeting, each layer, 6 mil, incl. glue & tape	$0.00	S.F.	0.006	$0.12
Floors (materials): Cover surfaces with polyethylene sheeting, each layer, 6 mil, incl. glue & tape	$0.08[c]	S.F.	0.000	$0.08
Walls[d]: Cover surfaces with polyethylene sheeting, each layer, 6 mil, incl. glue & tape	$0.08[c]	S.F.	0.008	$0.25
Tack pad	$0.51[e]	Per sheet	0	$0.51
Disposable shoe covers	$0.38[f]	Per pair	0	$0.38
Roll down polyethylene sheeting	$0.00	S.F.	0.002	$0.03
Bag polyethylene sheeting	$1.15	Ea.	0.05	$2.24
Cleaning				
HEPA vacuum for work area	$0.63[g,h]	Ea.	0	$0.63
HEPA vacuum use (floor)	$0.01	S.F.	0.002	$0.05
HEPA vacuum use (walls)	$0.01	S.F.	0.002	$0.05
HEPA vacuum clothes	$0.00	Hours	0.167	$3.44
Wet wipe, flat surfaces (cleaning)	$0.01	S.F.	0.002	$0.06
Verification				
Wet wipe, flat surfaces (verification)	$0.01	S.F.	0.002	$0.06
Electrostatic cloth sweeper	$0.01[g,i]	Ea.	0	$0.01
Disposable wet cloth	$0.01[j]	S.F.	0.002[k]	$0.05
Disposable dry cloth	$0.01[j]	S.F.	0.002[k]	$0.05

[a] Using a mean loaded wage rate of $20.62 (2005$) based on the wages of three construction laborers ($16.94/hr each) and one supervisor ($31.64.hr each) from the May, 2004 Occupational Employment Statistics data from the Bureau of Labor Statistics.

[b] The cost of a 9"x12" aluminum sign is $10.99; assumed to be used 100 times.

[c] Based on a web search, which showed that duct tape costs $0.02 per square foot and 6 mil. polyethylene sheeting costs $0.06 per square foot.

[d] Estimate used for plastic on the doors, windows, and ducts.

[e] Based on a review of price lists on the web, which showed that the average cost per disposable sheet is $0.51.

[f] Based on a review of price lists on the web, which showed that the average cost per pair of shoe covers is $0.38.

[g] Assumes that it will be used for 1,000 events.

[h] Based on a review of price lists on the web that showed that the average cost for a HEPA vacuum is $626.

[i] Based on a review of price lists on the web that showed that the average cost of an electrostatic cloth sweeper is $13.60.

[j] Based on a review of price lists on the web that showed that the average cost of an electrostatic cloth wet cloth is $0.46. Also based on clearance requirements that the work area must be divided into roughly equal sections that are 40 square feet, therefore it costs $0.01 per square foot.

[k] Based on EPA's (2005b) "Disposable Cleaning Cloth (DCC) Lead Clearance Field Study" document that it would take 5 minutes per cleaning cloth and clearance requirements that the work area must be divided into roughly equal sections that are 40 square feet that is equivalent to 0.125 minutes per square foot or 0.002 hours per square foot.

Abbreviations: S.F. = Square Feet; Ea. = Each Item

Source: RS Means 2005; U.S. Bureau of Labor Statistics 2005b.

Table 4-24: Unit Costs of RRP Exterior Activities (2005$)

Cost Type	Material Cost	Units	Labor Hours	Total Cost[a]
Sign	$0.11[b]	Ea.	0	$0.11
Ground: Cover surfaces with polyethylene sheeting, each layer, 6 mil, incl. glue & tape	$0.06[c]	S.F.	0.001	$0.08
Doors[d]: Cover surfaces with polyethylene sheeting, each layer, 6 mil, incl. glue & tape	$0.08[c]	S.F.	0.008	$0.25
Roll down polyethylene sheeting[e]	$0.00	S.F.	0.0005	$0.01

[a] Based on a mean loaded wage rate of $20.62 (2005$) based on the wages of three construction laborers ($16.94/hr each) and one supervisor ($31.64/hr) from the May, 2004 Occupational Employment Statistics data from the Bureau of Labor Statistics.

[b] The cost of a 9"x12" aluminum sign is $10.99 and it is assumed that the sign will be used 100 times.

[c] Based on a web search that showed that duct tape costs $0.02 per square foot and 6 mil. polyethylene sheeting costs $0.06 per square foot. Based on the EPA 2000a Model Renovation Training Course, duct tape will be used to tape the plastic to the building and rocks or other heavy objects will be used to weight down the edges therefore it is assumed that only ¼ of the duct tape is needed for floors.

[d] Estimate used for plastic on the doors.

[e] Assume that for exterior events the contractor would tape the plastic up rather than bagging it.

Abbreviations: S.F. = Square Feet; Ea. = Each Item

Source: RS Means 2005; U.S. Bureau of Labor Statistics 2005a and 2005b.

4.3.4 Quantities of Each Containment and Cleaning Practice

Table 4-25 and Table 4-26 describe how the number of units required for each work practice is estimated for the various event types. This methodology is the same as that used to estimate work practice costs in the 2008 LRRP rule analysis (EPA 2008). Appendix 4A in the Economic Analysis of the 2008 LRRP rule (EPA 2008) presents the resulting estimates for each type of event. The number of units is multiplied by the per-unit costs, which can be per-each, per-square foot, or per hour, as described above in section 4.3.3.

Table 4-25: Number of Units Required for RRP Interior Activities (2005$)		
Cost Type	**Units**	**Number of Units Required**
Containment		
(1) Sign	Ea.	Two signs are assumed to be required.
(2) Floors (labor): Cover surfaces with polyethylene sheeting, each layer, 6 mil, incl. glue & tape	S.F.	Estimated as 110% of the square footage of the work area (to include horizontal surfaces besides the floor) plus 60 square feet of sheeting for paths (except for small events).
(3) Floors (materials): Cover surfaces with polyethylene sheeting, each layer, 6 mil, incl. glue & tape	S.F.	Same as (2).
(4) Walls[d]: Cover surfaces with polyethylene sheeting, each layer, 6 mil, incl. glue & tape	S.F.	Estimated as the number of doors times 20 square feet (door size), plus 20 square feet (for an extra layer of plastic over the entry door), plus the number of ducts times 1 square foot (duct size).
(5) Tack pad	Per sheet	One tack pad per room affected.
(6) Disposable shoe covers	Per pair	Two for small jobs, none for large jobs.
(7) Roll down polyethylene sheeting	S.F.	(2) plus (4).
(8) Bag polyethylene sheeting	Ea.	(7) divided by 76.2 square feet (the amount of plastic that will fit in a bag).
Cleaning		
(9) HEPA vacuum for work area	Ea.	Estimated as 1.
(10) HEPA vacuum use (floor)	S.F.	Estimated as 110% (125% for kitchens and bathrooms, to include countertops) of the square footage of the work area plus the number of windows times 2/3 of a square foot (the size of a window sill).
(11) HEPA vacuum use (walls)	S.F.	Estimated as the square root of the square footage of the work area times 32 (4 eight foot tall walls).
(12) HEPA vacuum clothes	Hours	Estimated as ten minutes (small events only).
(13) Wet wipe, flat surfaces (cleaning)	S.F.	Estimated as the likelihood of uncarpeted floors multiplied by the square footage of the work area, plus 10% (or 25% for kitchens and bathrooms) of the square footage of the work area multiplied plus the number of windows times 2/3 of a square foot (the size of a window sill).
Verification		
(14) Wet wipe, flat surfaces (verification)	S.F.	Estimated as 31.8 percent (sum of first and second failure rates) multiplied by (13).
(15) Electrostatic cloth sweeper	Ea.	Estimated as 1.
(16) Disposable wet cloth	S.F.	Estimated as 131.8% multiplied by {the square footage of the work area, multiplied by the likelihood of uncarpeted floors plus the number of windows multiplied by 2/3 of a square foot (the size of a window sill)}.
(17) Disposable dry cloth	S.F.	Estimated as 1.8% (second failure rate), multiplied by the square footage of the work area, multiplied by the likelihood of uncarpeted floors.
Abbreviations: S.F. = Square Feet; Ea. = Each Item *Source: RS Means 2005; U.S. Bureau of Labor Statistics 2005b.*		

Table 4-26: Number of Units Required for RRP Exterior Activities (2005$)		
Cost Type	**Units**	**Number of Units Required**
Containment		
(1) Sign	Ea.	Two signs are assumed to be required.
(2) Ground: Cover surfaces with polyethylene sheeting, each layer, 6 mil, incl. glue & tape	S.F.	Estimated as the perimeter times 10 feet plus an extra 314 square feet for the corners.
(3) Doors: Cover surfaces with polyethylene sheeting, each layer, 6 mil, incl. glue & tape	S.F.	Estimated as the number of doors multiplied by 40 square feet, less 20 square feet.
(4) Roll down polyethylene sheeting	S.F.	Estimated as the sum of (2) and (3).
Abbreviations: S.F. = Square Feet; Ea. = Each Item *Source: RS Means 2005; U.S. Bureau of Labor Statistics 2005b.*		

4.3.5 Baseline Frequency of Prohibited Practice and Costs of Alternatives

Several paint preparation and removal practices are prohibited or restricted in renovations that require lead-safe work practices under the existing rule. A telephone questionnaire was administered to nine respondents to gather information on the baseline use of certain paint removal practices. The respondents included six painting firms and three historic home restoration firms. The six painting firms were randomly drawn from the online sales lead provider, Salesgenie.com. The historic home restoration firms were drawn randomly from the Old House Journal's online restoration directory.

These firms were asked how often they used the following four paint removal techniques on the interior and exterior of pre-1978 buildings:

1. Open flame burning or torching of paint;
2. Using a heat gun above 1,100º F;
3. Power sanding, grinding, or abrasive blasting except when done with HEPA exhaust control; and
4. Dry scraping of lead based-paint.

If the firms reported that they did not use the method, they were asked why they did not use it and what alternatives they used instead. They were also asked how much they thought costs would increase if the specific removal technique was prohibited and if there were any situations where use of the method could not be avoided. When responding firms could not precisely state what percentage of the time they used a certain work practice they were prompted with never, rarely, sometimes, often or nearly always. These prompted answers are assumed to correspond with the following percentages:

Table 4-27: Response Categories and Corresponding Percentages	
Never	1.5%
Rarely	16%
Sometimes	50%
Often	84%
Nearly Always	99%

Table 4-28 shows the minimum, maximum and average work practice frequencies, by interior and exterior work events:

Table 4-28: Summary Statistics for Frequency of Work Practices Included in Telephone Questionnaire						
	Interior			Exterior		
Prohibited Practice	**Min**	**Max**	**Average**	**Min**	**Max**	**Average**
Heat Gun (High Temp)	1.5%	16%	5%	1.5%	16%	5%
Open Flame Burning	1.5%	16%	3%	1.5%	16%	3%
Power Sanding	1.5%	99%	40%	1.5%	99%	47%
Dry Scraping	1.5%	99%	43%	1.5%	84%	30%

Based on these estimates it was estimated that interior and exterior painting jobs use various paint removal techniques with the frequencies presented in Table 4-29. Since several respondents indicated that they typically used heat guns at lower temperatures that are allowed under the LRRP rule (under 1100 °F), it was assumed that 20 percent of paint removal was performed with low temperature heat guns. The remaining 80 percent of paint removal practices were assumed to occur proportionally to the frequencies in the telephone questionnaire responses so that the sum of the frequencies for the five paint removal practices equals 100 percent.

Table 4-29: Summary Statistics for Frequency of Paint Removal Work Practice Use		
Paint Removal Practice Practice	**Interior**	**Exterior**
Heat Gun (Low Temp)	20%	20%
Heat Gun (High Temp)	7%	4%
Open Flame Burning	n.a.	3%
Power Sanding	35%	44%
Dry Scraping	38%	29%
Interior open flame burning is combined with interior high temperature heat gun usage (EPA 2008).		

4.3.5.1 Estimating the Incremental Costs of Alternatives to Prohibited Work Practices

Power Sanding without attachment to HEPA Vacuum

It is assumed that if power sanding, grinding, or abrasive blasting is prohibited in opt-out housing for renovations requiring lead-safe work practices under the rule, except when done with HEPA exhaust control, renovators would use power tools with HEPA exhaust controls.

The costs of requiring that power sanders be attached to vacuums with HEPA filters includes: (1) the cost of a sander capable of being attached to a HEPA vacuum, and (2) the cost of additional HEPA filters that will be required because of the increased vacuum use. The cost of a HEPA vacuum is not included as an incremental cost of this requirement since HEPA vacuum costs are already accounted for in the estimated costs of complying with the cleaning requirements under the rule.

To estimate the cost of the HEPA vacuum compatible power sanders, quotes for 27 power sanders were found through online queries; the average cost for such sanders was $209. It is assumed that each sander can be used for at least 200 jobs. Most power sanders have one-year warranties, thus 200 jobs represents the minimum lifespan. Therefore, the per-job cost of a new sander is $1.05 [$209/200].

The cost of extra HEPA filters was based on the cost of re-useable HEPA filters. Internet queries found that re-useable filters cost between $30 and $38 each, with an average price of about $35. It is assumed that each is good for the life of the sander (200 jobs), resulting in a cost per job of $.18 [$35/200].

Table 4-30: Per Job Equipment Costs as a Result of Prohibition on Power Sanding (Unless Done with HEPA Attachment)

Product	Average Cost	Expected Lifespan (# of Jobs)	Per Job Cost
Power Sander	$209	200	$1.05
HEPA Filter	$35	200	$0.18
Sum of Sander and Filter			$1.23

High Temperature Heat Guns and Open Flame Burning or Torching of Paint

It is assumed that if the use of high temperature heat guns (over 1,100 degrees F) and open flame burning or torching of paint is prohibited for renovations in opt-out housing requiring lead-safe work practices under the rule, renovators will use low temperature heat guns (under 1,100 degrees F) instead. The cost of switching to low temperature heat guns is described below for typical interior and exterior painting events where they may be used.

High Temperature Heat Guns and Open Flame Burning– Interior

An average interior heat gun event was assumed to involve paint removal from 144 sq. ft. of a 10’ x 10’ room. This calculation includes 3” molding around the ceiling, 6” baseboard, 1 doorway, and two 3’ x 5’ windows. It was estimated that this would take 1.05 hours using a high temperature heat gun and 1.36 hours using a low temperature heat gun.[20] Thus, switching to a low temperature heat gun would require

[20] According to Hunt (2006), a high temperature heat gun can remove the same amount of paint as dry scraping in 64 percent of the time required for dry scraping. It was estimated that dry scraping can be performed at a rate of 35-100 square feet per-hour, or 68 square feet per-hour on average (the rate of 35-100 square feet per-hour is from Painting and Decorating Contractors of America, 2003). Based on personal communications with industry sources, low-temperature heat gun paint removal takes 30 percent longer than high-temperature heat gun paint removal.

an additional 0.31 hours per job. At an hourly rate of $18/hr plus 60% overhead, the additional cost of using a low temperature heat gun rather than a high temperature heat gun is $8.93 (PDCA 2003).

High Temperature Heat Guns and Open Flame Burning – Exterior

Assuming exterior paint removal from 2 doorways and 10 windows, the average event would include paint removal from 243 sq. ft. It was estimated that this would take 1.77 hours using a high temperature heat gun and 2.3 hours using a low temperature heat gun.[21] Thus, switching to a low temperature heat gun would require an additional 0.53 hours per job. At an hourly rate of $18/hr plus 60% overhead, the incremental cost of using a low temperature heat gun is $15.26 per job. The cost of switching from using open flame burning or torching of paint to a low temperature heat gun is assumed to be the same as for switching from a high temperature heat gun to a low temperature heat gun.

Table 4-31: Time and Cost Associated with Using High and Low Temperature Heat Guns

Method	Interior Job			Exterior Job		
	Hours	Per Job Cost	Incremental Per Job Cost	Hours	Per Job Cost	Incremental Per Job Cost
High Temp	1.05	$30.24	-	1.77	$50.98	-
Low Temp	1.36	$39.17	$8.93	2.3	$66.24	$15.26

An average interior heat gun event was assumed to involve paint removal from 144 sq. ft. of a 10' x 10' room. This calculation includes 3" molding around the ceiling, 6" baseboard, 1 doorway, and two 3' x 5' windows. An average exterior heat gun event was assumed to involve paint removal from 243 sq. ft., involving 2 doorways and 10 windows.

Estimating Average Costs Per Interior Painting and Exterior Painting Job

The sections above described how the average costs per event using a prohibited or restricted practice were estimated. For cost estimating purposes an average cost across all jobs was estimated– including those without prohibited practices. Table 4-32 presents these estimates.

[21] See footnote 20.

Table 4-32: Average Additional Cost of Alternatives to Prohibited or Restricted Practices Over All Interior and Exterior Painting Jobs*

Prohibited Method	Average Interior Painting Job			Average Exterior Painting Job		
	Incremental Per Job Cost	Frequency as % of All Jobs	Average Cost Per Job	Incremental Per Job Cost	Frequency as % of All Jobs	Average Cost Per Job
High Temp	$8.93	7%	$0.63	$15.26	4%	$0.61
Open Flame	n.a.	n.a.	n.a.	$15.26	3%	$0.46
Power Sanding	$1.23	35%	$0.43	$1.23	44%	$0.54
All Prohibited Methods			**$1.06**			**$1.61**

*The average additional cost is a weighted average across all interior and exterior painting jobs, including those where prohibited practices are not used (and additional costs are not incurred).
Interior open flame burning is combined with interior high temperature heat gun jobs (EPA 2008).
Low temperature heat guns are assumed to be the alternative to high temperature heat guns and open flame burning. The alternative to power sanding not attached to a HEPA vacuum is assumed to be power sanding attached to a HEPA vacuum.

4.3.6 Frequency and Cost of Vertical Containment for Exterior Events

In certain situations, the renovation firm must take extra precautions in containing the work area for opt-out housing to ensure that dust and debris from an exterior renovation does not contaminate other buildings or other areas of the property or migrate to adjacent properties. These situations include work areas in close proximity to other buildings, work areas that abut a property line, and work in windy conditions. In some cases, it may be necessary to erect a system of vertical containment to prevent paint dust and debris from contaminating the ground or any object beyond the work area. Such vertical containment could take a number of forms such as attaching plastic sheeting to a fence or other support at the property line, attaching the plastic to a building or a frame attached to the building, or attaching the plastic to scaffolding erected next to the building.

This section presents the calculations used to determine the total and incremental vertical containment costs for events occurring along one side of a building or all four sides (referred to as 1 and 4-wall events) in target housing units. The hanging of disposable reinforced plastic sheeting constitutes the largest component of the vertical containment costs, so the average height of the buildings must be calculated to determine the surface area of the sheeting.

Information from the 2005 American Housing Survey (AHS) was used to calculate the average height of residential housing units. The AHS includes information on the number of stories in the buildings where housing units are located. The average heights of owner occupied units and renter occupied units are just under two stories and two-and-a-half stories, respectively.

In order to apply the average number of stories to the cost estimates, separate height estimates are needed for: single-family owner occupied, single-family rental, and multi-family units. Data from the U.S. Census Bureau's American Factfinder was used to determine which average height values from Table 4-33 to apply to these three categories of residential housing units using information on the percent of units that are in single-family or multi-family buildings.

Table 4-33: Average Height of Building for Owner and Renter Occupied Units, Total Housing Stock		
	Owner Occupied Units	**Renter Occupied Units**
Stories in Structure	**Total Occupied Units**	
1	26,278,000	8,537,000
2	24,026,000	12,257,000
3	16,375,000	7,340,000
4 to 6	2,248,000	2,880,000
7 or more	488,000	1,504,000
Total	69,415,000	32,518,000
Average	1.99	2.46
Sources: U.S. Census Bureau 2006. Note: To calculate the average, "4 to 6" was given a value of 5, and "7 or more" was given a value of 7		

Table 4-34 presents the number of owner-occupied housing units by the number of units in the structure. It also shows what percentage of the housing units are single-family homes and multi-family.

Table 4-34: Number of Housing Units, by Units in Structure		
Units in Structure	**Owner-occupied housing units**	
	Number	**Percentage**
1, detached or attached	56,255,657	86%
1, attached	3,819,810	
2	1,164,675	14%
3 or 4	651,003	
5 or more	1,989,511	
Mobile home	5,850,241	
Boat, RV, Van, etc.	85,616	
Total	**69,816,513**	**100%**
Sources: U.S. Census Bureau 2000		

As shown in Table 4-34, the majority of owner-occupied housing units are in one-unit buildings. Thus the average height of owner-occupied housing (2.0 stories) is used to characterize all single-family housing and the average height of rental housing (2.5 stories) is used to characterize the height of multi-family housing.

Table 4-35 summarizes the physical characteristics of the various building types. It assumes that the average height of a "story" is 12 feet.

Table 4-35: Physical Characteristics of Various Building, by Type

Building Type	Estimated Sq. ft. per floor	Estimated Perimeter (ft)	Estimated Front to Side Ratio	Estimated Width of Front (ft)	Estimated Width of Side (ft)	Average Number of Stories	Assumed height per story (ft)	Estimated Height of Building (ft)
Single-family owner occupied home	1,390	152	2 to 3	30.4	45.6	1.99	12	24
Multi-family owner-occupied housing structure	4,182	264	2 to 3	52.8	79.2	2.46	12	30

Source: EPA Calculations using U.S. DOE 2003.

Table 4-36 presents the total and incremental costs of a vertical containment event involving either one or four walls in the various residential housing units.[22] It is assumed that vertical containment is used for 2% of exterior painting events. To calculate the necessary amount of disposable reinforced plastic sheeting, it was assumed that the workers would hang the sheeting not on the perimeter of the house but on the perimeter of the laid polyethylene sheeting. Furthermore, it is assumed that for those jobs using vertical containment, 50% of the events in residential units will not need scaffolding because they will use plastic at the fence line or attached to the building, and that 50% of those events that do need scaffolding for vertical containment are already using it for other reasons, and only incur incremental costs related to plastic sheeting. Therefore only 25% of the residential units that undertake vertical containment will incur incremental costs for scaffolding.

[22] The analysis only considered one and four wall exterior events to capture the range of containment that might be required for exterior painting events. Two or three wall events are also possible and would result in containment costs between those estimated for the one and four wall events.

Table 4-36: Total and Incremental Costs of Vertical Containment Events Involving One and Four Walls in Residential Housing Units, by Type of Housing and Number of Walls

Cost Type	Cost Per Sq. Ft	Single Family Owner Occupied				Multi Family Owner Occupied			
		1 Wall Event		4 Wall Event		1 Wall Event		4 Wall Event	
		# of sq. ft.	Cost	# of sq. ft.	Cost	# of sq. ft.	Cost	# of sq. ft.	Cost
Scaffolding, steel tubular, regular, labor only to erect and dismantle, bldg ext, wall face, 6'-4"x5' frames[a]	$1.82	1088.7	$495.4	3629.1	$1,651.2	2338.1	$1,063.8	7793.7	$3,546.2
Scaffolding, steel tubular, regular for complete system for face of walls, 6'-4"x5' frames[a]	$0.38	1088.7	$5.1	3629.1	$68.0	2338.1	$11.0	7793.7	$146.1
Disposable reinforced plastic sheet[b]	$.23[d]	1088.7	$250.4	5921.2	$1,361.9	2338.1	$537.8	10627.8	$2,444.4
Plastic tape[c]	$0.02	18.1	$0.4	79.6	$1.6	39.0	$0.8	153.5	$3.1
Roll down polyethylene sheeting	$0.01	1088.7	$11.2	5921.2	$61.0	2338.1	$24.1	10627.8	$109.6
Total			$762.5		$3,143.8		$1,637.5		$6,249.3
Average (2% of Total) [e]			$15.25		$62.88		$32.75		$124.79

Sources: EPA calculations using RS Means 2005

a. The scaffolding costs take into account the assumption that only 25% of residential housing units with vertical containment will need incur incremental costs for scaffolding. It is assumed that the scaffolding is needed for one day per wall.

b. Based on a web search, which showed that reinforced plastic sheeting costs $.07 per square foot.

c. Based on a web search, which showed that duct tape costs $0.02 per square foot and 6 mil. polyethylene sheeting costs $0.06 per square foot.

d. This includes both material and labor costs.

e. The average presented is the average across all exterior painting jobs, including the 98% of exterior painting jobs where vertical containment is not assumed to be used.

Table 4-36 shows that the costs range in value from just over $760 for a one wall event in a single-family renter occupied unit, to just under $6,250 for a four wall event in a multi-family housing unit. On average, 59% of the total cost is due to the labor involved with erecting and dismantling the scaffolding.

4.3.7 Baseline Work Practices

Some of the containment and cleaning practice standards specified by EPA under the rule are currently in use by certain renovation contractors. The costs of work practices already in use are not incremental costs of the rule and are subtracted out of the cost estimates. In order to determine how often the required work practices are used in the absence of regulation, a telephone questionnaire was administered to 9 contractors in 2007 to collect information on baseline industry practices. A series of questions were asked to determine if the listed work practices were currently in use and if they were, the frequency with which they occur.

The questionnaire's objective was to collect responses to two sets of questions. One set of questions dealt with current interior RRP work practices. The other dealt with exterior work practices. The list of contractors to contact was generated from Salesgenie.com, an online service that contains contact information for over 14 million U.S. businesses. The service permitted companies to be selected based on their SIC Codes. The universe of potential respondents was generated by randomly selecting businesses with the following SIC Codes: 172101 (Painting Contractors), 1521 (General Contractors - Single-Family Houses), and 1522 (General Contractors - Residential Buildings Other Than Single-Family). The

responding companies were comprised of four painting firms and five general contracting firms. All nine of the painting and general contracting firms answered both the interior and exterior surveys. The instrument used to administer the questionnaire is presented below (Figure 4-1 and Figure 4-2).

Figure 4-1: Questions Regarding Work Practices – Interior RRP

Question #	Practice	*Percent of Time Used*
1	• How often do you post signs warning residents to remain outside the work area?	
2	• While the work is being performed, how often do you keep all windows and doors within the work area closed, or covered with sheeting?	
3	• How often do you cover the floor within the work area with taped down sheeting?	
4	If > 0%, When you cover the floor with sheeting, do you dispose of the sheeting afterwards or do you reuse the sheeting for other jobs?	
5	If > 0%, When you cover the floor with disposable plastic sheeting how often do you, your crew or your subcontractors mist the sheeting, fold it dirty side inward, and tape it shut to seal or seal in heavy duty plastic bags before removing from the work area?	
6	• To prevent tracking dust outside the work area, how often do you place a tack-pad outside the work area to catch dust on your shoes?	
7	• To prevent tracking dust outside the work area, how often do you wear disposable shoe covers?	
8	• To prevent tracking dust outside the work area, how often do you vacuum your clothes, tools, and other items each time you leave the work area?	
9	• After completing the job, how often do you vacuum any surfaces in the work area	
10	If >0%, How often was a HEPA vacuum used for vacuuming floors?	
11	If >0%, How often do you vacuum the walls?	
12	• After completing the job, how often do you wipe all smooth surfaces with a damp cloth?	
13	• After completing a job where the floor is not carpeted, how often do you wet mop?	
14	If >0%, How often do you use a two-bucket mopping system? (Two-bucket mopping means using one bucket and mop with wash water and another bucket and mop with rinse water)	
15	• After completing a job where the floor is not carpeted, how often do you sweep with an electrostatic cloth sweeper (for example a Swiffer®)?	

Figure 4-2: Questions Regarding Work Practices – Exterior Painting	
Practice	***Percent of Time Practice Used***
(1) How often do you post signs warning residents to remain outside the work area?	
(2) While the work is being performed, how often do you keep all windows and doors within 20 feet of the work area closed, or covered with sheeting?	
(3) How often do you cover the ground with sheeting in order to collect falling paint debris?	

Table 4-37 presents the individual results of the surveys as well as overall statistics for across the surveys. The data are broken down by firm type (painting or general contracting), and survey type (interior or exterior questions).

Table 4-37: Summary of Baseline Work Practice Survey Results

		Painting Firms				General Contractors					Descriptive Statistics		
		P1	**P2**	**P3**	**P4**	**G1**	**G2**	**G3**	**G4**	**G5**	**Min**	**Max**	**Average**
Interior	**1**	0%	5%	100%	0%	100%	100%	0%	0%	0%	0%	100%	34%
	2	80%	100%	75%	0%	100%	75%	100%	100%	50%	0%	100%	76%
	3	100%	100%	100%	100%	16%	100%	100%	25%	50%	16%	100%	77%
	4	Reuse	Reuse	Reuse	Reuse	Dispose	Dispose	Reuse	-	Dispose			-
	5	100%	-	100%	100%	16%	100%	0%	0%	100%	0%	100%	77%
	6	16%	0%	45%	0%	0%	100%	100%	0%	0%	0%	100%	29%
	7	0%	0%	0%	0%	0%	25%	100%	50%	0%	0%	100%	19%
	8	0%	0%	0%	0%	50%	50%	100%	50%	10%	0%	100%	29%
	9	100%	100%	25%	75%	100%	100%	100%	75%	50%	25%	100%	81%
	10	0%	0%	0%	100%	?	100%	100%	0%	0%	0%	100%	38%
	11	0%	0%	0%	0%	100%	100%	0%	75%	0%	0%	100%	31%
	12	100%	100%	15%	50%	100%	100%	100%	75%	90%	15%	100%	81%
	13	100%	50%	10%	0%	16%	100%	0%	75%	100%	0%	100%	50%
	14	0%	100%	100%	0%	0%	100%	0%	16%	0%	0%	100%	35%
	15	0%	60%	0%	0%	16%	0%	0%	0%	0%	0%	60%	8%
Exterior	**1**	0%	5%	100%	10%	100%	100%	0%	0%	0%	0%	100%	35%
	2	100%	100%	75%	100%	100%	100%	100%	75%	100%	75%	100%	94%
	3	0%	100%	100%	0%	100%	100%	100%	100%	0%	0%	100%	67%

Notes: When respondents gave a range of values for the percent of time they used a certain work practice, the midpoint of the range was used in calculating the average. When the respondent was unable to give a response, a question mark is presented and the value is excluded from the calculation.

Table 4-38 describes how the incremental cost adjustment is estimated to account for the use of required work practices in the baseline. These calculations are based on the questionnaire responses and adjusted to account for the assumption in this analysis that there will be 75 percent compliance with the rule. For example, based on the average questionnaire response, signs are posted 34 percent of the time. Since it is assumed that signs will be posted 75 percent of the time after the rule, 45 percent (45% = 34%/75%) of the post-rule sign-posting costs are already incurred in the baseline. Thus, since it is estimated that

posting a sign costs $0.11 per-event, the incremental impact of the rule's sign posting requirement is $0.07 ($0.11 * (1-45%)) after adjusting for baseline sign posting

Table 4-38: Description of Calculations for Baseline Work Practice Factors

	Work Practice	Question Number(s)	Description of Calculation	Unadjusted Percentage	Compliance-adjusted Percentage[a]
Interior	Sign	1	Simple average of responses	34%	45%
	Floors: Cover surfaces with polyethylene sheeting (labor)	3	Simple average of responses	77%	100%
	Floors: Cover surfaces with polyethylene sheeting (materials)	3,4	An average was calculated; those who stated that they reused the sheeting were coded as zeroes; the values given in question three were used for those who disposed of the sheeting.	21%	28%
	Walls: Cover surfaces with polyethylene sheeting	2	Simple average of responses	76%	100%
	Tack pad	6	Simple average of responses	29%	39%
	Pair of disposable shoe covers	7	Simple average of responses	19%	26%
	Roll down polyethylene sheeting	3,5	Product of 3 and 5	69%	92%
	Bag polyethylene sheeting	3,5	0% if Reuse, Product of 3 and 5 if Dispose.	19%	25%
	HEPA vacuum for work area (the actual vacuum)	10	An average was calculated; those who responded that they used a HEPA vacuum were coded a one, and those who stated that they didn't were coded a zero.	38%	50%
	HEPA vacuum use	10,11	An average of the responses to questions 10 and 11.	34%	45%
	vacuum use (floors)	9	Simple average of responses	81%	100%
	vacuum use (walls)	11	Simple average of responses	31%	41%
	HEPA vacuum clothes	8	Simple average of responses	29%	39%
	Wet wipe, flat surfaces	12	Simple average of responses	81%	100%
	Wet wipe, flat surfaces (verification)		Assume zero, this is the extra verification cleaning.	0%	0%
	Electrostatic cloth sweeper	15	An average was calculated; those who responded that they used an electorstatic cloth sweeper were coded as ones; those who responded that they didn't were coded as zeroes.	22%	30%
	Disposable wet cloth		Assume zero, this is the cleaning verification.	0%	0%
	Disposable dry cloth		Assume zero, this is the cleaning verification.	0%	0%
Exterior	Sign	1	Simple average of responses	35%	47%
	Ground: Cover surfaces with polyethylene sheeting, each layer, 6 mil, incl. glue & tape	3	Simple average of responses	67%	89%
	Doors: Cover surfaces with polyethylene sheeting, each layer, 6 mil, incl. glue & tape	2	Simple average of responses	94%	100%
	Roll down polyethylene sheeting[e]	3, interior 5	Product of 3 and interior 5	40%	53%

a. The compliance-adjusted work practice factor inflates the unadjusted value by incorporating an assumed 75% non-compliance rate and cannot be greater than 100%.

4.3.8 Summary of Incremental Work Practice Costs Per Event in Target Housing

Table 4-39 summarizes the incremental work practice costs associated with containment, cleaning, and verification in target housing. The methodology behind these estimates is described in the preceding sections and more detailed data is presented in Appendix 4A of the Economic Analysis of the 2008 LRRP rule (EPA 2008). Table 4-40 shows the average expected costs per-compliant event, accounting for the relative number of small and large events. These are average expected costs so some individual events will be above the average and some will be below it.

Table 4-39: Average Incremental Work Practice Costs in Residences (Adjusted for Baseline Work Practices, Assumes 75 Percent Compliance Rate)

	Single-Family Owner-Occupied				Multi-Family Owner-Occupied			
Interior	Cont.	Clean.	Verif.	**Tot.**				
Bath	$11	$7	$4	**$22**	$10	$7	$4	**$22**
Kit	$21	$15	$14	**$49**	$14	$10	$7	**$30**
Ad-S	$5	$9	$2	**$16**	$5	$9	$2	**$16**
Ad-M	$21	$13	$7	**$41**	$14	$9	$4	**$26**
Ad-L	$26	$15	$10	**$51**	$19	$12	$6	**$36**
Wl-S	$5	$9	$2	**$16**	$5	$9	$2	**$16**
Wl-M	$21	$13	$7	**$41**	$14	$9	$4	**$26**
Wl-L	$26	$15	$10	**$51**	$19	$12	$6	**$36**
WD-S	$6	$10	$3	**$19**	$5	$9	$2	**$15**
WD-M	$21	$13	$7	**$41**	$14	$9	$4	**$26**
WD-L	$66	$29	$29	**$124**	$38	$19	$15	**$72**
IP-S	$11	$11	$5	**$27**	$8	$9	$4	**$22**
IP-M	$33	$19	$14	**$67**	$22	$14	$8	**$46**
IP-L	$51	$25	$23	**$101**	$31	$18	$13	**$63**
Exterior	Cont.	Proh.	V.C.	**Tot.**	Cont.	Proh.	V.C.	**Tot.**
EP	$16	$2	$39	**$57**	$25	$2	$79	**$106**
C Ext	$10	-		**$10**	$10			**$10**
W Ext	$25			**$25**	$41			**$41**

Notes: The sum of the containment, cleaning and verification costs may not equal the total per-event cost due to rounding. The costs associated with using prohibited practice alternatives are only included in the Total Per-Event Cost column. The prohibited practice alternatives costs are $1.06 for the interior painting events and $1.61 for exterior painting events.

Abbreviations:
Cont. = Per Event Containment Costs (does not include vertical containment); Clean = Per Event Cleaning Costs; Verif. = Per Event Verification Costs; Tot. = Total Per-Event Costs, including costs for prohibited practice alternatives and vertical containment; Proh. = prohibited practice costs; V.C. = vertical containment costs; Kit = Kitchen Event; Bath = Bathroom Event; Ad-S = Small Addition; Ad-M = Medium Addition; Ad-L = Large Addition; Wl-S = Small Wall-Disturbing Event; Wl-M = Medium Wall-Disturbing Event; Wl-L = Large Wall-Disturbing Event; WD-S = Small Window or Door Replacement Event; WD-M = Medium Window or Door Replacement Event; WD-L = Large Window or Door Replacement Event; IP-S = Small Interior Painting; IP-M = Medium Interior Painting; IP-L = Large Interior Painting; EP = Exterior Painting; C Ext = Contained Exterior Event; W Ext = Whole Exterior Event.

4.3.9 Total Work Practice Costs Resulting from Removing Opt-Out Provisions

Table 4-40 through Table 4-43 present the total work practice costs associated with target housing regulated under the revised rule (i.e., owner occupied housing that may no longer opt out of the LRRP

program requirements) for the first and second years after the revisions rule goes into effect. For individual options the costs vary between the first and the second year for two primary reasons: (1) for some options, the scope of the regulated universe expands between the first and the second year, and (2) the improved test kits are assumed to become available by January 2011, which is the second year of the rule for Options A through C. Increasing the scope of the regulated universe tends to increase costs and the availability of the improved test kits tends to decrease the costs (since improved test kits will lower the number of instances where LSWP costs are incurred when lead-based paint is not disturbed). After the second year, estimated work practice costs decline proportionally to the assumed decline in the stock of regulated buildings (a 0.41 percent decline per year). Note that the removal of the opt-out provision would not begin until the second year under Option C.

Table 4-40: Option A: First Year Target Housing Work Practice Costs

	Events (thousands)			Unit Costs			Total Costs (thousands)			
	All	LSWP		Spot Test	LSWP		Spot Test	LSWP		Total Costs
		SF-O	Multi-O		SF-O	Multi-O		SF-O	Multi-O	
Bath	269	179	13	$10	$22	$22	$2,695	$3,930	$284	$6,909
Kit	277	186	16	$10	$49	$30	$2,774	$9,098	$488	$12,360
Ad-S	55	42	1	$10	$16	$16	$548	$677	$8	$1,234
Ad-M	21	16	0	$10	$41	$26	$207	$669	$0	$877
Ad-L	84	65	1	$10	$51	$36	$844	$3,334	$32	$4,210
Wl-S	885	571	31	$10	$16	$16	$8,853	$9,140	$496	$18,489
Wl-M	51	34	2	$10	$41	$26	$506	$1,392	$63	$1,961
Wl-L	0	0	0	$10	$51	$36	$0	$0	$0	$0
WD-S	228	168	6	$10	$19	$15	$2,282	$3,187	$84	$5,553
WD-M	267	195	8	$10	$41	$26	$2,666	$8,011	$215	$10,892
WD-L	358	261	13	$10	$124	$72	$3,579	$32,424	$972	$36,975
IP-S	612	441	30	$10	$27	$22	$6,117	$11,906	$666	$18,690
IP-M	345	248	18	$10	$67	$46	$3,453	$16,603	$820	$20,876
IP-L	292	209	16	$10	$101	$63	$2,921	$21,112	$979	$25,013
EP	2,828	2,029	110	$10	$57	$106	$28,281	$115,670	$11,674	$155,625
C Ext	347	249	0	$10	$10	$10	$3,470	$2,487	$0	$5,956
W Ext	352	256	12	$10	$25	$41	$3,518	$6,394	$484	$10,396
Total	**7,272**	**5,150**	**277**				**$72,716**	**$246,034**	**$17,265**	**$336,014**

See Table 4-1 for options descriptions.

Abbreviations: SF-O = Single-Family Owner-Occupied Unit; Multi-O = Multi-Family Owner-Occupied Unit; Kit = Kitchen Event; Bath = Bathroom Event; Ad-S = Small Addition; Ad-M = Medium Addition; Ad-L = Large Addition; Wl-S = Small Wall-Disturbing Event; Wl-M = Medium Wall-Disturbing Event; Wl-L = Large Wall-Disturbing Event; WD-S = Small Window or Door Replacement Event; WD-M = Medium Window or Door Replacement Event; WD-L = Large Window or Door Replacement Event; IP-S = Small Interior Painting; IP-M = Medium Interior Painting; IP-L = Large Interior Painting; EP = Exterior Painting; C Ext = Contained Exterior Event; W Ext = Whole Exterior Event.

Table 4-41: Option B: First Year Target Housing Work Practice Costs

	Events (thousands)			Unit Costs			Total Costs (thousands)			
	All	LSWP		Spot	LSWP		Spot	LSWP		Total
		SF-O	Multi-O	Test	SF-O	Multi-O	Test	SF-O	Multi-O	Costs
Bath	135	89	6	$10	$22	$22	$1,347	$1,965	$142	$3,454
Kit	139	93	8	$10	$49	$30	$1,387	$4,549	$244	$6,180
Ad-S	27	21	0	$10	$16	$16	$274	$339	$4	$617
Ad-M	10	8	0	$10	$41	$26	$104	$335	$0	$438
Ad-L	42	33	0	$10	$51	$36	$422	$1,667	$16	$2,105
Wl-S	443	286	16	$10	$16	$16	$4,426	$4,570	$248	$9,244
Wl-M	25	17	1	$10	$41	$26	$253	$696	$31	$980
Wl-L	0	0	0	$10	$51	$36	$0	$0	$0	$0
WD-S	114	84	3	$10	$19	$15	$1,141	$1,594	$42	$2,777
WD-M	133	98	4	$10	$41	$26	$1,333	$4,005	$107	$5,446
WD-L	179	131	7	$10	$124	$72	$1,790	$16,212	$486	$18,488
IP-S	306	220	15	$10	$27	$22	$3,059	$5,953	$333	$9,345
IP-M	173	124	9	$10	$67	$46	$1,727	$8,301	$410	$10,438
IP-L	146	105	8	$10	$101	$63	$1,461	$10,556	$490	$12,506
EP	1,414	1,015	55	$10	$57	$106	$14,141	$57,835	$5,837	$77,812
C Ext	173	124	0	$10	$10	$10	$1,735	$1,243	$0	$2,978
W Ext	176	128	6	$10	$25	$41	$1,759	$3,197	$242	$5,198
Total	**3,636**	**2,575**	**138**				**$36,358**	**$123,017**	**$8,632**	**$168,007**

See Table 4-1 for options descriptions.

Abbreviations: SF-O = Single-Family Owner-Occupied Unit; Multi-O = Multi-Family Owner-Occupied Unit; Kit = Kitchen Event; Bath = Bathroom Event; Ad-S = Small Addition; Ad-M = Medium Addition; Ad-L = Large Addition; Wl-S = Small Wall-Disturbing Event; Wl-M = Medium Wall-Disturbing Event; Wl-L = Large Wall-Disturbing Event; WD-S = Small Window or Door Replacement Event; WD-M = Medium Window or Door Replacement Event; WD-L = Large Window or Door Replacement Event; IP-S = Small Interior Painting; IP-M = Medium Interior Painting; IP-L = Large Interior Painting; EP = Exterior Painting; C Ext = Contained Exterior Event; W Ext = Whole Exterior Event.

Table 4-42: Option D: First Year Target Housing Work Practice Costs

	Events (thousands)			Unit Costs			Total Costs (thousands)			
	All	LSWP		Spot	LSWP		Spot	LSWP		Total
		SF-O	Multi-O	Test	SF-O	Multi-O	Test	SF-O	Multi-O	Costs
Bath	119	87	6	$10	$22	$22	$1,191	$1,903	$133	$3,227
Kit	124	93	7	$10	$49	$30	$1,241	$4,556	$216	$6,012
Ad-S	25	22	1	$10	$16	$16	$252	$346	$8	$606
Ad-M	11	10	0	$10	$41	$26	$110	$390	$0	$500
Ad-L	41	36	0	$10	$51	$36	$414	$1,842	$0	$2,256
Wl-S	436	296	16	$10	$16	$16	$4,356	$4,742	$251	$9,349
Wl-M	31	21	2	$10	$41	$26	$308	$875	$56	$1,240
Wl-L	0	0	0	$10	$51	$36	$0	$0	$0	$0
WD-S	113	92	3	$10	$19	$15	$1,128	$1,745	$52	$2,924
WD-M	137	111	5	$10	$41	$26	$1,371	$4,539	$138	$6,049
WD-L	190	152	9	$10	$124	$72	$1,898	$18,821	$666	$21,386
IP-S	379	294	20	$10	$27	$22	$3,786	$7,926	$437	$12,149
IP-M	212	164	11	$10	$67	$46	$2,121	$10,995	$521	$13,637
IP-L	180	138	10	$10	$101	$63	$1,795	$13,982	$621	$16,399
EP	1,457	1,161	60	$10	$57	$106	$14,568	$66,152	$6,343	$87,062
C Ext	178	137	0	$10	$10	$10	$1,780	$1,366	$0	$3,145
W Ext	189	150	9	$10	$25	$41	$1,886	$3,740	$349	$5,975
Total	**3,821**	**2,962**	**159**				**$38,205**	**$143,921**	**$9,790**	**$191,916**

See Table 4-1 for options descriptions.

Abbreviations: SF-O = Single-Family Owner-Occupied Unit; Multi-O = Multi-Family Owner-Occupied Unit; Kit = Kitchen Event; Bath = Bathroom Event; Ad-S = Small Addition; Ad-M = Medium Addition; Ad-L = Large Addition; Wl-S = Small Wall-Disturbing Event; Wl-M = Medium Wall-Disturbing Event; Wl-L = Large Wall-Disturbing Event; WD-S = Small Window or Door Replacement Event; WD-M = Medium Window or Door Replacement Event; WD-L = Large Window or Door Replacement Event; IP-S = Small Interior Painting; IP-M = Medium Interior Painting; IP-L = Large Interior Painting; EP = Exterior Painting; C Ext = Contained Exterior Event; W Ext = Whole Exterior Event.

Table 4-43: Options A, B, C, and D: Second Year Target Housing Work Practice Costs

	Events (thousands)			Unit Costs			Total Costs (thousands)			
	All	LSWP		Spot Test	LSWP		Spot Test	LSWP		Total Costs
		SF-O	Multi-O		SF-O	Multi-O		SF-O	Multi-O	
Bath	268	78	6	$10	$22	$22	$2,684	$1,726	$132	$4,541
Kit	276	92	8	$10	$49	$30	$2,763	$4,487	$237	$7,487
Ad-S	55	27	0	$10	$16	$16	$546	$431	$7	$985
Ad-M	21	11	0	$10	$41	$26	$207	$438	$0	$644
Ad-L	84	43	0	$10	$51	$36	$841	$2,174	$13	$3,028
Wl-S	882	195	11	$10	$16	$16	$8,816	$3,115	$181	$12,112
Wl-M	50	16	1	$10	$41	$26	$504	$639	$37	$1,179
Wl-L	0	0	0	$10	$51	$36	$0	$0	$0	$0
WD-S	227	97	4	$10	$19	$15	$2,272	$1,852	$54	$4,178
WD-M	266	116	5	$10	$41	$26	$2,655	$4,737	$141	$7,533
WD-L	356	157	9	$10	$124	$72	$3,565	$19,513	$662	$23,740
IP-S	609	269	19	$10	$27	$22	$6,092	$7,260	$423	$13,775
IP-M	344	150	11	$10	$67	$46	$3,439	$10,069	$519	$14,027
IP-L	291	127	10	$10	$101	$63	$2,909	$12,787	$611	$16,308
EP	2,817	1,165	63	$10	$57	$106	$28,165	$66,406	$6,668	$101,238
C Ext	346	114	0	$10	$10	$10	$3,455	$1,141	$0	$4,596
W Ext	350	149	8	$10	$25	$41	$3,504	$3,716	$321	$7,540
Total	**7,242**	**2,804**	**157**				**$72,417**	**$140,490**	**$10,004**	**$222,912**

See Table 4-1 for options descriptions.
Abbreviations: SF-O = Single-Family Owner-Occupied Unit; Multi-O = Multi-Family Owner-Occupied Unit; Kit = Kitchen Event; Bath = Bathroom Event; Ad-S = Small Addition; Ad-M = Medium Addition; Ad-L = Large Addition; Wl-S = Small Wall-Disturbing Event; Wl-M = Medium Wall-Disturbing Event; Wl-L = Large Wall-Disturbing Event; WD-S = Small Window or Door Replacement Event; WD-M = Medium Window or Door Replacement Event; WD-L = Large Window or Door Replacement Event; IP-S = Small Interior Painting; IP-M = Medium Interior Painting; IP-L = Large Interior Painting; EP = Exterior Painting; C Ext = Contained Exterior Event; W Ext = Whole Exterior Event.

4.4 Estimating the Number of Firms and Personnel Obtaining Training and Certification to Meet the Demand for Lead-Safe RRP Services

The rule requires all entities that conduct RRP activities for compensation in regulated structures to become certified under the rule. This analysis refers to these certified entities as firms. The regulations also require firms to ensure that all persons performing renovation activities on behalf of the firm are either certified renovators that have received formal training or have received informal training from a certified renovator. Hereafter, "renovator" refers to an individual who has successfully completed a renovator course accredited by EPA or an EPA-authorized State or Tribal program, and "worker" refers to an individual who has received on-the-job training in the work practices from a certified renovator. It is expected that two types of construction businesses will perform regulated RRP work – businesses with employees and non-employer, or self-employed, contractors. In addition, rental companies are likely to perform some of the RRP work on the properties they manage rather than hire an outside contractor. Likewise, schools and daycare centers are likely to perform some or all of their RRP work with their own staff. The regulation requires that a certified renovator be physically present when warning signs are being posted, the work site is being contained, and when the post-renovation cleaning is being done. The certified renovator must be available, either on-site or by telephone, at all other times when regulated renovation activities are being performed. In addition, only a certified renovator may perform the cleaning verification step required by the rule. As such, each certified firm with employees will need to

have at least one certified renovator on staff. All self-employed contractors performing regulated RRP work will need to be trained as renovators and upon satisfying the training requirements, will need to be certified as firms.

4.4.1 Residential Activities: Estimating the Number of Firms and Personnel Obtaining Training and Certification to Meet the Demand for Lead-Safe RRP Services

This section describes how the analysis estimates the number of (1) firms obtaining certification, (2) renovators obtaining formal training, and (3) workers obtaining informal on-the-job training in order to meet the demand for lead-safe RRP services in residential settings. The general approach was to obtain Census estimates of the total number of establishments and employees in affected industries and adjust these estimates to account for the fact that not all work performed in these industries is affected by the rule. Note that Census data are only available for establishments and not firms, and these data are used as the basis for estimating the number of firms that will obtain certification. The total numbers of establishments and employees are adjusted in two ways: (1) according to the share of their revenues that come from residential work, and (2) to reflect the share of the housing stock that is affected by the LRRP revisions rule. [23] These adjustments imply that there will be some degree of specialization in regulated work. They do not, however, imply full specialization in regulated work. In addition, the adjustments do not fully reflect the share of RRP work that does not disturb any painted surfaces, or the disproportionate amount of residential work that is related to new construction. Adjusting for these two factors would result in a lower estimate of the number of affected firms and personnel.

4.4.1.1 Estimating the Stock of Certified Firms Necessary to Meet Demand for Residential RRP

The numbers of firms seeking certification under the rule are estimated in three segments: (1) residential construction establishments with employees, (2) non-employer residential construction establishments (i.e., self-employed contractors), and (3) Residential Property Managers and Lessors. Residential Property Managers and Lessors would not be affected by the removal of the opt-out provision (because rental units were not eligible for the opt-out provision under the 2008 LRRP rule) but they would be affected by the additional recordkeeping checklist requirement.

[23] With respect to the second adjustment, it implies that by expanding the scope of the LRRP program (by removing the opt-out provisions), the LRRP revisions will proportionately increase the number of certified firms and trained renovators and workers, and thus the total training and certification costs for residential contractors. To the extent that firms are less specialized than assumed here, more renovators and firms than originally predicted may become trained and renovated as a result of the 2008 LRRP rule. In that case, the incremental training and certification cost of the LRRP revisions rule may be less than this analysis estimates.

Estimating the Number of Residential Construction Establishments with Employees

The LRRP revisions rule requires firms that conduct RRP activities in housing previously eligible for the opt-out provision to become certified under the LRRP program rule. Because the majority of firms involved in construction work are likely to be small, single establishment businesses, this analysis assumes that firms will seek certification at the establishment level. As demonstrated in Chapter 2, the eleven potentially affected construction sectors (Residential Remodelers and ten specialty contractor sectors: Plumbing and HVAC, Tile and Terrazzo, Painting and Wall Covering, Finish Carpentry, Glass and Glazing, Drywall and Insulation, Siding, Other Building Equipment, Other Building Finishing, and Electrical contractors) include over 357,000 establishments with employees. Because these establishments are involved in a variety of construction and non-construction activities, in all likelihood only some of them will seek certification under the LRRP program rule. For example, only 54 percent of Residential Remodeling establishments specialize in residential work (i.e. derive at least 51 percent of their revenues from residential work). In addition, only 56 percent of the revenues of Residential Remodelers come from residential RRP activities. Establishments may choose to incur the cost of certification and of training their employees only if they derive a substantial portion of their revenues from residential Renovation, Repair, and Painting in housing affected by the regulations. Businesses that derive the majority of their revenues from new construction or from RRP activities in non-target housing may decide not to invest in certification.

Unfortunately, the U.S. Economic Census does not provide data on the number of establishments that specialize in residential RRP. The number of establishments estimated to specialize in residential RRP was estimated by multiplying the total number of establishments by each industry sector's ratio of RRP residential revenues to total construction revenues (See Table 4-44).

Table 4-44: Employer Construction Establishments, Total and Number Specializing in Residential RRP

NAICS	Description	Number of Employer Estab. in Industry	Residential Adjustment Factor: Residential Revenues as a Percent of Total Value of Construction	Number of Employer Estab. in Industry, Adjusted by Residential Adjustment Factor
236118	Residential remodelers	82,747	56%	46,338
238170	Siding contractors	6,632	50%	3,316
238350	Finish carpentry contractors	35,087	50%	17,544
238290	Other building equipment contractors	6,087	33%	2,009
238390	Other building finishing contractors	3,729	30%	1,119
238340	Tile and terrazzo contractors	8,950	28%	2,506
238220	Plumbing and HVAC contractors	87,501	27%	23,625
238150	Glass and glazing contractors	5,294	26%	1,376
238320	Painting and wall covering contractors	38,943	25%	9,736
238210	Electrical contractors	62,586	23%	14,395
238310	Drywall and insulation contractors	19,598	21%	4,116
Total		**357,154**	**35%**	**126,080**

Source: U.S. Census Bureau 2003; U.S. Census Bureau 2005d,f; U.S. Small Business Administration 2005; EPA Calculations

Estimating the Number of Non-Employer Residential Construction Firms

The number of self-employed (non-employer) firms in each of the eleven affected industry sectors is presented in Table 4-45. It was assumed that these firms will specialize in residential work with the same frequency as employer establishments in the same industry. In other words, to estimate the number of self-employed contractors specializing in residential work, the estimated number of non-employer establishments in each industry was multiplied by that industry's ratio of residential RRP revenues to total construction revenues (see Table 4-45).

Table 4-45: Non-Employer Construction Establishments, Total and Number Specializing in Residential RRP

NAICS	Description	Number of Non-Employer Estab. in Industry	Residential Adjustment Factor: Residential Revenues as a Percent of Total Value of Construction	Number of Non-Employer Estab. in Industry, Adjusted by Residential Adjustment Factor
236118	Residential remodelers	194,182	56%	108,742
238170	Siding contractors	15,939	50%	7,970
238350	Finish carpentry contractors	185,118	50%	92,559
238290	Other building equipment contractors	9,710	33%	3,204
238390	Other building finishing contractors	19,674	30%	5,902
238340	Tile and terrazzo contractors	47,220	28%	13,222
238220	Plumbing and HVAC contractors	110,183	27%	29,749
238150	Glass and glazing contractors	12,723	26%	3,308
238320	Painting and wall covering contractors	205,462	25%	51,366
238210	Electrical contractors	102,219	23%	23,510
238310	Drywall and insulation contractors	103,398	21%	21,714
Total		**1,005,828**	**36%**	**361,246**

Source: U.S. Census Bureau 2003; U.S. Census Bureau 2005d,f; U.S. Small Business Administration 2005; EPA Calculations

Estimating the Number of Property Managers and Lessors that Perform Residential RRP

Instead of hiring an outside contractor for RRP work on properties under their management, Residential Property Managers (NAICS 531311) and Lessors of Residential Buildings and Dwellings (NAICS 531110) may choose to do the renovation work with their own staff. Since all firms performing RRP work in regulated housing must be certified, establishments that choose to perform their own RRP work will seek certifications under the regulations. The estimated numbers of these establishments are presented in Table 4-46. Note that rental units and therefore Residential Property Managers and Lessors of Residential Buildings and Dwellings are not affected by the opt-out provision, but would be subject to the additional recordkeeping checklist requirement.

The U.S. Economic Census does not present any data on the amount of RRP work performed by Residential Property Managers on their own properties. Due to this lack of data, this analysis assumes that all Residential Property Management and Lessors of Residential Buildings and Dwellings establishments that have paid employees and manage housing regulated by the rule will seek certification and train their employees as certified renovators or workers. Although this assumption is likely to overestimate the number of establishments and personnel seeking certification and training, it is not unreasonable since performing minor renovation or maintenance work in-house is often less expensive than hiring an outside contractor. The vast majority of establishments that manage regulated housing may

thus find certification worthwhile. Note that only establishments with employees are expected to seek certification; non-employers are unlikely to have the time or manpower to perform renovations themselves and are more likely to hire an outside contractor for work that disturbs more than 6 square feet per room of a painted surface for interior renovations or 20 square feet for exterior renovations.

Table 4-46: Property Managers and Lessor Establishments Performing RRP

NAICS	Description	Number of Establishment in Industry
531311	Residential Property Managers	26,223
531110	Lessors or Residential Buildings and Dwellings	61,787
Total		**88,010**

Source: U.S. Census Bureau 2003; U.S. Census Bureau 2005d,f; U.S. Small Business Administration 2005; EPA Calculations

Summary of the Additional Number of Establishments Needed to Perform Residential RRP After the Removal of the Opt-Out Provision

Table 4-47 presents a summary of the estimated number of establishments specializing in residential RRP. The estimated number of residential RRP establishments was further reduced to account for the fact that only some of these entities will perform RRP work in target housing. The latter adjustment was made based on data obtained from the American Housing Survey that 65 percent of U.S. households reside in target housing.

Table 4-47: Total Number of Establishments Performing Residential RRP in Target Housing

Type of Establishment	Number Performing Residential RRP	Estimated Number of Establishments Performing Residential RRP in Pre-1978 Housing
Non-Employer Construction Establishments	361,246	234,810
Employer Construction Establishments	126,080	81,952
Property Manager and Lessor Establishments	88,010	57,207
Total	**575,336**	**373,968**

Source: U.S. Census Bureau 2003; U.S. Census Bureau 2005d,f; U.S. Small Business Administration 2005; EPA Calculations

The estimate that 373,968 firms perform residential RRP in pre-1978 housing represents the total stock of firms that would be required to meet the potential demand for RRP using LSWP in all target housing. To estimate the stock of certified firms under the various options, 373,968 is adjusted by 75 percent to account for the 75 percent rate of compliance assumed in this analysis. In addition, the compliance-adjusted estimate is adjusted to reflect the scope of each regulatory option, based on the percentage of all target housing RRP events regulated under each option. The removal of the opt-out provision from the final LRRP rule would affect entities performing RRP work in owner-occupied target housing units that are not COFs and where no child under the age of six or a pregnant woman resides. The estimated stock of firms needed to meet the demand for RRP under the 2008 LRRP rule as well as the increase in the

stock of certified firms that would be needed after the removal of the opt-out provision is presented in Table 4-48.

Table 4-48: Estimated Stock of Firms Certified to Perform RRP Under the 2008 LLRP Rule and the Opt-Out Revision, by Option and Year

	2008 LRRP Rule	Additional Number Estimated due to LRRP Revisions			
		Option A	Option B	Option C	Option D
Year 1	211,721	111,426	55,713	0	58,544
Year 2	210,853	110,969	110,969	110,969	110,969
Year 3	209,989	110,514	110,514	110,514	110,514

See Table 4-1 for options descriptions.
Source: EPA Calculations.

Estimating the Stock of Trained Construction Workers Necessary to Meet Demand for Residential RRP

The rule requires certified firms to ensure that renovation activities covered by the rule are performed by certified renovators, or by renovation workers who receive on-the-job training in the work practices from a certified renovator. The regulation requires that a certified renovator be physically present when warning signs are being posted, the work site is being contained, and during post-renovation cleaning. The certified renovator must be available, either on-site or by telephone, at all other times when regulated renovation activities are being performed. In addition, only a certified renovator may perform the cleaning verification step required by the rule. As such, each certified establishment with employees will need to have at least one certified renovator on staff. All self-employed contractors performing regulated RRP work will need to be trained as renovators and upon satisfying the training requirements, will need to be certified as firms.

Estimating the Number of Residential Construction Employees (excluding self-employed)

To estimate the number of construction employees that will train to become certified renovators, this analysis looked at the average number of construction employees in establishments performing residential RRP jobs. The average employment size was calculated by dividing the number of construction employees seeking training by the number of establishments certified in each industry (See Table 4-49). This analysis also assumed that establishments will employ one certified renovator per every five construction employees. In other words, establishments that have one to five construction workers on staff will employ one renovator, establishments with more than five and fewer than 10 construction workers on staff will employ two renovators, and those with 10 or more construction workers on staff will employ three renovators. The average number of construction workers per establishment was no higher than 15 in any affected sector.

To estimate the number of construction employees that would be trained as renovators, the estimated number of establishments seeking certification in each sector was multiplied by the expected number of renovators per establishment for that sector (see Table 4-49 and Table 4-50). Four of the affected sectors (Other Building Equipment Contractors, Other Building Finishing Contractors, Electrical Contractors and Drywall and Insulation Contractors) had, on average, between 10 and 15 construction employees per establishment and were assumed to have three renovators on staff each. The number of construction employees in each sector that will need to receive worker training was estimated by subtracting the

number of people receiving renovator certification from the total number of people seeking training (see Table 4-50).

Table 4-49: Employer Construction Employees: Construction Workers in Supervisory Roles

NAICS	Description	Number of Employer Estab. in Industry	Number of Construction Workers Employed by Employer Establishments	Employees Per Establishment	Estimated Number of Renovators Per Establishment*
236118	Residential remodelers	82,747	207,633	2.5	1
238170	Siding contractors	6,632	30,284	4.6	1
238350	Finish carpentry contractors	35,087	129,888	3.7	1
238290	Other building equipment contractors	6,087	90,504	14.9	3
238390	Other building finishing contractors	3,729	37,353	10.0	3
238340	Tile and terrazzo contractors	8,950	44,729	5.0	1
238220	Plumbing and HVAC contractors	87,501	712,452	8.1	2
238150	Glass and glazing contractors	5,294	34,086	6.4	2
238320	Painting and wall covering contractors	38,943	184,328	4.7	1
238210	Electrical contractors	62,586	606,403	9.7	2
238310	Drywall and insulation contractors	19,598	261,239	13.3	3
Total		**357,154**	**2,338,899**	**6.5**	**2**

*It is assumed that establishments with 5 or fewer employees will have one construction worker in a supervisory role; establishments with more than 5 and fewer than 10 employees will have two construction workers in supervisory roles; establishments with 10 or more employees will have three construction workers in supervisory roles.

Source: U.S. Census Bureau 2003; U.S. Census Bureau 2005d,f; U.S. Small Business Administration 2005; EPA Calculations

The number of employee establishment personnel expected to seek training as either certified renovators or workers was estimated by applying the same approach used for the estimation of the number of establishments that will seek certification under the regulations (note: employee establishment personnel does not include the self-employed). It was assumed that the number of people who perform RRP work in each of the affected industries is proportional to the ratio of residential RRP revenues to the total construction revenues in that sector. In other words, it was assumed that since 28 percent of construction revenues in the Tile and Terrazzo contractor industry come from residential RRP, then 28 percent of the construction employees perform residential RRP work. The number of employees estimated to specialize in residential RRP was estimated by multiplying the total number of employees by each industry sector's ratio of RRP residential revenues to total construction revenues (See Table 4-50).

Table 4-50: Employer Construction Renovators and Workers, Total and Number Specializing in Residential RRP

NAICS	Description	Estimated Number of Construction Renovators	Estimated Number of Non-Supervisory Construction Workers	Residential Adjustment Factor: Residential Revenues as a Percent of Total Value of Construction	Estimated Number of Residential Construction Renovators	Estimated Number of Non-Supervisory Residential Construction Workers
236118	Residential remodelers	82,747	124,886	56%	46,338	69,936
238170	Siding contractors	6,632	23,652	50%	3,316	11,826
238350	Finish carpentry contractors	35,087	94,801	50%	17,544	47,400
238290	Other building equipment contractors	18,261	72,243	33%	6,027	23,839
238390	Other building finishing contractors	11,187	26,166	30%	3,357	7,849
238340	Tile and terrazzo contractors	8,950	35,779	28%	2,506	10,018
238220	Plumbing and HVAC contractors	175,002	537,450	27%	47,250	145,112
238150	Glass and glazing contractors	10,588	23,498	26%	2,752	6,110
238320	Painting and wall covering contractors	38,943	145,385	25%	9,736	36,346
238210	Electrical contractors	125,172	481,231	23%	28,790	110,683
238310	Drywall and insulation contractors	58,794	202,445	21%	12,348	42,512
Total		**571,363**	**1,767,536**	**36%**	**179,964**	**511,631**

Source: U.S. Census Bureau 2003; U.S. Census Bureau 2005d,f; U.S. Small Business Administration 2005; EPA Calculations

Estimating the Number of Property Managers and Lessors Employees that Perform Residential RRP

Based on 2002 U.S. Census Data, establishments in the Residential Property Manager industry employ about eleven people on average. It was estimated that each establishment will have two certified renovators on staff; the remainder of the employees will be trained as workers. This estimate is based on the fact that Residential Property Manager establishments are involved in a variety of non-construction activities; it is thus unlikely that these businesses will have more than one ten-person construction crew on staff. Lessors of Residential Buildings and Dwellings establishments employ about five people on

average, and will thus each have one certified renovator on staff. The remaining employees involved in RRP projects will be trained as workers. Table 4-51 presents the estimated number of employees in the residential property managers and lessors of residential buildings and dwellings industries seeking training.

Table 4-51: Property Managers and Lessor Establishments Performing RRP

NAICS	Description	Number of Establishments in Industry	Number of RRP Work Renovators	Number of RRP Workers (Non-Supervisors)
531311	Residential Property Managers	26,223	52,446	237,424
531110	Lessors or Residential Buildings and Dwellings	61,787	61,787	230,618
Total		**88,010**	**114,233**	**468,042**

Source: U.S. Census Bureau 2003; U.S. Census Bureau 2005d,f; U.S. Small Business Administration 2005; EPA Calculations

4.4.1.2 Estimating the Increase in the Number of Firms and Personnel Seeking Certification and Training Each Year After the Removal of the Opt-Out Provision

The number of renovators and firms that seek training and certification in the first few years is estimated slightly differently for the option with a phase-in period (Option D) as it is for those that do not phase-in regulated structures in the second year (Options A and C). Further, Option B, which would implement the revised rule midway through the first year, is calculated similarly to an option with a phase-in period.

The methodology employed to estimate the stock of renovators and firms required to meet the demand for lead-safe RRP services is described above and the results are summarized in Table 4-48. The number of firms and individuals seeking training and certification in any given year is estimated from the stock of firms and individuals necessary to meet demand for lead-safe RRP services. (Because training and certification are valid for five years, the annual number trained and certified each year after the first year is a fraction of the total stock of trained individuals and certified firms.) The differences in the number of renovators and firms seeking training and certification across the options are proportional to the number of RRP events regulated by each option..

Note that many of the additional firms and renovators that expected to become certified and trained because of the removal of the opt-out provision are likely to seek certification and training before the removal of the opt-out provision goes into effect. (So, for example, under Option C, it is unlikely that there would actually be zero firms certified or renovators trained in the first year after promulgation of the rule.) However, this analysis utilizes the simplifying assumption that any additional initial certification and training takes place over a 12 month period starting from the date of the expansion of the regulated universe.

Options Without Phase-In (Options A and C)

In the first year, it is assumed that the increase in the number of renovators and firms that seek initial training and certification is equal to the number that is necessary to meet the increase in demand for lead-safe RRP services in that first year. Thus, under options A and C, the number of initial trainings and certifications in the year the opt-out provision is removed is equal to the stock of renovators and firms required to meet the increase in demand for lead-safe RRP services associated with all owner-occupied target housing units where no child under age six or pregnant woman resides. After the first year, it is assumed that one-fifth of the necessary stock of individuals and firms will obtain training and certification

each year (since refresher-training and re-certification is required every five years). In addition, the number of individuals trained is assumed to decline by 0.41 percent annually to account for the decline in the size of the pre-1978 housing stock over time, and thus the decline in demand for lead-safe renovation services. The entire stock of workers is assumed to receive informal training each year.

Options With Phase-In (Option D):

In the first year, it is assumed that the increase in the number of renovators and firms that seek initial training and certification is equal to the number that is necessary to meet the demand for lead-safe RRP services in that first year. Under Option D, the number of initial trainings and certifications in the first year is equal to the stock of renovators and firms required to meet the increase in demand for lead-safe RRP services associated with all owner-occupied pre-1960 housing units where no child under age six or pregnant woman resides. In the second year, this analysis makes the simplifying assumption that one-fifth of the number who were trained and certified in the first year will seek initial- or re-certification (adjusted by 0.41 percent annually to reflect the decline in the stock of pre-1978 buildings), and that the stock of individuals and firms required to meet the additional demand in the newly regulated 1960 to 1978 structures will obtain initial training and certification. In later years, it is assumed that one-fifth of the necessary stock of individuals and firms will obtain training and certification each year (since refresher-training and re-certification is required every five years). The entire stock of workers is assumed to receive informal training each year.

Options With Partial-Year Implementation (Option B):

In the first year, it is assumed that the increase in the number of renovators and firms that seek initial training and certification is equal to the number that is necessary to meet the increased demand for lead-safe RRP services in that first year. Under Option B, the rule does not become effective until halfway through the first year. Thus, under Option B, the stock of renovators and firms seeking initial training and certification in the first year is half as large as that required to meet the increase in demand for lead-safe RRP services in all pre-1978 structures during a full year. In the second year, this analysis makes the simplifying assumption that one-fifth of the number who were trained and certified in the first year will seek initial- or re-certification (adjusted by 0.41 percent annually to reflect the decline in the stock of pre-1978 buildings). In addition, the stock of individuals and firms required to meet the additional demand for a full year's renovations (rather than the six months in the first year) will obtain initial training and certification. In later years, it is assumed that one-fifth of the necessary stock of individuals and firms will obtain training and certification each year (since refresher-training and re-certification is required every five years). The entire stock of workers is assumed to receive informal training each year.

Training and Certification after the Initial Years

As indicated above, this analysis assumes a steady annual number of firm and individual certifications after the second year of regulation with an annual decline of 0.41 percent. If all the individuals and firms needed to meet the demand for lead-safe RRP were trained and certified in the first and second years, one might expect a drop in the level of training and certification in the third year, followed by a spike in the next year. That is, one might expect a cyclical pattern of training and certification to emerge. However, it is difficult to predict how cyclical the training and certification demand might be or how this cyclicality might diminish over time. Therefore, this analysis assumes that a typical amount of training and certification occurs each year after the first two years. Modeling a cyclical component would add little to the analysis without being able to estimate the extent of any cyclicality more precisely.

The analysis does account for certified firms and trained individuals that exit the industry each year and are replaced by new entrants. This analysis accounts for turnover in the regulated RRP industry by assuming a certain percentage of certifications each year are initial certifications. Specifically, after the

first year, 52 percent of the renovators seeking training and certification are assumed to be seeking their initial certification. This percentage is based on the relative number of Abatement Supervisors applying for initial certifications according to the Federal Lead-Based Paint Program (FLPP) database (EPA 2005). Similarly, 54 percent of firms seeking certification are assumed to be seeking their initial certification based on the relative frequency of initial certifications observed for abatement firms in the FLPP database.

Summary of Number of Individuals Trained to Perform Residential RRP using LSWP

Table 4-52 presents a summary of the estimated number of construction renovators and workers specializing in residential RRP. The estimated number of residential RRP renovators and workers was further reduced to account for the fact that only some of these individuals will perform RRP work in target housing. The latter adjustment was made based on data obtained from the American Housing Survey that 65 percent of U.S. households reside in target housing.

Table 4-52: Total Number of Renovators and Workers Performing Residential RRP in Target Housing

Type of Establishment	Number of Renovators Performing Residential RRP	Number of Renovators Performing Residential RRP in Pre-1978 Housing	Number of Non-Supervisors Performing Residential RRP	Number of Non-Supervisors Performing Residential RRP in Pre-1978 Housing
Non-Employer Construction Establishments	361,245	234,809	0	0
Employer Construction Establishments	179,964	116,977	511,631	332,560
Property Manager and Lessor Establishments	114,233	74,251	468,042	304,227
Total	**655,442**	**426,038**	**979,673**	**636,787**

Source: U.S. Census Bureau 2003; U.S. Census Bureau 2005d,f; U.S. Small Business Administration 2005; EPA Calculations

The estimated number of renovators and workers that perform residential RRP in pre-1978 housing, 426,038 and 636,787, respectively, represents the estimated stock of renovators and workers that would be required to meet the demand for RRP in target housing (This includes renovations covered by the 2008 LRRP rule as well as the LRRP revisions rule). To estimate the stock of trained individuals under the various options, these estimates are adjusted by 75 percent to account for the 75 percent rate of compliance assumed in this analysis. In addition, the compliance-adjusted estimate is further adjusted to reflect the scope of each regulatory option based on the percentage of all target housing RRP events regulated under each option. For example, the increase in the stock of trained renovators under Option A (126,940) is estimated by multiplying the estimated stock of renovators that would be required to meet the demand for RRP in all target housing (426,038) by the compliance rate (75 percent) and the percentage of target housing RRP events regulated under Option A (35 percent). The removal of the opt-out provision from the 2008 LRRP rule would require that RRP is performed by trained renovators and workers in owner-occupied target housing units that are not COFs and where no child under the age of six or a pregnant woman resides. The estimated increase in the stock of renovators and workers that would be

required after the removal of the opt-out provision is presented in Table 4-53, and compared to the prior estimates for the 2008 LRRP rule (EPA 2008).

Table 4-53: Estimated Stock of Trained Individuals to Perform RRP in Regulated Target Housing Under the 2008 LRRP Rule and Opt-out Revision, by Option and Year

	2008 LRRP Rule	Additional Number Estimated due to LRRP Revisions			
		Option A	**Option B**	**Option C**	**Option D**
Renovators					
Year 1	*235,916*	126,940	63,470	0	66,695
Year 2	*234,949*	126,420	126,420	126,420	126,420
Year 3	*233,985*	125,901	125,901	125,901	125,901
Workers					
Year 1	*337,887*	189,734	94,867	0	99,688
Year 2	*336,502*	188,956	188,956	188,956	188,956
Year 3	*335,122*	188,181	188,181	188,181	188,181

See Table 4-1 for options descriptions.

Source: EPA Calculations.

Table 4-54 presents a summary of the estimated increase in the number of establishments that will seek firm certification each year as a result of the removal of the opt-out provision, as well as the increase in the estimated number of employees that will need to be trained as renovators and workers in years 1 through 3, and compares this to prior estimates for the 2008 LRRP rule (EPA 2008).

Table 4-54: Target Housing Activities: Estimated Number of Establishments Seeking Certification and Workers and Renovators Seeking Training Under the 2008 LRRP Rule and the Opt-out Revision

	2008 LRRP Rule	Additional Number Estimated due to LRRP Revisions			
		Option A	Option B	Option C	Option D
Year 1					
Total Number of Establishments (with Employees and without) Seeking Certification	*211,721*	111,426	55,713	0	58,544
Total Number of Renovators Seeking Training	*235,916*	126,940	63,470	0	66,695
Total Number of Workers Seeking Training	*337,887*	189,734	94,867	0	99,688
Year 2					
Total Number of Establishments (with Employees and without) Seeking Certification	*70,284*	22,194	66,581	110,969	64,326
Total Number of Renovators Seeking Training	*78,316*	21,913	74,166	126,420	71,511
Total Number of Workers Seeking Training	*336,502*	188,956	188,956	188,956	188,956
Year 3					
Total Number of Establishments (with Employees and without) Seeking Certification	*69,996*	22,103	22,103	22,103	22,103
Total Number of Renovators Seeking Training	*77,995*	21,823	21,823	21,823	21,823
Total Number of Workers Seeking Training	*335,122*	188,181	188,181	188,181	188,181

Note: Components may not add up to totals due to rounding. The number of firms and individuals certified and trained, respectively, are assumed to decline by 0.41 percent annually to account for the decline in the size of the regulated housing stock over time, and thus the demand for lead-safe renovation services. This table presents the numbers of renovators and firms seeking training and certification in a given year; therefore the numbers in years 2 and 3 differ from those presented in Table 4-48, which presents the stock of trained renovators and certified firms. Because training and certification are valid for five years, the stock of certified firms and trained individuals exceeds the annual number trained and certified each year after Year 1. Workers receive training each year.
See Table 4-1 for options descriptions.
Source: EPA Calculations.

4.5 Training Costs

Training costs include the cost of the time spent on training activities as well as the associated travel and tuition costs. Note that tuition costs are assumed to include the costs associated with training provider accreditation. In other words, it is assumed that accredited training providers pass along their accreditation fees and other administrative costs through their tuition. These accreditation fees and other administrative costs are estimated in the paperwork burden analysis but are only implicitly accounted for (as part of tuition costs) in the estimates of the total cost of the rule.

4.5.1 Training Burden Per Individual

To estimate the incremental burden of training, several cost components are calculated, including tuition rates, wage rates, and travel and expense costs. Each certified renovator will participate in 8 hours of formal initial training. Refresher renovator certification training is required every five years; the refresher course is only four hours. Workers receive informal, on-the-job training; it is assumed that, on average, three workers are trained at a time by a certified renovator and the training requires one hour.

Tuition for the initial certified renovator training class is estimated to be $186; the corresponding refresher course tuition is estimated to be $93 (EPA 2006). This estimate relies on the assumption that the average hourly tuition is equal to the observed rates for the accredited lead abatement and evaluation

courses ($23.26/hr).[24] Additional travel and meal costs associated with training are assumed to be $121 (EPA 2006).[25] Digital photos of each certified renovator are also added into the additional costs. The total cost for a one-time use digital camera that takes 25 pictures is $14 ($0.56 per picture taken). The total time allotted to taking and processing these photos is estimated at 3 minutes ($1.20). A total cost of $1.76 (rounded to $2 in the total cost estimates) is therefore estimated. For a class size of 10 students, 3 minutes per student is equivalent to a total time of 30 minutes to take the digital photos, associate them with the appropriate students, and insert the photos onto the training certificates.

The value of the time for certified renovators to receive formal initial training is $253 (8 hours at a loaded wage rate of $31.64/hour); the refresher training is half this amount, or $127 (EPA 2006). Certified renovators may be self-employed or might be employed by a larger company. Therefore, the value of time is likely to represent a mix of lost wages and additional overhead to firms. Assuming one certified renovator trains three workers at a time and this informal training requires an hour, informal training is estimated to cost $27 per worker trained, based on the renovator wage rate and an average loaded wage rate for workers of $16.94/hour (EPA 2006). Thus, as shown in Table 4-55, the aggregated incremental cost of training is $560 for initial certified renovator training, $341 for refresher certified renovator training and $27 for informal worker training (EPA 2006).

Table 4-55: Incremental Training Costs (2005$)

	Tuition	Value of Time	Travel and Meals	Digital Photo	Total
Initial Training					
Certified Renovator	$186	$253	$121	$2	$562
Worker	$0	$27	$0	$0	$27
Refresher Training					
Certified Renovator	$93	$127	$121	$0	$341

Source: EPA Calculations.

4.5.2 Total Training Costs

Table 4-56 through Table 4-58 present the total training costs of the rule for the first three years. The number of renovators and workers seeking training is described in Section 4.4.1.2, the value of training time for renovators and workers is described in Section 4.5.1. The average training cost per renovator varies in the initial years of the regulation according to the relative number of initial and refresher trainings. After the second year, 52 percent of contractors and public or commercial building renovators receive initial training (due to turnover in the industry) and the rest obtain refresher training. Note that an individual who received initial training and let their certification expire must retake the initial training. The stock of regulated structures declines by 0.41 percent annually which also reduces the demand for lead-safe renovation services, and thus the number of renovators and workers seeking training and the undiscounted total training costs.

[24] The average of the hourly tuition rates are used rather than picking a single similar course because no single course is similar enough to the renovator course. For example, the initial courses are the only courses with hands-on training, but they are also longer than the renovator course. The refresher courses are more similar in length, but have no hands on requirements.

[25] Travel costs include 2 hours of travel time ($63), meals ($9), and mileage costs (50 miles, $49).

Table 4-56: Total Training Costs for Renovators and Workers: First Year of Regulation

	Number of Renovators Seeking Training	Average Cost of Training	Total Renovator Training Cost	Total Worker Training Cost ($27 Per Worker)	Total Training Costs (2005$, before discounting)
Year 1					
Initial Training Renovators					
Option A	126,940	$562	$71,340,280	$5,122,818	$76,463,098
Option B	63,470	$562	$35,670,140	$2,561,409	$38,231,549
Option C	0	$562	$0	$0	$0
Option D	66,695	$562	$37,482,590	$2,691,576	$40,174,166

See Table 4-1 for options descriptions.
Source: EPA Calculations.

Table 4-57: Total Training Costs for Renovators and Workers: Second Year of Regulation

	Number of Renovators Seeking Training	Average Cost of Training	Total Renovator Training Cost	Total Worker Training Cost ($27 Per Worker)	Total Training Costs (2005$, before discounting)
Year 2					
Initial Training Renovators					
Option A	21,913	$562	$12,314,949	$5,101,814	$17,416,764
Option B	74,166	$562	$41,681,367	$5,101,814	$46,783,182
Option C	126,420	$562	$71,047,785	$5,101,814	$76,149,599
Option D	71,511	$562	$40,189,218	$5,101,814	$45,291,033
Refresher Training Renovators					
Option A	3,371	$341	$1,149,575	n/a	$1,149,575
Option B	1,686	$341	$574,788	n/a	$574,788
Option C	0	$341	$0	n/a	$0
Option D	1,771	$341	$603,993	n/a	$603,993

See Table 4-1 for options descriptions.
Source: EPA Calculations.

Table 4-58: Total Training Costs for Renovators and Workers: Third Year of Regulation

	Number of Renovators Seeking Training	Average Cost of Training	Total Renovator Training Cost	Total Worker Training Cost ($27 Per Worker)	Total Training Costs (2005$, before discounting)
Year 3					
Initial Training Renovators					
Option A	21,823	$562	$12,264,458	$5,080,897	$17,345,355
Option B	21,823	$562	$12,264,458	$5,080,897	$17,345,355
Option C	21,823	$562	$12,264,458	$5,080,897	$17,345,355
Option D	21,823	$562	$12,264,458	$5,080,897	$17,345,355
Refresher Training Renovators					
Option A	3,357	$341	$1,144,862	n/a	$1,144,862
Option B	3,357	$341	$1,144,862	n/a	$1,144,862
Option C	3,357	$341	$1,144,862	n/a	$1,144,862
Option D	3,357	$341	$1,144,862	n/a	$1,144,862

See Table 4-1 for options descriptions.
Source: EPA Calculations.

4.6 Certification Costs: Firm Paperwork Burden and EPA Administrative and Enforcement Costs

Under this rule, states are given the option of administering the regulations as long as the state implementation plan is approved by EPA. EPA will directly administer programs in states that do not have an approved implementation plan. This section of the analysis estimates costs that EPA expects to incur while administrating and enforcing the LRRP rule under the assumption that EPA administers the program everywhere. States that choose to implement the rule themselves are expected to incur similar costs in lieu of EPA. Firm paperwork costs associated with certification are also presented in this section.

EPA will perform three tasks as part of administering the LRRP rule: accrediting training providers, certifying firms, and processing training provider notifications. In addition to administrative costs, EPA will also incur costs to enforce the LRRP rule. To reduce the burden on the regulated community, EPA has decided not to require formal certification for renovators and workers.

In the economic analysis of the 2008 LRRP rule, EPA estimated enforcement costs independently from firm certification costs. However, for this analysis, EPA adopted firm certification fees set forth in a separate rulemaking. Under this fee schedule, enforcement costs are assumed to be variable and captured by the certification fees paid by firms.

Accreditation/certification cost estimates are based on the 2009 rule that set fees for accreditation of training programs and certification of lead-based paint activities and renovation contractors (EPA 2009). This analysis utilizes the $300 per firm fees set for initial certification and re-certification. Note that there are also administrative and enforcement costs related to accrediting training providers but these costs are also assumed to be recovered through tuition charges and are therefore accounted for through the tuition costs.

4.6.1 Administrative and Enforcement Costs: Contribution to Total Costs

The fees that firms and training providers pay to become certified and accredited, respectively, are designed to recover EPA's administrative and enforcement costs. These fees were set in a separate rulemaking (74 Federal Register 11863, March 20, 2009, codified at 40 CFR ' 745.92). Simply adding these costs to the other cost components, however, will result in some double counting. This analysis assumes that training providers will recover their accreditation fees (which in turn cover EPA's administrative and enforcement costs of training provider accreditation) through the tuition they charge to renovators. Those costs have already been accounted for in Section 4.5 Thus, the additional social cost of EPA's administrative and enforcement activities can be calculated based on the fees firms pay to become certified. The EPA costs that will be recovered from RRP firms in a given year are calculated as follows:

$$\text{EPA Administrative and Enforcement Costs that will be recovered from Firms}_{\text{Year X}} = \$300 * \#\text{ of Firms Certified}_{\text{Year X}}$$

4.6.2 Firm Paperwork Burden

It is estimated that firms will spend a total of three hours to familiarize themselves with the LRRP rule's requirements and a half an hour to fill out and mail the one-page application for renovator certification. In addition, each year time is spent keeping records that demonstrate compliance with the LRRP training and work-practice requirements. Additional costs are minor and include: one application printout, one photocopy for personal records, an envelope, and a stamp. As shown in Table 4-60, it is estimated that

paperwork costs are $263 in initial certification years, $168 in re-certification years and $152 in other years.

Table 4-59: Costs to Firms Associated with Information Collection (2005$)

	First Year/Initial Certification Year	Re-Certification Year	Non-Certification Years
Rule Familiarization (3 hours)	$94.93	$0	$0
Certification Form (half hour)	$15.82	$15.82	$0
Recordkeeping (4.8 hours per firm)	$151.89	$151.89	$151.89
2 photocopies	$0.16	$0.16	$0
1 envelope	$0.02	$0.02	$0
1 Stamp	$0.37	$0.37	$0
Total[a]	**$263**	**$168**	**$152**

[a] Rounded to nearest dollar.
Source: EPA Calculations and U.S. Bureau of Labor Statistics 2005a.

4.6.3 Total Certification Costs: Increase in Firm Paperwork and EPA Administrative and Enforcement Costs Associated with the Removal of the Opt-Out Provision

Table 4-60 shows the total certification costs for the LRRP rule revision in the first year. Table 4-61 and Table 4-62 show the total certification costs by initial certification firms, refresher certification firms, and firms not seeking certification for the LRRP rule revision in the second and third years, respectively. The certification costs decline by 0.41 percent each year after the third year, accounting for the expected decline in regulated universe as older housing units are replaced with newer structures. Total costs per-firm are the sum of EPA's administrative costs per firm and the firm's costs for paperwork and recordkeeping. This cost per firm is multiplied by the additional number of establishments estimated to provide lead-safe RRP services as a result of the removal of the opt-out provision (see Section 4.4.1.1).

In the first year, all the firms listed in the number of establishments' column in Table 4-60 are presumed to seek initial certification, paying their share of EPA's administrative and enforcement costs ($300 per firm, see Section 4.6.1). In addition, they incur a cost for paperwork and recordkeeping. The tables reflect only those additional firms that are expected to become certified as a result of the removal of the opt-out provision.

Table 4-60: Firm Annual Certification Costs: Firm Paperwork and Fees in the First Year of Regulation (including EPA Administrative and Enforcement Costs)

	EPA Administrative / Enforcement Costs	Paperwork Costs	Number of Establishments	Total Certification Costs (2005$, before discounting)
Year 1				
Initial Certification Firms				
Option A	$300	$263	111,426	$62,732,838
Option B	$300	$263	55,713	$31,366,419
Option C	$300	$263	0	$0
Option D	$300	$263	58,544	$32,960,272

See Table 4-1 for options descriptions.
Source: U.S. EPA 2009

In subsequent years, the increase in EPA administrative costs per-firm and the firm paperwork costs are estimated based on the costs presented in Table 4-61 and Table 4-62 and the relative number of firms seeking initial-certification, re-certification, and not seeking certification. Section 4.4.1.1 describes and presents these estimates. The increase in the number of establishments is shown for firms seeking initial certification, recertification, and not seeking certification.

Table 4-61: Firm Annual Certification Costs: Firm Paperwork and Fees in the Second Year of Regulation (including EPA Administrative and Enforcement Costs)

	EPA Administrative / Enforcement Costs	Paperwork Costs	Number of Establishments	Total Certification Costs (2005$, before discounting)
Year 2				
Initial Certification Firms				
Option A	$300	$263	19,974	$11,245,614
Option B	$300	$263	65,472	$36,860,624
Option C	$300	$263	110,969	$62,475,633
Option D	$300	$263	63,160	$35,559,023
Re-Certification Firms				
Option A	$300	$168	2,219	$1,038,671
Option B	$300	$168	1,110	$519,336
Option C	$300	$168	0	$0
Option D	$300	$168	1,166	$545,725
Non-Certification Year Firms				
Option A	n/a	$152	88,775	$13,493,849
Option B	n/a	$152	44,388	$6,746,925
Option C	n/a	$152	0	$0
Option D	n/a	$152	46,643	$7,089,763

See Table 4-1 for options descriptions.

Source: EPA Calculations; U.S. EPA 2009

Table 4-62: Firm Annual Certification Costs: Firm Paperwork and Fees in the Third Year of Regulation (including EPA Administrative and Enforcement Costs)

	EPA Administrative / Enforcement Costs	Paperwork Costs	Number of Establishments	Total Certification Costs (2005$, before discounting)
Year 3				
Initial Certification Firms				
Option A	$300	$263	19,893	$11,199,507
Option B	$300	$263	19,893	$11,199,507
Option C	$300	$263	19,893	$11,199,507
Option D	$300	$263	19,893	$11,199,507
Re-Certification Firms				
Option A	$300	$168	2,210	$1,034,413
Option B	$300	$168	2,210	$1,034,413
Option C	$300	$168	2,210	$1,034,413
Option D	$300	$168	2,210	$1,034,413
Non-Certification Year Firms				
Option A	n/a	$152	88,411	$13,438,524
Option B	n/a	$152	88,411	$13,438,524
Option C	n/a	$152	88,411	$13,438,524
Option D	n/a	$152	88,411	$13,438,524

See Table 4-1 for options descriptions.

Source: EPA Calculations; U.S. EPA 2009

4.7 Recordkeeping Checklist Provision Costs

4.7.1 Recordkeeping Checklist Provision Requirements

The revision to the 2008 LRRP rule would require all renovation firms to provide a copy of the records demonstrating compliance with the training and work practice requirements of the RRP rule to the owner and, if different, the occupant of the building being renovated or the operator of the child-occupied facility. Renovation firms would have to provide this information to owners and occupants when the final invoice for the renovation is delivered, or within thirty days of the completion of work, whichever is earlier. It is expected that renovators will furnish this information by providing a copy of the short checklist or other form that is used for compliance purposes, and thus it is referred to here as a checklist. If dust clearance is performed in lieu of cleaning verification, the renovation firm must also provide a copy of the dust wipe sampling report(s). For renovations occurring in common areas of target housing or child-occupied facilities, the renovation firm can post instructions to tenants on how to obtain the information.

The checklist or form must include documentation that a certified renovator was assigned to the project, that the certified renovator provided on-the-job training for workers used on the project, that the certified renovator performed or directed workers who performed the tasks required by this final rule, and that the certified renovator performed the post-renovation cleaning verification. It must also include the identifying information on the manufacturer and model of the test kits used, if any; a description of the components that were tested including their locations; and the test kit results. This documentation must include a certification by the certified renovator that the work practices were followed with descriptions as applicable (see Figure 4-3 for a sample recordkeeping checklist).

Figure 4-3: Sample Recordkeeping Checklist

FUTURE SAMPLE RENOVATION RECORDKEEPING CHECKLIST
(effective April 2010)

Name of Firm:_____
Date and Location of Renovation:_____
Brief Description of Renovation: _____
_____
Name of Assigned Renovator:_____
Name(s) of Trained Workers, if used:_____
_____
Name of Dust Sampling Technician, Inspector, or Risk Assessor, if used:_____
_____

- ☐ Copies of renovator and dust sampling technician qualifications (training certificates, certifications) on file.
- ☐ Certified renovator provided training to workers on (check all that apply):
  - ☐ Posting warning signs
  - ☐ Setting up plastic containment barriers
  - ☐ Maintaining containment
  - ☐ Avoiding spread of dust to adjacent areas
  - ☐ Waste handling
  - ☐ Post-renovation cleaning
- ☐ Test kits used by certified renovator to determine whether lead was present on components affected by renovation (identify kits used and describe sampling locations and results):_____
  _____
  _____
- ☐ Warning signs posted at entrance to work area.
- ☐ Work area contained to prevent spread of dust and debris
  - ☐ All objects in the work area removed or covered (interiors)
  - ☐ HVAC ducts in the work area closed and covered (interiors)
  - ☐ Windows in the work area closed (interiors)
  - ☐ Windows in and within 20 feet of the work area closed (exteriors)
  - ☐ Doors in the work area closed and sealed (interiors)
  - ☐ Doors in and within 20 feet of the work area closed and sealed (exteriors)
  - ☐ Doors that must be used in the work area covered to allow passage but prevent spread of dust
  - ☐ Floors in the work area covered with taped-down plastic (interiors)
  - ☐ Ground covered by plastic extending 10 feet from work area—plastic anchored to building and weighted down by heavy objects (exteriors)
  - ☐ If necessary, vertical containment installed to prevent migration of dust and debris to adjacent property (exteriors)
- ☐ Waste contained on-site and while being transported off-site
- ☐ Work site properly cleaned after renovation
  - ☐ All chips and debris picked up, protective sheeting misted, folded dirty side inward, and taped for removal
  - ☐ Work area surfaces and objects cleaned using HEPA vacuum and/or wet cloths or mops (interiors)
- ☐ Certified renovator performed post-renovation cleaning verification (describe results, including the number of wet and dry cloths used):_____
  _____
  _____
  - ☐ If dust clearance testing was performed instead, attach a copy of report.
- ☐ I certify under penalty of law that the above information is true and complete.

_____ _____
name and title date

4.7.2 Recordkeeping Checklist Unit Costs

4.7.2.1 Labor Costs

Under the requirements of the 2008 LRRP rule, renovation firms must complete and retain a copy of the information described above for enforcement purposes. Therefore, the LRRP revisions rule would only result in renovation firms incurring the incremental labor costs of photocopying and distributing the checklist to the owners and/or occupants. The burden will be minimal, since the renovator will typically be delivering the checklist along with an invoice or other job-relate paperwork. EPA assumed that photocopying and distributing the checklist would take an average of three minutes of a renovator's time at a loaded wage rate of $31.64 per hour, for an average cost of $1.58.

4.7.2.2 Material Costs

The checklist provision requires renovation firms to supply a copy of the checklist to the owner of the affected building, or if different, the occupant of the affected target housing unit or operator of the child-occupied facility, and to post the checklist in a common area. Therefore, renovation firms performing work in target housing or public or commercial buildings would incur an incremental cost of photocopy materials.

Table 4-63 shows the estimated average costs per event of the checklist provision requirements.

Table 4-63: Cost of the Checklist Provision per Event

	Target Housing Events		Public or Commercial Building Events		
	Owner	Renter	In-house / Landlord [b]	Contractor – Owner [c]	Contractor – Renter [d]
Labor Cost [a]	$1.58	$1.58	$1.58	$1.58	$1.58
Material Cost	$0.08	$0.16	$0.08	$0.16	$0.24
Total Cost	$1.66	$1.74	$1.66	$1.74	$1.82

[a] Based on a burden of 3 minutes, at a wage rate of $31.64.
[b] RRP is performed by the owner of a public or commercial building.
[c] RRP is performed by a contractor in an owner-occupied public or commercial building.
[d] RRP is performed by a contractor in a renter-occupied public or commercial building.
Source: EPA Calculations.

4.7.3 Number of Events Affected by the Checklist Provision

The recordkeeping checklist provision would apply to both firms affected by the 2008 LRRP rule and to firms that would be covered by the elimination of the opt-out provision. Under Option A, the entire stock of firms necessary to meet demand, including those working in target housing, and public or commercial building COFs, would incur checklist costs in the first year. However, under Options B and C, which have delayed implementation, and Option D, which has a phase-in period, only some of the incremental stock of firms ultimately affected by the removal of the opt-out provision would incur costs in the first year. That is, there would be no delay in providing the checklist for events covered by the 2008 LRRP rule; for options with a delayed effective date or phase-in, the checklist provision requirement would take effect at the same time as the LRRP work practice requirements. From the second year onward, the entire stock of firms would incur checklist provision costs.

As mentioned above, firms performing work in owner-occupied target housing would be required to distribute one copy of the checklist while firms performing work in renter-occupied target housing would be required to provide a copy to the owner and occupant. If the work occurs in the common area of an

apartment building, the checklist, or information on how to obtain the checklist, can be posted on a sign in the common area.

The checklist provision also applies to firms performing work in public or commercial building COFs. Child-occupied facilities that perform work themselves must post the checklist, or information on how to obtain the checklist, on a sign that is accessible to parents or guardians of the children. Similarly, landlords that perform work would have to supply one copy of the checklist attached to a sign in the area where the work is being performed. Contractors who perform work in owner-occupied COFs must provide two copies of the checklist: one copy to the owner of the COF and one copy to be posted on a sign in the COF. In addition to the two copies required in owner-occupied events, contractors working in renter-occupied COFs must also provide the operator of the COF with a third copy of the checklist.

Table 4-64 presents the number of events affected by the checklist provision in the first and second years of the rule's implementation by event type and compares the number of events affected under each option with the number that would be affected without the elimination of the opt-out provision (events regulated under the 2008 LRRP rule).

Table 4-64: Number of Events Affected by the Checklist Provision by Option and Event Type

Option	All Events	Target Housing Events		Public or Commercial Building COF Events		
		Owner	Renter	In-house / Landlord [b]	Contractor – Owner [c]	Contractor – Renter [d]
Year 1						
2008 LRRP Rule Events	11,412,621	1,459,940	9,572,191	100,057	267,533	12,900
Option A	18,684,176	8,731,495	9,572,191	100,057	267,533	12,900
Option B	15,048,399	5,095,718	9,572,191	100,057	267,533	12,900
Option C	11,412,621	1,459,940	9,572,191	100,057	267,533	12,900
Option D	15,233,155	5,280,474	9,572,191	100,057	267,533	12,900
Year 2 [a]						
2008 LRRP Rule Events	11,365,829	1,453,954	9,532,945	99,647	266,436	12,847
Option A	18,607,571	8,695,696	9,532,945	99,647	266,436	12,847
Option B	18,607,571	8,695,696	9,532,945	99,647	266,436	12,847
Option C	18,607,571	8,695,696	9,532,945	99,647	266,436	12,847
Option D	18,607,571	8,695,696	9,532,945	99,647	266,436	12,847

"2008 LRRP Rule Events" represents the number of events affected by the checklist requirement if the opt-out provision is not removed. The number of events for each regulatory option represents the total number of events affected by the checklist requirement if the opt-out is removed, including the 2008 LRRP Rule Events. The number of events affected the opt-out removal can be calculated by subtracting the 2008 LRRP Rule Events from the number of events for each regulatory option.

[a] Assumed to decline by 0.41 percent each year after the first year, accounting for the decline in the stock of pre-1978 structures.

[b] RRP is performed by the owner of a public or commercial building.

[c] RRP is performed by a contractor in an owner-occupied public or commercial building.

[d] RRP is performed by a contractor in a renter-occupied public or commercial building.

See Table 4-1 for options descriptions.

4.7.4 Total Costs of the Recordkeeping Checklist Provision

Table 4-65 presents the total costs imposed on firms as a result of the recordkeeping checklist provision in the first and second years of the rule's implementation under each option with the costs that would be incurred without the elimination of the opt-out provision (costs of events regulated under the 2008 LRRP rule). EPA estimated total costs by multiplying unit costs in Table 4-63 with the corresponding number of events in Table 4-64.

Table 4-65: Total Cost of the Recordkeeping Checklist Provision by Option and Event Type

Option	All Events	Target Housing Events		Public or Commercial Building Events		
		Owner	Renter	In-house / Landlord[b]	Contractor – Owner[c]	Contractor – Renter[d]
Year 1						
2008 LRRP Rule Events	$19,757,018	$2,426,420	$16,674,757	$166,295	$466,042	$23,504
Option A	$31,842,342	$14,511,745	$16,674,757	$166,295	$466,042	$23,504
Option B	$25,799,680	$8,469,082	$16,674,757	$166,295	$466,042	$23,504
Option C	$19,757,018	$2,426,420	$16,674,757	$166,295	$466,042	$23,504
Option D	$26,106,746	$8,776,148	$16,674,757	$166,295	$466,042	$23,504
Year 2 [a]						
2008 LRRP Rule Events	$19,676,014	$2,416,472	$16,606,390	$165,613	$464,131	$23,408
Option A	$31,711,789	$14,452,247	$16,606,390	$165,613	$464,132	$23,407
Option B	$31,711,789	$14,452,247	$16,606,390	$165,613	$464,132	$23,407
Option C	$31,711,789	$14,452,247	$16,606,390	$165,613	$464,132	$23,407
Option D	$31,711,789	$14,452,247	$16,606,390	$165,613	$464,132	$23,407

"2008 LRRP Rule Events" represents the cost of the checklist requirement if the opt-out provision is not removed. The cost for each regulatory option represents the total cost of the checklist requirement if the opt-out is removed, including the checklist cost for the 2008 LRRP Rule Events. The cost for events affected by the opt-out removal can be calculated by subtracting the cost for the 2008 LRRP Rule Events from the cost for each regulatory option.

[a] Assumed to decline by 0.41 percent each year after the first year, accounting for the decline in the stock of pre-1978 structures.

[b] RRP is performed by the owner of a public or commercial building.

[c] RRP is performed by a contractor in an owner-occupied public or commercial building.

[d] RRP is performed by a contractor in a renter-occupied public or commercial building.

See Table 4-1 for options descriptions.

4.8 Total Costs

This section presents the total costs of the revisions to the LRRP program. Total costs are estimated for the first, second, and third years of regulation. Total 50-year costs and 50-year annualized costs are also calculated. Out year costs are estimated using discount rates of both 3 and 7 percent.

4.8.1 Total Costs in the First Year of Regulation

Table 4-66 presents the total first year costs associated with the LRRP rule. Total containment, cleaning, and verification costs are calculated by adding the cost of testing using the LBP test kits to the costs of containment, cleaning, and verification. The total costs of containment, cleaning, and verification are calculated by multiplying the number of events requiring work practices (Section 4.2) by the corresponding incremental unit costs (Section 4.3). The total cost of conducting LBP tests using test kits

is estimated as the number of events (Section 4.2) multiplied by the cost of conducting the test (see Section 4.3.1). Total training costs are calculated by multiplying the number of trained individuals (Section 4.4) by the corresponding incremental training costs (Section 4.5.1). Total certification costs are calculated by multiplying the number of firms (Section 4.4) by the corresponding incremental firm costs (Section 4.6). The recordkeeping checklist provision costs are calculated by multiplying the number of events where a recordkeeping checklist must be provided (Section 4.7.3) by the corresponding unit cost of providing the recordkeeping checklist (Section 4.7.2).

The total costs are higher in the first year for the options that regulate more RRP events. First year costs are highest under Option A ($507 million), which fully eliminates the opt-out provision immediately. First year costs are second highest under Option D ($291 million), which fully eliminates the opt-out provision for pre-1960 housing as soon as the rule is implemented. The costs under Option B ($263 million), which fully eliminates the opt-out provision midway through the first year, are slightly lower compared to Option D. Option C first year total costs ($20 million) only include recordkeeping checklist provision costs for events covered by the 2008 LRRP rule in the first year.

Table 4-66: Total First Year Incremental Costs of the Rule (millions 2005$)

Cost Type	Option A	Option B	Option C	Option D
Work Practice	$336	$168	$0	$192
Training	$76	$38	$0	$40
Certification	$63	$31	$0	$33
TH Checklist[a]	$31	$25	$19	$25
COF Checklist[b]	$1	$1	$1	$1
Total	**$507**	**$263**	**$20**	**$291**

a. Target Housing (TH)
b. Public or Commercial Building (COF)
See Table 4-1 for options descriptions.

4.8.2 Total Costs in the Second and Third Years of Regulation

Table 4-67 and Table 4-68 show that total costs differ across options in the second year but are the same across all options by the third year. Despite the second year expansion of the number of regulated events under Option D, the total work practice costs are only slightly higher than in the first year. This modest increase results from the improved effectiveness of the test kit (decrease in false positive rate of 63 percent to 10 percent), which offsets a portion of the cost increase associated with the larger universe of regulated events.

In the second year, the training and certification costs are highest under Option C and are relatively higher under Option B and Option D compared to Option A. This ranking reflects the delayed start-up costs associated with training and certifying the additional individuals and firms needed to meet the demand increase that corresponds to the expansion in the regulated universe in the second year. From the third year forward, training and certification costs are the same under all options.

Table 4-67: Total Second Year Incremental Costs of the Rule (millions 2005$)				
3 Percent Discount Rate				
Cost Type	**Option A**	**Option B**	**Option C**	**Option D**
Work Practice	$216	$216	$216	$216
Training	$18	$46	$74	$45
Certification	$25	$43	$61	$42
TH Checklist[a]	$30	$30	$30	$30
COF Checklist[b]	$1	$1	$1	$1
Total	**$290**	**$336**	**$382**	**$334**
7 Percent Discount Rate				
Cost Type	**Option A**	**Option B**	**Option C**	**Option D**
Work Practice	$208	$208	$208	$208
Training	$17	$44	$71	$43
Certification	$24	$41	$58	$40
TH Checklist[a]	$29	$29	$29	$29
COF Checklist[b]	$1	$1	$1	$1
Total	**$279**	**$323**	**$368**	**$321**

a. Target Housing (TH)
b. Public or Commercial Building (COF)
See Table 4-1 for options descriptions.

Table 4-68: Total Third Year Incremental Costs of the Rule (millions 2005$)				
3 Percent Discount Rate				
Cost Type	**Option A**	**Option B**	**Option C**	**Option D**
Work Practice	$209	$209	$209	$209
Training	$17	$17	$17	$17
Certification	$24	$24	$24	$24
TH Checklist[a]	$29	$29	$29	$29
COF Checklist[b]	$1	$1	$1	$1
Total	**$281**	**$281**	**$281**	**$281**
7 Percent Discount Rate				
Cost Type	**Option A**	**Option B**	**Option C**	**Option D**
Work Practice	$194	$194	$194	$194
Training	$16	$16	$16	$16
Certification	$22	$22	$22	$22
TH Checklist[a]	$27	$27	$27	$27
COF Checklist[b]	$1	$1	$1	$1
Total	**$260**	**$260**	**$260**	**$260**

a. Target Housing (TH)
b. Public or Commercial Building (COF)
See Table 4-1 for options descriptions.

4.8.3 Total 50-Year and 50-Year Annualized Costs

The total costs are also calculated discounted over a 50-year period. Discounting refers to the economic conversion of future costs (and benefits) to their present values, accounting for the fact that society tends to value future costs or benefits less than comparable near-term costs or benefits. Discounting is

important when the values of costs or benefits occur over a multiple year period and may vary from year to year. Discounting enables the accumulation of the cost and benefit values from multiple years at a single point in time, accounting for the difference in how society values those costs and benefits depending on the year in which the values are estimated to occur.

The 50-year costs were estimated by developing a profile of the compliance costs associated with each option over a 50-year period. (The 50-year period was chosen to be consistent with the economic analysis done for the TSCA Section 403 Lead-Based Paint Hazard Standards.) The profile of costs over time was developed by estimating an annual decline in pre-1978 housing stock of 0.41 percent per-year and assuming that the regulated universe would decrease by that rate every year. That rate was calculated using the average annual compound rate of change in the pre-1980 housing stock using data from the 1990 and 2000 Decennial Census (U.S. Census Bureau 1990 and 2000c). This rate affects costs because it decreases the number of events and number of workers trained every year.

As discussed above, first year training and certification costs account for the training and certification of all renovators and firms to meet the demand for lead-safe RRP services in the first year. For Option B and Option D, it is assumed that the additional individuals and firms will obtain training and certification in the second year to meet the increase in demand associated with the larger number of regulated RRP events in the second year. In subsequent years, it is assumed that one fifth of the necessary stock of individuals and firms will obtain training and certification each year (since refresher-training and re-certification is required every five years).

In fact, if all the individuals and firms needed to meet the demand for lead-safe RRP are trained and certified in the first and second years, one might expect a drop in the level of training and certification in the third year followed by a spike in the future years. That is, one might expect a cyclical pattern of training and certification to emerge. This analysis assumes a typical amount of training and certification occurs each year because modeling such a trend would add little to the analysis without being able to precisely estimate the extent of any cyclicality.

The total 50-year costs and the 50-year annualized costs are discounted using rates of 3 and 7 percent. These discount rate values reflect guidance from the Office of Management and Budget regulatory analysis guidance document, Circular A-4 (OMB, 2003).

The following formula was used to calculate the present value (PV) of the time stream of costs:

$$PV = \frac{Cost_{x,t}}{(1+r)^{(t-1)}}$$

where:

$Cost_t$	=	Costs in year t;
r	=	Discount rate (3 percent and 7 percent); and
t	=	Year in which cost is incurred.

This analysis also presents the 50-year annualized costs of the rule. Conceptually, the 50-year annualized cost is the level annual payment that one would have to make to pay off a debt equal to the present value total 50-year cost for a given interest rate (the discount rate).

The following formula is used to calculate the 50-year annualized cost.

$$AC = PV_r \times \frac{r \times (1+r)^{50}}{(1+r)^{(50)} - 1}$$

where:

AC = Annualized 50-Year Costs;
PV_r = Present Value Total 50-Year Costs assuming a discount rate of r; and
r = Discount rate (3 percent and 7 percent)

Table 4-69 shows the present value of the total 50-year costs, and Table 4-70 shows the annualized 50-year costs for the options considered. Because the test kits available for the first year (i.e., starting in June 2010) have a high false positive rate, including the newer housing units in the regulated universe before improved test kits are available is relatively costly. This is because the high rate of false positives will require many units without LBP to use the more costly work practices.

Table 4-69: Total Present Value 50 Year Incremental Costs of the Revisions to the Renovation, Repair, and Painting Rule (millions 2005$)

3 Percent Discount Rate				
Cost Type	**Option A**	**Option B**	**Option C**	**Option D**
Work Practice	$5,617	$5,449	$5,281	$5,473
Training	$516	$506	$496	$507
Certification	$673	$660	$646	$661
TH Checklist[a]	$767	$761	$755	$761
COF Checklist[b]	$16	$16	$16	$16
Total	**$7,590**	**$7,392**	**$7,194**	**$7,418**
7 Percent Discount Rate				
Cost Type	**Option A**	**Option B**	**Option C**	**Option D**
Work Practice	$3,255	$3,087	$2,919	$3,111
Training	$320	$308	$297	$309
Certification	$400	$386	$372	$387
TH Checklist[a]	$438	$432	$426	$432
COF Checklist[b]	$9	$9	$9	$9
Total	**$4,422**	**$4,222**	**$4,023**	**$4,248**

a. Target Housing (TH)
b. Public or Commercial Building (COF)
See Table 4-1 for options descriptions.

Table 4-70: Annualized 50 Year Incremental Costs of the Revisions to the Renovation, Repair, and Painting Rule (millions 2005$)

3 Percent Discount Rate				
Cost Type	**Option A**	**Option B**	**Option C**	**Option D**
Work Practice	$218	$212	$205	$213
Training	$20	$20	$19	$20
Certification	$26	$26	$25	$26
TH Checklist[a]	$30	$30	$29	$30
COF Checklist[b]	$1	$1	$1	$1
Total	**$295**	**$287**	**$280**	**$288**
7 Percent Discount Rate				
Cost Type	**Option A**	**Option B**	**Option C**	**Option D**
Work Practice	$236	$224	$212	$225
Training	$23	$22	$22	$22
Certification	$29	$28	$27	$28
TH Checklist[a]	$32	$31	$31	$31
COF Checklist[b]	$1	$1	$1	$1
Total	**$320**	**$306**	**$291**	**$308**

a. Target Housing (TH)
b. Public or Commercial Building (COF)
See Table 4-1 for options descriptions.

4.9 Alternative Regulatory Options: Options E1 – E4

Options A through D differ only in the timing of how the regulated universe is covered. This section presents cost estimates for various work practice alternatives to Option A, including: (1) requiring interior containment without any cleaning or verification requirements, (2) requiring interior cleaning without any containment or verification requirements, (3) requiring interior cleaning and verification without any interior containment requirements, and (4) no ban on prohibited practices and no exterior vertical containment requirements. Like Option A, these options would become effective June 2010, and would be applied to all pre-1978 housing eligible for the opt-out provision under the 2008 LRRP rule. In addition, the requirement for the renovator to provide the recordkeeping checklist to the owners and occupants would apply in both the renovations covered by the 2008 LRRP rule and those formerly eligible for the opt-out provision. Options E1 to E4 cover the same number of renovation events as Option A, and result in the same number of renovators being trained and firms certified. Thus, Options E1 to E4 have the same training, certification, and checklist costs as Option A, but the work practice costs differ from Option A.

4.9.1 Alternative Interior Containment, Cleaning, and Verification Requirements

Section 4.3 presents the work practice unit costs for the following three components: (1) containment, (2) cleaning, and (3) verification. Under the alternative regulatory options presented in Table 4-71, not all of these work practice components are required and therefore compliance costs are lower. Not requiring any interior cleaning or verification, but requiring rule containment, lowers the total annualized costs by about 12 percent compared to Option A. Requiring rule-style interior cleaning and verification, but not requiring interior containment also lowers the annualized total costs of the rule by 12 percent compared to Option A. Not requiring any interior containment or verification, but requiring rule-style cleaning, results in the largest decline in total annualized costs of about 17 percent compared to Option A.

Table 4-71: Options E1-E3: Alternative Interior Containment, Cleaning, and Verification requirements				
	3 Percent Discount Rate		7 Percent Discount Rate	
Option	Annualized Costs	Percent Change from Option A	Annualized Costs	Percent Change from Option A
Option A	$295		$320	
Option E1: No Interior Cleaning or Verification Required	$258	-12%	$281	-12%
Option E2: No Interior Containment Required	$261	-12%	$283	-12%
Option E3: No Interior Containment or Verification Required	$246	-17%	$267	-17%
See Table 4-1 for options descriptions.				

4.9.2 Regulatory Alternative without a Paint Removal Practice Prohibition

This alternative regulatory option has the same scope and work practice requirements as Option A, except that there is no prohibition or restriction on open-flame burning or torching of LBP; operating a heat gun on LBP at 1100° F or higher; or using machines that remove LBP through high speed operation (such as sanding, grinding, power planing, needle gun, abrasive blasting, or sandblasting) without HEPA exhaust control. As shown in Table 4-72, if the rule allows these paint removal practices to continue to be used, total annualized costs for the option would be 1 percent lower than for Option A.

Table 4-72: Option E4: Alternative Containment, Cleaning, and Verification requirements				
	3 Percent Discount Rate		7 Percent Discount Rate	
Option	Annualized Costs	Percent Change from Option A	Annualized Costs	Percent Change from Option A
Option A	$295		$320	
Option E4: No Prohibited Practice Ban	$292	-1%	$317	-1%
See Table 4-1 for options descriptions.				

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5. Benefits of the Revisions to the LRRP Rule

This chapter presents a discussion of the benefits associated with reducing lead exposure by revising the lead, renovation, repair and painting (LRRP) program regulations. The revisions to the LRRP program include: (1) the removal of the opt-out provision (currently available for owner-occupied target housing without either children under the age of 6 or a pregnant woman in residence and where the housing is not a COF), and (2) an additional requirement that the renovator provide a copy of their recordkeeping checklist to owners and occupants of renovated structures.

An overview of the opt-out provision, as it applies to this benefits estimation, is provided in Section 5.1. Section 5.2 presents calculated values meant to serve as a proxy for the magnitude of benefits under this action. Section 5.3 includes a discussion of the benefits of the additional recordkeeping checklist provision requirement. Finally, in Section 5.4, the human health and ecological consequences of lead exposure are summarized.

The work practices, training and certification requirements for the housing units previously eligible for the opt-out provision will reduce lead exposure by increasing the containment and cleanup of dust and debris generated by renovation, repair, and painting (RRP) activities. Additional reductions in lead exposure will be achieved by prohibiting the use of certain paint preparation and removal techniques in jobs that require lead-safe work practices. These reductions in exposure will in turn reduce the risks of adverse health and ecological effects in the vicinity of these activities.

A great deal of information on the numerous adverse health effects of lead is available from decades of medical observation and scientific research. Inhaled or ingested lead is distributed throughout the body and is toxic to many organ systems. As a result, its toxicity manifests itself in the form of impacts on several organ systems. A reduction in lead exposure resulting from the rule would lead to a reduction in these adverse health effects and the costs of treating them. Young children (from birth through age five) are particularly sensitive to lead, which impairs a child's neuropsychological development (frequently measured by IQ change). EPA's Air Quality Criteria for Lead (EPA 2006b) provided a thorough review of the available science on lead-related health and ecological effects. An excerpt from the Executive Summary is provided in section 5.4 of this analysis.

With regard to potential implications of lead effects on IQ, the Criteria Document recognizes the ''critical'' distinction between population and individual risk, identifying issues regarding declines in IQ for an individual and for the population. The Criteria Document further states that a ''point estimate indicating a modest mean change on a health index at the individual level can have substantial implications at the population level'' (CD, p. 8–77). A downward shift in the mean IQ value is associated with both substantial decreases in percentages achieving very high scores and substantial increases in the percentage of individuals achieving very low scores (AQCD, p. 8–81). For an individual functioning in the low IQ range due to the influence of developmental risk factors other than lead, a lead-associated IQ decline of several points might be sufficient to drop that individual into the range associated with increased risk of educational, vocational, and social failure (AQCD, p. 8–77).

Other cognitive effects observed in studies of children have included effects on attention, executive functions, language, memory, learning and visuospatial processing (AQCD, sections 5.3.5, 6.2.5 and 8.4.2.1), with attention and executive function effects associated with lead exposures indexed by blood lead levels below 10 μg/dL (AQCD, section 6.2.5 and pp. 8–30 to 8–31). The evidence for the role of lead in this suite of effects includes experimental animal findings (discussed in AQCD, section 8.4.2.1; p. 8–31), which provide strong biological plausibility of lead effects on learning ability, memory and attention (AQCD, section 5.3.5), as well as associated mechanistic findings.

These cognitive and behavioral effects, discussed above, are strongly related to future productivity and expected earnings (Salkever 1995). Based on Salkever's coefficients, the estimated value of an IQ point is $12,953 (2005 dollars). This IQ value is modeled as the present value of a loss in expected lifetime earnings due to a one point IQ drop. The present value is calculated assuming that children would be affected by lead at 3 years of age, the median of the range when children are most susceptible to lead hazards; that while most people start working at age 18, average income in the early adult years is reduced because some are still in school; and that retirement occurs at the age of 67. This estimated value of an IQ point is limited to reduced income, and does not include other potential impacts such as additional education costs for special and remedial education, and medical costs to treat very high levels of lead.

Both epidemiologic and toxicological studies have shown that environmentally relevant levels of lead affect many different organ systems (EPA 2006b, p.E-8). It appears that some of these effects, particularly changes in the levels of certain blood enzymes and in aspects of children's neurobehavioral development, may occur at blood-lead levels so low as to be essentially without a threshold (EPA 2004).

Epidemiologic studies have consistently demonstrated associations between lead exposure and enhanced risk of deleterious cardiovascular outcomes, including increased blood pressure and increased hypertension (EPA 2006b). Neurotoxic effects in children and cardiovascular effects in adults are among those best substantiated as occurring at blood-lead concentrations as low as 5 to 10 ug/dL (or possibly lower); and these categories of effects are currently clearly of greatest public health concern (EPA 2006b, p 8-60). Other newly demonstrated immune and renal system effects among general population groups are also emerging as low-level lead exposure effects of potential public health concern (EPA 2006b, p 8-60).

Some studies have examined the question of whether the neurological effects of exposures in early childhood are ameliorated when blood-lead levels decline. The data are mixed on this issue. In a study that treated lead-exposed children with a chelating agent, Ruff (1993) found that children whose blood-lead levels had the greatest decline showed the most improvement in cognitive scores. In contrast, Rogan (2001) found that treatment with a chelating agent lowered blood-lead levels in children but did not appear to improve neurological function. Liu (2002) also found that chelation therapy at age 2, while lowering blood-lead levels, did not improve neurological function in children at 5 years of age. While the study did detect a relationship between declining blood-lead and improved neurological function, this association was observed only in the untreated group, leading the authors to speculate that some other factor besides declining lead levels from chelation therapy (such as greater parental involvement), led to the neurological gains. Dietrich (2004) had similar findings in the same cohort of children at 7 years of age. One study cited in ATSDR (1999) showed impaired motor and cognitive function at a current mean level of 2.9 μg/dL, about 20 years after exposure when blood-lead levels were 40-50 μg/dL (Stokes 1998). The negative impact of lead on IQ and other neurobehavioral outcomes persist in most recent studies following adjustment for numerous confounding factors including social class, quality of caregiving, and parental intelligence. Moreover, these effects appear to persist into adolescence and young adulthood in the absence of marked reductions in environmental exposure to lead. (EPA 2006b, p. 6-76). This further supports the concern that early exposures to lead may lead to irreversible damage and supports the benefits of regulatory interventions to prevent and/or reduce lead exposure.

5.1 Overview of Removal of Opt-Out Provision in Terms of Benefits Estimation

Under 40 CFR 745.82(c), the LRRP rule's training requirements and work practice standards do not apply to renovations in target housing when the firm performing the renovation has obtained a statement signed by the owner that the renovation will occur in the owner's residence, no child under age 6 resides there, no pregnant woman resides there, the housing is not a child-occupied facility, and the owner acknowledges

that the renovation firm will not be required to use the work practices contained in EPA's renovation, repair, and painting rule. This is referred to as the "opt-out provision" of the LRRP rule.

After further consideration of the opt-out provision, the Agency believes it is in the best interest of the public to remove the provision. EPA has decided it is important to require the LRRP work practices in target housing even if there is no child under age six or pregnant woman residing there and the housing is not a COF. The 2008 LRRP rule focused mainly on protecting young children and pregnant women from lead hazards. Lead exposure adversely affects older children and adults. Those effects most pertinent to adults at levels associated with individual blood lead levels in the range of 10 ug/dL and less include hematological, cardiovascular and renal effects.

Epidemiologic studies have consistently demonstrated associations between lead exposure and enhanced risk of deleterious cardiovascular outcomes, including increased blood pressure and incidence of hypertension. A meta-analysis of numerous studies estimates that a doubling of blood-lead level (e.g., from 5 to 10 μg/dL) is associated with ~1.0 millimeter of mercury (mm Hg) increase in systolic blood pressure and ~0.6 mm Hg increase in diastolic pressure. The evidence for an association of lead with cardiovascular morbidity and mortality is limited but supportive (EPA 2006b, p. E-10).

The Criteria Document states ''although an increase of a few mmHg in blood pressure might not be of concern for an individual's well-being, the same increase in the population mean might be associated with substantial increases in the percentages of individuals with values that are sufficiently extreme that they exceed the criteria used to diagnose hypertension'' (EPA 2006b, p. 8–77).

Renovation activities that disturb lead-based paint create high dust-lead levels which are not removed through typical cleaning practices. EPA's Dust Study (EPA 2007) found that dust-lead levels created by renovation activities ranged from 422 to 32,633 μg/ft^2. While dry sweeping and the use of a regular shop vacuum resulted in a reduction in these levels, a significant amount of leaded dust remained. All residents of the household or occupants of the building can be exposed to this dust, regardless of age. EPA's Exposure Factors Handbook (EPA 1997) contains recommended soil and dust ingestion estimates for adults, and EPA's Child-Specific Exposure Factors Handbook (EPA 2008a), which includes recommended soil and dust ingestion estimates for children between the ages of 6 and 21.

By removing the opt-out provision the rule will go farther toward protecting older children and adult occupants of target housing where no child under six or pregnant woman resides. In addition, removal of the opt-out provision will provide additional protection for women who do not know they are pregnant at the time a renovation commences, women who become pregnant shortly after a renovation occurs, and women of child-bearing age in general. This is particularly important because the transplacental transfer of lead in humans is well documented, and infants are generally born with a lead body burden reflecting that of the mother.

Removing the opt-out provision also protects children under the age of six who spend a limited amount of time in housing (such as a relative or caregiver's house) where a renovation has been performed under the opt-out provision; children who move into such housing when their family purchases it after such a renovation has been performed; and children who live in a property adjacent or near to owner-occupied housing where renovation has been performed under the opt-out provision.

Some locations where children under the age of six regularly receive child care are eligible for the opt-out provision because of the way a child-occupied facility (COF) is defined. A COF is defined as ''a building, or portion of a building, constructed prior to 1978, visited regularly by the same child, under the age of six, on at least 2 different days within any week (Sunday through Saturday period), provided that each day's visit lasts at least 3 hours and the combined weekly visits last at least 6 hours, and the combined annual visits last at least 60 hours." Non-resident children may regularly visit or receive child

care in target housing that is eligible for the opt-out provision because the children do not spend enough time there for the building to meet the COF definition. These children may nevertheless receive a dose of lead from playing in dust-lead hazards created by renovations performed under the opt-out provision

Removing the opt-out provision will also result in fewer homes being purchased with pre-existing lead hazards. It is common for home owners to perform activities that disturb paint before selling a house. Under the RRP rule, the opt-out provision was limited to owner-occupied target housing and did not extend to rental housing because of the concern that future lessees could unknowingly move into a rental unit where dust-lead hazards created by the renovation are present. In the same way, dust-lead hazards created during renovations in an owner-occupied residence conducted prior to a sale will be present for the next occupants. Removing the opt-out provision decreases the likelihood of lead hazards being present when someone else (which may include a child under the age of six or a pregnant woman) moves into the home.

Eliminating the opt-out provision will also protect individuals including pregnant women and families with young children residing adjacent to homes undergoing renovations. Under the 2008 LRRP rule, an owner occupant can take advantage of the opt-out provision even if a child under 6 or pregnant woman lives in an adjacent home. Renovations on the exterior of a residence can spread leaded dust and debris some distance from the renovation activity, which is why, for regulated exterior renovations, EPA requires renovation firms to cover the ground with plastic sheeting or other impermeable material a distance of 10 feet from the renovation. If homeowners opt out of the LRRP program, renovations on the exterior of their homes are likely to contaminate neighboring yards and porches, resulting in exposure inside the neighboring houses as well as outside (because exterior dust is tracked into the home).

Removing the opt-out provision will also provide protection to family pets living in owner-occupied housing where no children under age 6 or pregnant women reside. Lead poisoning resulting from renovations has been identified as a means of exposure in both cats and dogs (Knight 2003, Kowalczyk 1976). This can result in both veterinary care costs and, in some instances, loss of a family pet.

5.1.1 Regulatory Options Under the Elimination of the Opt-Out Provision

This economic analysis considers several regulatory options related to removal of the opt-out provision (See Table 5-1). Options A through D all include containment, cleaning, and cleaning verification requirements, as well as restricting or prohibiting certain paint removal practices. Options A through D differ in terms of the effective date of the rule and the universe of structures affected in each year (phasing in of regulatory coverage). Options A and D both have effective dates of June 2010, but Option A does not phase in regulatory coverage while Option D is limited to pre-1960 structures during Phase 1 of the regulation and its scope is expanded to include structures built between 1960 and 1978 in Phase 2, which has an effective date of June 2011. Options B and D have effective dates of January 2011 and June 2011, respectively, and neither option phases in regulatory coverage. Options E1 to E4 cover the same target housing universe and have the same effective date as Option A, but do not provide the same level of protection because they do not require all of the work practice standards under 40 CFR 734.85.

Table 5-1: Effective Start Dates for Options Examined in Economic Analysis				
Option	**Target Housing**	**Effective Date For Opt-Out Elimination**		
		June 2010	**January 2011**	**June 2011**
A	All	X		
B	All		X	
C	All			X
D	Pre-1960 1960-1978	X		 X
E1 to E4*	All	X		
* Options E1 to E4 cover the same target housing universe and have the same effective date as Option A, but do not provide the same level of protection because they do not require all of the work practice standards under 40 CFR 734.85.				

5.2 Calculated Benefits of Eliminating the Opt-Out Provision

EPA has calculated crude benefits numbers for several groups of individuals protected by removing the opt-out provision. This has been done by estimating the number of individuals in each group and combining this with the average benefit per individual for a similar group from previous LRRP rule analyses. These averages do not replicate the scenarios used in the previous analyses, which included an array of factors such as age of child, type of renovation, size of job, and building vintage, so the calculations in this chapter do not reflect the methodology that EPA previously had peer reviewed for the LRRP rule analysis.

As a result of severe time constraints for the conduct of this analysis, the average benefits per individual from the previous analyses have not been modified to reflect any differences in exposure between populations protected by the 2008 rule and those protected by the removal of the opt-out provision. While these values can serve as a proxy to provide a sense of the magnitude of benefits from this action, the amount of error in these values is unknown. The exposure scenarios differ between this rule and the 2008 rule, for example, in the length of time that individuals spend in renovated structures, and in the frequency, types, and sizes of renovations affected by the two rulemakings. Simple computational adjustments to the average benefits to try and address the differences in the scenarios do not fully reflect the complex nature of the relationships being addressed. For example, there are two key relationships involved in calculating IQ change – going from lead exposure to blood lead, and from blood lead to IQ. Both of these relationships are non-linear, with the steepest slopes at lower levels, meaning that IQ effects are proportionately greater for lower exposures and blood lead levels.

Moreover, because of the complex interactions between different components of the previous analysis for the 2008 rule, how the estimated benefits differ between scenarios is not always obvious. For example, children who receive childcare in a COF in target housing generally spend less time there than in their own residence. Yet as described later in this section, based on the 2008 analysis, preventing exposures to the children in target housing COFs yields an average benefit of $1,772 per child, which is larger than the average benefit of $1,384 per child for children residing in target housing. (This is due to differences in average background lead levels and the non-linear relations that are being modeled.) This example demonstrates the pitfalls of making simplified assumptions such as calculating the benefits to one group

of children by scaling the estimated benefits to a different group of children based on the amount of time spent at home or in childcare. In the example given above, calculating the average benefits per child for children in target housing COFs by a linear scaling of the results for children residing in target housing would yield a lower average benefits value for the non-residential children, while the 2008 analysis indicates that the benefits are higher.

Estimating benefits from avoided lead exposure is not an issue that lends itself to simplified calculations. Thus, the benefits calculations used here should be viewed as crude indicators of the magnitude of benefits. In light of this, the analysis calculates benefits under two different scenarios. In one of the scenarios, aggregate benefits are based on average benefits per individual from previous analyses multiplied by an estimate of the number of people affected by the rule. In the second scenario, benefits are calculated by applying a simple linear adjustment factor to one of the components in the first scenario, in order to reflect the uncertainties created by relying on the average benefit per individual from previous analyses as a basis for the calculation.

It would not be accurate to characterize the average benefits per child calculated here as an upper bound estimate. The change in IQ may be larger for children with lower exposures, due to the non-linearities in the relationships. Because the previous LRRP rule analysis reflected a broad range of exposures and conditions, the IQ benefits in the earlier analysis may include flatter sections of the curves. To the extent that children protected by removing the opt-out provision are on steeper sections of the curves, the average benefit per child calculated from the 2008 analysis may underestimate the benefit of avoiding exposures by removing the opt-out provision.

A limitation of this analysis is that the benefits calculations presented here are only based on some of the populations protected by the rule, and on some of the health effects avoided due to the rule. The population groups discussed below do not reflect all of the individuals protected by removing the opt-out, but instead represent groups for which calculations can be readily made. For example, these calculations do not include individuals living in detached houses adjacent to houses renovated under the opt-out provision, or children who spend time in a friend or relative's house renovated under the opt-out. Furthermore, the calculations do not include the benefits of avoiding other effects that can be caused by lead exposure such as neurobehavioral impacts in children (e.g., aggression, attention deficit problems, and hyperactivity), as well as various other health effects that can also occur in individuals of all ages (including renal effects, immune system effects, and reproductive and developmental effects). The benefits of avoiding these effects were not quantified in the previous LRRP analyses, and thus are not calculated here.

Benefits are calculated in this chapter for several groups of individuals affected by the removal of the opt-out provision: those residing in housing renovated under the opt-out provision; those living contiguous to attached housing renovated under the opt-out provision; those moving in to housing renovated by the previous owner under the opt-out provision; and those receiving childcare in housing renovated under the opt-out provision.

5.2.1 Individuals Residing in Housing Units Renovated Under the Opt-out Provision

Lead can result in serious effects for adults at low blood lead levels. According to the Clean Air Scientific Advisory Committee (CASAC) Lead Review Panel (CASAC 2007a):

> Lead's effects extend beyond childhood. In adults, lead exposure is a risk factor for some of the most prevalent diseases or conditions of industrialized society, including cardiovascular disease and renal disease (16–20). There is also compelling evidence that the risks for mortality from stroke and myocardial infarction are increased at PbB concentrations below 10 μg/dl, which is considerably lower than those considered acceptable for adults (19). Finally, although less

> definitive, there is also evidence that lead exposure during pregnancy is a risk factor for spontaneous abortion or miscarriage at PbB concentrations < 10 μg/dl (21).

CASAC has advised EPA not to focus only on IQ changes in children (CASAC 2007b):

> While the CASAC agrees with the Agency's choice of IQ alterations in young children as the priority health effect and population for the risk assessment, the Lead Panel cautions against focusing only on IQ loss (or gain). There are ramifications of lead exposure on other endpoints that have societal and individual implications of great importance. Neurological developmental and functional effects in children exposed to Pb can lead to negative and disruptive behaviors well into teenage years. Moreover, while the adult nervous system has long been recognized as a target of Pb toxicity, epidemiologic and experimental toxicology data are emerging that support the relationship between Pb exposure and increased adverse cardiovascular outcomes, including increased blood pressure, increased incidence of hypertension, and cardiovascular morbidity and mortality at lower and lower levels of exposure.

Removing the opt-out provision will benefit adults by reducing their exposure to lead dust generated by RRP activities in housing eligible for the opt-out provision. The first step in calculating these benefits is to estimate the number of individuals that would be protected by eliminating the opt-out provision. This is done by estimating the number of affected housing units. Next the number of occupants in the affected households must be estimated. Then the number of individuals protected is estimated as the number of individuals who reside where LBP is disturbed during RRP. Finally, the number of individuals is multiplied by the average benefit per individual.

5.2.1.1 Estimating the Number of Individuals Residing in Housing Units Renovated Under the Opt-out Provision

The elimination of the opt-out provision would affect owner-occupied target housing units where no child under the age of six or pregnant woman resides, and that do not meet the definition of a COF. Owner-occupied housing units where a child under the age of six or a pregnant woman resides can be identified in the 2003 American Housing Survey (AHS) data. (See Chapter 4 for a detailed discussion of the AHS data.) AHS respondents report information about the ages of householders, who are defined by the survey as persons who live or sleep there most of the time. Thus, child-occupied households are defined as those households with a householder under the age of six at the time of the RRP. Child-occupied households are estimated as households with a householder between the ages of one and seven at the time of the survey, since it is assumed that any RRP reported occurred a year earlier. (RRP performed up to two years earlier may be reported.) It follows that the number of households occupied by pregnant women can be estimated as the number of households with a woman of childbearing age and a child who is under the age of one in the household at the time of the survey.

As described above, the AHS data can be used to identify rental units and target housing units where no child under the age of six or pregnant woman resides. However, to estimate the number of units that would be affected by the elimination of the opt-out provision, target housing units that are also COFs must also be identified so they can be excluded from the count of affected units.

Note that COFs in target housing include family daycare providers and the homes of family, friends, and neighbors who regularly care for someone else's children. The estimates include care provided with and without compensation and rely primarily on estimates of the size of the childcare workforce (Center for the Child Care Workforce, 2002). The Center for the Child Care Workforce (2002) report includes: (1) data on family child care providers caring for unrelated children in their own homes, (2) paid relatives and non-relatives providing child care, and (3) unpaid relatives and non-relatives providing child care.

The number of target housing COFs is projected based on estimates of the caregiver workforce in the Center for the Child Care Workforce (2002) report. Based on a Wilder Research Center report, it is assumed that 10 percent of family child care providers caring for unrelated children in their own homes employ 2 workers (Wilder Research Center 2001, p.16). For the remaining childcare providers, one worker is assumed per location. Based on 2003 AHS data for the general population of target housing, it is assumed that 65 percent of these housing units were built before 1978.

The number of target housing units is adjusted to account for units that are already included in the LRRP rule universe or do not qualify as COFs because: (1) care is provided in a child's own home, or (2) less than six hours of care per week is provided. In addition, the number of target housing units where childcare is provided that are regulated under the 2008 LRRP rule without qualifying as COFs must be estimated to avoid double counting. This includes: (1) units where the caregiver is pregnant or has a child under six living in the household, and (2) units where the caregiver lives in a rental unit. The basis for these adjustments is presented below.

- Care Provided in Child's Own Home
  - It is assumed that 22 percent of relatives and non-relatives (paid or unpaid) provide care in the child's home; this is based on a Wilder Research Center (2005, p.28) report on the results of the 2004 Minnesota Statewide Household Child Care Survey.
- Less Than Six Hours of Care Per-Week is Provided
  - Of those providing care in their own home, it is assumed that 27 percent of relatives and non-relatives (paid or unpaid) provide care for less than six hours a week (Wilder Research Center 2005, p.28). All family daycare providers caring for unrelated children in their own homes are assumed to care for at least one child for more than six hours a week.
- Caregiver Lives in a Rental Unit
  - It is assumed that family, friend, and neighbor caregivers have the same likelihood of living in a rental unit as the general population of target housing occupants (39 percent).
- Caregiver has a Child Under Six Living With Them
  - Based on the January 2006 Current Population Survey (U.S. Bureau of Labor Statistics 2006), 16 percent of Child Care Workers have children under six. Thus, it is assumed that 16 percent of in-home family daycare providers (formal care providers) caring for unrelated children in their own homes themselves have children under the age of six. Based on the Wilder Research Center (2005, p.19) report, 57.5 percent of family, friend, and neighbor caregivers (informal care providers) have children under the age of 12. Thus it is assumed that half as many, or 29 percent, have children under the age of six.
- Caregiver is Pregnant
  - It was estimated that 1.1% of owner-occupied households with no child under the age of six were occupied by a pregnant woman using the 2003 AHS data.

5.2.1.2 Summary of Target Housing COF Units

Table 5-2 presents the estimated number of target housing units regulated under the 2008 LRRP rule.

Table 5-2: Number of Owner-Occupied Pre-1978 Target Housing Units Regulated Under 2008 LRRP Rule (Excluding Rental Units and Units Where a Child Under 6 or Pregnant Woman Resides)

Type of Care [a]	Number of Target Housing COFs (thousands) [b]	*In child's own home*	*Less than 6-hours per-week*	*Post-78*	*In rental unit*	*Child under 6 resides*	*Pregnant woman resides*	Total Adjustment[c]	Total Regulated Units (thousands) [d]
Paid In-Home Family Daycare	**591**	n.a.	n.a.	35%	n.a.	16%	1.1%	**55%**	**319**
Paid Relative Care	**804**	22%	27%	35%	39%	29%	1.1%	**84%**	**128**
Unpaid Relative and Non-Relative Care	**2,354**	22%	27%	35%	39%	29%	1.1%	**84%**	**376**
Total (Pre-78)									**824**
Total (Pre-60) [e]									**424**

a. Paid In-Home Family Daycare refers to formal licensed daycare located in the provider's home. Paid relative care is when family members are paid to care for the child in the family member's home (unlicensed care). Unpaid relative and non-relative care refers to informal unpaid care provided at the homes of family, friends or neighbors (unlicensed care).

b. Based on the size of the childcare workforce (Center for the Child Care Workforce 2002), assuming 1.1 workers per location for paid in-home family daycare and 1 worker per location for other types of care.

c. Calculated as one minus the product of one minus the adjustments. e.g., for the first row, 55% = 100% - (100%-35%)*(100%-16%)*(100%-1.1%).

d. Components may not sum to totals due to rounding. Not adjusted for compliance rates.

e. Adjusted based on number of target housing units.

Source: U.S. Census Bureau 1995, 1997, and 2003; EPA Calculations.

As described in Table 5-2, there are about 824,000 target housing COFs where no child under the age of six or a pregnant woman resides. Thus, of the 47,080,000 owner occupied housing units (see Section 2.8 of Chapter 2):

- A child under six resides or pregnant woman resides in 6,370,000 units (see Section 2.8 of Chapter 2)
- About 824,000 units are COFs where no child under the age of six or pregnant woman resides (see Table 5-2)

Therefore, about 39,886,000 units would be affected by the elimination of the opt-out provision.[1]

5.2.1.3 Number of Individuals Residing in Housing Units Affected by the Elimination of the Opt-Out Provision

Only individuals age six and greater reside in housing units that would be affected by the elimination of the opt-out provision. Using the methodology described in Section 4.2 of Chapter 4, it was estimated that about 5.7 percent of pre-1978 households disturb LBP during RRP annually. In pre-1960 households, which are more likely to contain LBP, 10.1 percent households disturb LBP during RRP annually. The resulting estimates of the number of individuals who reside in these housing units where LBP is disturbed during RRP are presented in Table 5-3.

[1] 39,886,000 = 47,080,000 – 6,370,000 – 824,000.

Table 5-3: Annual Number of Individuals Age 6 and Older Residing in Opt-Out Eligible Housing Where LBP is Disturbed During an RRP Event that are Protected by the Removal of the Opt-out Provision

Option	Number of Individuals Age 6 and Older Protected by the Rule Each Year[a]	
	First Year	Second Year[b]
A	5,248,000	5,226,000
B	2,624,000	5,226,000
C	0	5,226,000
D	4,380,000	5,226,000
E1 to E4[c]	5,248,000	5,226,000

a. Assumes a 75% compliance rate.
b. The stock of target housing, and therefore the number of individuals living in target housing, is assumed to decline by 0.41% per year (due to demolitions, conversions, etc,) based on Census data.
c. Options E1 to E4 cover the same target housing universe and have the same effective date as Option A, but do not provide the same level of protection because they do not require all of the work practice standards under 40 CFR 734.85.

Since the opt-out provision is eliminated under Option A as soon as the rule becomes effective, all individuals residing in opt-out eligible housing performing RRP that disturbs LBP are protected in the first year. Since the opt-out provision under Option B is eliminated six months later (halfway through the beginning of the first year the rule is in place), the number of individuals protected under Option B in the first year is half the number estimated for Option A. Under Option C, the opt-out provision is eliminated a year later. Under Option D the opt-out provision is eliminated as soon as the rule becomes effective for housing built before 1960. Options E1 through E4 have the same effective dates and universe of regulated structures as Option A, but consider alternative work practice requirements. As indicated in the numbers presented in Table 5-3, the majority of the individuals that would be protected by the elimination of the opt-out provision reside in housing built before 1960 because of the higher likelihood of LBP in these housing units. In the second year (starting June 2011), the opt-out provision would be eliminated under all options.[2]

5.2.1.4 Calculated Benefits to Individuals Residing in Housing Units Renovated Under the Opt-out Provision

EPA's Economic Analysis for the 2006 proposed LRRP rule included estimates of benefits from avoided increases in blood pressure due to lead exposure and associated incidences of hypertension, heart attack, stroke, and death (EPA 2006b). The proposed rule was estimated to protect around 4.5 million individuals age 6 and older, resulting in annualized adult benefit of $2.25 billion/year, which is equivalent to an average benefit of $523 per year per person. The 2006 proposed rule only estimated cardiovascular benefits for adults age 40 and older, but the number of such adults protected by the LRRP rule was not listed in the Economic Analysis report. Instead, the 2006 report provides information on the number of

[2] The stock of target housing, and therefore the number of individuals living in target housing, is assumed to decline by 0.41% per year (due to demolitions, conversions, etc.) based on Census data.

individuals age 6 and older. Dividing total estimated adult benefits from the 2006 LRRP analysis by the number of individuals 6 and older protected by the LRRP rule underestimates the average cardiovascular benefit per person for adults 40 and older. However, assuming that the ratio of the number of adults over age 40 protected to the number of all individuals over age 6 protected is similar for both the LRRP rule and the opt-out rule, multiplying the average benefit per individual age 6 and above by the number of individuals age 6 and above protected by the opt-out rule yields an estimate of the cardiovascular benefits of the opt-out rule to adults age 40 and older.

Table 5-4 combines that $523 average with the 5.2 million individuals age 6 and older living in opt-out housing to calculate cardiovascular benefits under Scenario 2. Similar to the IQ change calculations discussed earlier, this is a crude indicator that does not account for differences in renovations or exposure between the LRRP rule and the opt-out proposal. This calculation is limited to cardiovascular effects and does not include the avoided incidence of other effects such as renal effects, immune system effects, and reproductive and developmental effects.

Due to the uncertainty in calculating benefits using the average benefit per individual from a previous LRRP analysis, Scenario 1 is calculated assuming that the average cardiovascular benefit per individual is a quarter of the Scenario 2 value, or an average of $130.86 per individual age 6 and older. This could reflect potential improvements in treatment of high blood pressure and cardiovascular disease since the 1970's and 1980's, when the data on which the Scenario 2 benefits per individual were based, were collected. These results are also shown in Table 5-4.

As discussed in the 2006 analysis (EPA 2006a, p. 5-42), EPA acknowledges that the dose-response functions noted in that analysis rely on older published data and that not all of these data were included in the review presented in Appendix 5A of the 2006 document. EPA plans to prepare an expanded assessment for future rulemakings which quantify adult cardiovascular benefits, and will explore the use of more recent equations and more recent NHANES data. The use of newer equations and data is expected to reduce some of the existing uncertainties.

Table 5-4: Calculated Cardiovascular Benefits for Adults Who Reside in Housing where LBP is Disturbed in RRP Events Under the Opt-Out Provision (millions, 2005$)

Scenario	Number Of Individuals ≥6*	Average Cardiovascular Benefit Per Individual ≥6 (2005$)	Adult Benefits (millions, 2005$)		
			First Year Cardiovasc. Benefits	Annualized Cardiovasc. Benefits (3 percent)	Annualized Cardiovasc. Benefits (7 percent)
Scenario 1	5,247,590	$130.86	$687	$657	$699
Scenario 2	5,247,590	$523.44	$2,747	$2,626	$2,795

* Monetized benefit estimate reflects the fraction of this population age 40 and older.
Notes: 1. Assumes a 75% compliance rate. 2. Average benefit based only on avoided cardiovascular effects.

5.2.2 Number of Individuals Residing in Housing Attached to Opt-Out Housing

Another group that would benefit from the removal of the opt-out provision is neighbors living nearby. The Dust Study indicates that exterior renovations generate large quantities of lead dust that spreads from the renovation site. This lead dust can contaminate neighboring properties. This analysis calculates the benefits of removing the opt-out provision for residents of neighboring properties, but the calculation is limited to a subset of such properties. The benefits calculation is based on the number of neighbors living in attached housing (such as townhouses) contiguous with housing renovated under the opt-out provision. In the Dust Study, testing samples taken 12 to 15 feet or more from the renovation work showed high dust

lead levels. These distances are sufficient to reach across the property lines of attached houses. However, dust from RRP work can also contaminate non-contiguous attached houses and detached houses. Therefore, the individuals counted here represent a subset of the number of neighbors potentially exposed from RRP work on opt-out housing.

Based on American Housing Survey (AHS) data (U.S. Census 2003), there are approximately 3.4 million attached housing units built before 1978, of which 1.9 million are owner-occupied. About 1.6 million of these units (or 48 percent of the 3.4 million pre-1978 attached units) are eligible for the opt-out provision under the 2008 LRRP rule because there is no child under the age of 6 or pregnant woman in residence and the unit is not a COF. According to the AHS data, about 751 thousand children under the age of six and 7.7 million individuals age six and older reside in these 3.4 million pre-1978 attached housing units. These individuals are among those who may be exposed to lead dust generated from exterior RRP work performed on a nearby unit that is renovated under the opt-out provision.

The number of exposed individuals in attached housing units contiguous to a unit renovated under the opt-out provision is calculated by extrapolating from the existing LRRP analyses based on the number of exterior renovations that disturb lead-based paint. The number of attached opt-out housing units with exterior renovations that disturb lead-based paint and comply with the rule represent 3.2 percent of all compliant regulated single family housing units (assuming a 75 percent compliance rate).[3] Assuming each attached opt-out unit is attached to two other housing units (one on either side), the probability that LBP is disturbed during exterior RRP in an adjacent unit is double the 3.2 percent, or 6.4 percent[4]. Since about 48 percent of attached housing units are eligible for the opt-out provision, 3.1 percent of all attached housing units will be attached to an opt-out eligible housing unit where LBP is disturbed during exterior RRP work (where 3.1 percent is the product of 48 percent and 6.4 percent). Thus, it is estimated that the removal of the opt-out provision would protect 23 thousand children and 238 thousand individuals aged 6 and older from exterior RRP work that disturbs LBP on a contiguous attached housing unit.

The benefits to children in contiguous attached housing are calculated using the average benefit per child from the analysis of the 2008 LRRP final rule (EPA 2008b) for children under six residing in target housing with exterior renovation jobs. That value was $689.32 per child, and is used to calculate benefits under both Scenario 1 and Scenario 2.[5]

There are multiple factors that influence the benefits to individuals in these contiguous attached housing. Because of insufficient data, the analysis does not address these factors. For example, calculating benefits based on the average benefit for exterior RRP events from the 2008 analysis may underestimate the

[3] 3.2 percent is calculated as the sum of the exterior events where test kits correctly identified the presence of LBP in single family owner-occupied housing (1,226 thousand, see Table 4-13) divided by the total number of single family owner-occupied housing units, 38.1 million.

[4] Some houses that are semi-attached (e.g., duplexes and end units) rather than townhouses were included in this analysis, and such units are attached to one other housing unit instead of two units. It should be noted that semi-attached houses are typically placed on small lots. Thus, the distance between the opt-out house and the non-contiguous adjacent house are typically relatively small. These non-contiguous adjacent houses are not included in this analysis, but the impact on residents of such housing may be similar to residents of attached houses.

[5] Numerous epidemiological studies have reported neurocognitive, neurobehavioral, sensory, and motor function effects in children with blood lead levels below 10μg/dL (CD, sections 6.2 and 8.4). [FN 7. Further, neurological effects in general include behavioral effects, such as delinquent behavior (CD, sections 6.2.6 and 8.4.2.2), sensory effects, such as those related to hearing and vision (CD, sections 6.2.7 and 8.4.2.3), and deficits in neuromotor function (CD, p. 8–36).] The benefits of avoiding other adverse effects caused by lead exposure were not quantified in the previous analyses, and thus are not calculated here. See section 5.4 for a discussion of these health effects.

benefits to children living in contiguous attached housing of removing the opt-out provision. The 2008 analysis of exterior target housing RRP events calculated a single average lead level for an entire yard, assumed to be 9,304 square feet in size. (The use of a yard-wide average was based on the modeling assumption that a child is equally likely to spend time in any part of a yard.) The yard-wide lead level was a weighted average calculated by combining the lead levels from three component areas – the dripline area, the nearby area, and the rest of the yard. The dripline area was between 4 feet and 12 feet from the house (depending on the Dust Study experiment being modeled) and the lead loading was based on samples taken from the area covered by rule plastic in the Dust Study. The nearby area extended from 3 feet to 8 feet from the dripline area (again depending on the Dust Study experiment being modeled), and the lead loading was based on samples taken from the area covered by containment plastic in the Dust Study. The lead level in the rest of the yard was an average soil level taken from HUD NSLAH data, and was significantly below the levels in the dripline and nearby areas. Since the yard-wide average lead level is the weighted average of these three areas, and the rest of the yard area was larger than the other areas, the yard-wide average lead level was well below the levels in the dripline area and the nearby area.

The yards for typical attached housing are likely to be smaller than those for detached housing. For some attached housing, the entire yard size is an area equivalent to the dripline area or the combined dripline and nearby areas. The lead levels in the yards of both renovated attached opt-out housing and the contiguous attached housing may be underestimated by using yard-wide lead levels based on a 9,304 square feet yard. Other factors, such as neighboring housing not being subject to the work practices (like closing windows and using plastic to collect lead dust) may affect the magnitude or exposure and related benefits for children in neighboring attached housing, compared to those for children in housing undergoing renovation. Because the net effect of such factors is unknown, the average benefit per child in Scenarios 1 and 2 are the same for this group of exposed children. Combining the number of children with the average benefit per child, Table 5-5 presents the calculated benefit of removing the opt-out provision in terms of the avoided IQ loss for children residing in contiguous attached housing units.

Table 5-5: Calculated IQ Benefits for Children Under 6 Residing in Attached Housing Contiguous to a Unit Where LBP is Disturbed During an Exterior RRP Event (millions, 2005$)

Option	Number Of Children <6	Average IQ Benefit Per Child <6 for Target Housing Exterior RRP (2005$)	First Year IQ Benefits	Annualized IQ Benefits (3 percent)	Annualized IQ Benefits (7 percent)
			(millions, 2005$)		
Scenario 1 and Scenario 2	23,386	$689.32	$16.1	$15.4	$16.4

Notes: 1. Assumes a 75% compliance rate. 2. Average benefit based only on avoided IQ loss. 3. Number of individuals does not include residents of detached housing or non-contiguous attached housing.

The estimated adult benefits from avoided incidences of hypertension, heart attack, stroke, and death from EPA's Economic Analysis for the 2006 proposed LRRP rule averaged $523 per person per year. Combining the benefit per individual with the 238 thousand individuals age 6 and older, Table 5-6 presents the calculated benefits of avoided cardiovascular impacts attached housing contiguous to a unit where lead-based paint is disturbed in an exterior RRP event.

Table 5-6: Calculated Cardiovascular Benefits for Adults Residing in Attached Housing Contiguous to a Unit Where LBP is Disturbed During an Exterior RRP Event (millions, 2005$)

Scenario	Number Of Individuals ≥6*	Average Cardiovascular Benefit Per Individual ≥6 (2005$)	Adult Benefits (millions, 2005$)		
			First Year Cardiovasc. Benefits	Annualized Cardiovasc. Benefits (3 percent)	Annualized Cardiovasc. Benefits (7 percent)
Scenario 1 and Scenario 2	238,359	$523.44	$125	$119	$127

* Monetized benefit estimate reflects the fraction of this population age 40 and older.
Notes: 1. Assumes a 75% compliance rate. 2. Average benefit based only on avoided cardiovascular effects. 3. Number of individuals does not include residents of detached housing or non-contiguous attached housing.

5.2.3 Individuals Moving into Housing Units Renovated Under the Opt-Out Provision

Another group that would benefit from the removal of the opt-out provision is individuals who move into housing units that were recently renovated under the opt-out provision. Owners typically perform painting and renovation work prior to selling a house, and baseline cleaning (i.e., not following the rule's work practices) removes only visible dust, often leaving behind lead dust hazards. Thus, individuals who move into a house where RRP work has been performed under the opt-out provision will be exposed to the lead dust that remains.

Based on AHS data (U.S. Census 2003), there are about 2.8 million owner-occupied target housing units that are sold per year, and about 927 thousand children under the age of six and 6.5 million individuals ago six and above move into these units. About 85 percent of these housing units were eligible for the opt-out provision under the previous owner, based on the overall percentage of owner-occupied target housing units that are eligible for the opt-out provision. Thus, each year about 785,000 children under the age of 6 and 5.5 million individuals age six and above move into units that were eligible for the opt-out provision.

Overall, an average of about 35 percent of renovations in opt-out housing disturb lead-based paint (see Table 4-13 in Chapter 4). Scenario 1 uses this 35 percent and assumes that RRP work is performed in one quarter of these opt-out housing units before the units are sold. Thus, under Scenario 1, about 69 thousand children under the age of six and 481 thousand individuals age 6 and above move into housing units each year where LBP was disturbed during RRP. Assuming 75 percent compliance with the rule, eliminating the opt-out provision will protect about 52 thousand children under the age of six and 361 thousand individuals age six and above annually from RRP events where LBP was disturbed before they move in.

Scenario 2 assumes that RRP work that disturbs lead-based paint is performed in all opt-out housing units before the units are sold. Thus, under Scenario 2, assuming a 75 percent compliance rate, eliminating the opt-out provision will protect about 206 thousand children under the age of six and 1.4 million individuals age six and above annually from RRP events where LBP was disturbed before they move in.

Benefits are calculated under this simplified scenario assuming that homeowners disturb lead-based paint by painting or remodeling shortly before their house is sold, so that relatively few iterations of routine cleaning occur prior to the new occupants moving in. To the extent that there is an appreciable time period between when these RRP events occur and when new tenants move in, the lead levels in these

housing units may be lower than the lead levels used in the 2008 analysis. However, since the health effects models are non-linear, the size of the impact on the benefits calculation is not known.

The average monetized benefit from the 2008 LRRP rule analysis for avoided IQ loss in children exposed in target housing where an RRP event was performed that disturbed lead-based paint is $1,384.07 (EPA 2008b). Table 5-7 presents the calculated benefits of avoided IQ loss for children residing in housing units where LBP is disturbed during a RRP event before they moved in.

Table 5-7: Calculated IQ Benefits for Children Under the Age of Six Who Move into Housing where LBP was Disturbed During an RRP Event that was Eligible for the Opt-Out Provision

Option	Number Of Children <6	Average IQ Benefit Per Child <6 for Target Housing (2005$)	First Year IQ Benefits	Annualized IQ Benefits (3 percent)	Annualized IQ Benefits (7 percent)
			(millions, 2005$)		
Scenario 1	51,538	$1,384.07	$71.3	$68.2	$72.6
Scenario 2	206,150	$1,384.07	$285.3	$272.7	$290.3

Notes: 1. Assumes a 75% compliance rate. 2. Average benefit based only on avoided IQ loss.

As shown in Table 5-8, Scenarios 1 and 2 use the same average adult cardiovascular benefit per individual ($131 and $523, respectively) as Scenarios 1 and 2 in Section 5.2.1.4. The calculations shown in this table are not included in the summary of the benefits calculations shown in Table 5-12. Since the calculations for this scenario are based on the assumption that RRP work occurs shortly before the new occupants move in, the original owners are assumed to move out shortly after the RRP work is performed. Under this scenario, excluding the new residents from the total is equivalent to subtracting the individuals who move out from the number of individuals calculated in Table 5-4. However, the adult benefit estimates in the 2006 analysis were based on a non-linear model, so benefits to avoiding exposure to two individuals (the home seller and the home buyer) for a shorter period of time may exceed the benefits of avoiding exposure to one individual for a longer time period. Under a different scenario (where there was assumed to be a non-trivial time delay between when RRP work was performed and when the house was sold), it would be appropriate to count benefits to both the old and new occupants in the total.

Table 5-8: Calculated Cardiovascular Benefits for Adults Who Move into Housing that was Eligible for the Opt-Out Provision When LBP was Disturbed During an RRP Event

Scenario	Number Of Individuals ≥6*	Average Cardiovascular Benefit Per Individual ≥6 (2005$)	Adult Benefits (millions, 2005$)		
			First Year Cardiovasc. Benefits	Annualized Cardiovasc. Benefits (3 percent)	Annualized Cardiovasc. Benefits (7 percent)
Scenario 1	360,680	$130.86	$47.2	$45.1	$48
Scenario 2	1,442,720	$523.44	$755	$722	$768

* Monetized benefit estimate reflects the fraction of this population age 40 and older.
Notes: 1. Assumes a 75% compliance rate. 2. Average benefit based only on avoided IQ loss.

5.2.4 Children Receiving Regular Care in Target Housing that is not a COF

A target housing unit where a child visits regularly, but spends fewer that 6 hours a week, is not considered a child-occupied facility. Therefore, these housing units, hereafter referred to as Regular Care Target Housing (RCTH) units, are eligible for the opt-out provision under the existing LRRP rule providing that there is no child under the age of six or pregnant woman that resides in the unit. Thus, children visiting RCTH may benefit from the elimination of the opt-out provision by reducing their potential exposures to lead dust during these visits.

The methodology developed to estimate the number of children protected from potential lead exposures in RCTH units eligible for the opt-out provision under the existing rule has three primary steps: (1) estimate the number of children who regularly visit RCTH units that are eligible for the opt-out provision, (2) estimate the frequency that LBP is disturbed during RRP in these units, and (3) combine the results. These steps are described in more detail below.

5.2.4.1 Number of Children Visiting RCTH units

The total population of children under the age of six and the estimated percentages of children in non-parental care arrangements utilized in this analysis is from Mulligan et al. (2005) and is presented in Table 5-9. Following the methodology from the economic analysis of the 2008 LRRP rule (EPA 2008b), it is assumed that all paid non-relative care arrangements are in COFs (care for at least one child is provided for more than six hours a week) and therefore would not be affected by the elimination of the opt-out provision. However, some unpaid non-relative care arrangements and relative care arrangements (paid and unpaid) are expected to be for fewer than six hours a week and therefore may be in the RCTH units that would be affected by the elimination of the opt-out provision. Of those providing care in their own home, it is assumed that 27 percent of relatives (paid and unpaid) and unpaid non-relatives provide care for less than six hours a week (Wilder Research Center 2005, p.28). In addition, the estimates are adjusted by 22 percent so that they only include children receiving care in homes that are (1) target housing, (2) owner occupied, (3) where no pregnant woman resides, (4) outside the child's own home, and (5) where no child under the age of six resides.[6]

The adjustment factors listed above are combined to estimate the number of children who regularly visit RCTH units that are eligible for the opt-out provision of the existing LRRP rule presented in Table 5-9.

[6] Based on 2003 AHS data it is estimated that 65 percent of housing units are target housing, 61 percent are owner-occupied, and 98.9 percent of housing units are not occupied by a pregnant woman.

Based on the Wilder Research Center (2005, p.19) report, 57.5 percent of family, friend, and neighbor caregivers (informal care providers) have children under the age of 12. It is assumed that half as many, or 29 percent, have children under the age of six. Thus, 71 percent of RCTH units are not occupied by a child under the age of six.

Based on a Wilder Research Center (2005, p.28) report on the results of the 2004 Minnesota Statewide Household Child Care Survey it is assumed that 78 percent of relatives and non-relatives (paid or unpaid) provide care outside the child's home.

The product of the above adjustment factors, 65%, 61%, 98.9%, 71%, and 78%, is 22%.

Table 5-9: Number of Children Visiting RCTH Units Affected by the Opt-Out Elimination Regulatory Options

Age	*Total Population (thousands)*	*Percent Receiving Unpaid Non-Relative Care*	*Percent Receiving Relative Care*	*Percent Receiving Care < 6 Hours Per Week*	*Receiving Care in Owner-Occupied, Pre-78 Housing, Where no Child-Under Six or Pregnant Woman Resides**	*Population Receiving Unpaid Non-Relative Care (thousands)*	*Population Receiving Relative Care (thousands)*	*Total Population in Affected Units (thousands)*
0	3,868	1.4%	21.0%	27.0%	22.0%	3.3	48.5	51.9
1	3,902	2.1%	22.0%	27.0%	22.0%	4.8	51.3	56.1
2	3,931	1.9%	23.0%	27.0%	22.0%	4.5	54.0	58.5
3	3,795	1.6%	22.0%	27.0%	22.0%	3.7	49.9	53.5
4	3,861	1.6%	21.0%	27.0%	22.0%	3.7	48.4	52.1
5	896	1.7%	20.0%	27.0%	22.0%	0.9	10.7	11.6
0-5	**20,253**					**21.0**	**262.9**	**283.9**

*61% of TH units are owner-occupied; 65% of TH units are pre-1978, 78% of children receive care outside their own home, and 71% receive care where no other child under the age of six resides, and 98.9% receive care where no pregnant woman resides. The product of 61%, 65%, 78%, 71%, and 98.9% is 22%.

5.2.4.2 Number of Children Visiting RCTH Protected by the Opt-Out Provision Elimination

The second measure of the benefits for each of the regulatory options consists of the number of children regularly visiting RCTH units where LBP is disturbed during RRP in housing eligible for the opt-out provision under the existing rule. Using the methodology described in Section 4.2 of Chapter 4, it was estimated that about 5.7 percent of Pre-1978 households perform RRP that disturbs lead-based paint (LBP) annually. In Pre-1960 households, which are more likely to contain LBP, 10.1 percent households perform RRP that disturbs lead-based paint (LBP) annually. Combining the 5.7 percent of RRP events that disturb LBP with the 283,900 children receiving child care in RCTH units presented in Table 5-9 yields the estimate of 16,215 children presented in Table 5-10.

Table 5-10: Annual Number of Children Visiting Opt-Out Eligible RCTH Where LBP is Disturbed During an RRP Event that are Protected by the Removal of the Opt-out Provision

Option	Number of Children Under the Age of 6 Protected by the Rule each Year[a]	
	First Year	Second Year[b]
A	16,215	16,149
B	8,108	16,149
C	0	16,149
D	13,597	16,149
E1 to E4[c]	16,215	16,149

a. Assumes a 75% compliance rate.

b. The stock of target housing, and therefore the number of individuals living in target housing, is assumed to decline by 0.41% per year (due to demolitions, conversions, etc,) based on Census data.

c. Options E1 to E4 cover the same target housing universe and have the same effective date as Option A, but do not provide the same level of protection because they do not require all of the work practice standards under 40 CFR 734.85.

Since the opt-out provision is eliminated under Option A as soon as the rule becomes effective, all children receiving care in opt-out eligible RCTH performing RRP that disturbs LBP are protected in the first year. Since the opt-out provision under Option B is eliminated six months later (halfway through the beginning of the first year the rule is in place), the number of individuals protected under Option B in the first year is half the number estimated for Option A. Under Option C, the opt-out provision is eliminated a year later. Under Option D the opt-out provision is eliminated as soon as the rule becomes effective for housing built before 1960. Options E1 through E4 have the same effective dates and universe of regulated structures as Option A, but consider alternative work practice requirements. As indicated in the numbers presented in Table 5-10, the majority of the children that would be protected by the elimination of the opt-out provision reside in housing built before 1960 because of the higher likelihood of LBP in these housing units. In the second year (starting June 2011), the opt-out provision would be eliminated under all options.

Calculated Benefits for Children in Opt-Out Eligible RCTH

Under Scenario 2, the IQ benefit per child for children receiving care in RCTH units eligible for the opt-out provision is calculated using the average monetized benefits due to IQ loss for children receiving childcare in target housing where LBP was disturbed during RRP work, taken from the Economic Analysis for the 2008 LRRP rule (EPA 2008b). The average calculated benefit due to IQ loss for these children $1,771.97 per child.[7]

[7] The benefits of avoiding other adverse effects caused by lead exposure (including such neurobehavioral impacts in children as aggression, attention deficit problems, and hyperactivity), as well as various other health effects that can also occur in older individuals (including renal effects, immune system effects, and reproductive and developmental effects), were not quantified in the previous analyses, and thus are not calculated here. See section 5.4 for a discussion of these health effects.

The average Scenario 2 benefit of $1,771.97 per child for children receiving childcare in target housing is higher than the $1,384.07 average benefit for children residing in target housing. (Both of these values are for target housing where an RRP event was performed that disturbed LBP.) At first glance this result seems counterintuitive, since children who reside in renovated target housing spend more time there on average than children who attend childcare in renovated target housing. The result is due to differences in background levels for the two groups, and non-linearities in the benefits modeling.

In the 2008 analysis, vintage-specific background levels were used to estimate media concentrations at the site where the RRP activity was occurring. However, "overall" background levels were used to estimate media concentrations during time spent away from the site where the RRP activity was occurring. The "overall" background level was the average background level across all vintages – including post-1978 buildings. When the exposure scenario was at a child's house, and he spent some time at daycare, his background exposure was lower for the time at daycare. When the exposure scenario was at a child's daycare, her background exposure was lower when she was at home.

In the 2008 analysis, when a child started from a lower background level of exposure, the damage in terms of IQ loss from an exposure was greater. This "background" effect dominated the effect from spending less time at the exposure site. As described earlier in this report, there are two key relationships involved in calculating IQ change – going from lead exposure to blood lead, and from blood lead to IQ. Both of these relationships are nonlinear, with the steepest slopes at lower levels, meaning that IQ effects are proportionately greater for lower exposures and blood lead levels. Thus, benefits from avoiding exposure are proportionately greater for children starting from a lower background level of exposure. The children with the lowest average background exposure level are those exposed at daycare in target housing – because these children include children living in post-1978 housing. The result is that children receiving childcare in target housing have a higher average benefit per child ($1,771.97 per child) under Scenario 2 than children exposed in all target housing units ($1,384.07 per child).

According to data from the Department of Education National Center for Education Statistics's 2005 "Early Childhood Program Participation Survey", the average amount of time that children under the age of 6 spend in COFs in target housing varies by age of child, ranging from 25 to 30 hours per week. Because the 6 hours per week in childcare assumed for RCTH children is about one quarter of the average amount of time children spend in COFs, Scenario 1 assumes that the average benefit per child is one quarter that of Scenario 2, or $442.99 per child.

To be classified as a COF, a pre-1978 building must be frequented by the same child at least two different days of the week, with each visit consisting of at least 3 hours each day, and the combined visits at least 6 hours per week. This can result in a situation where a facility is not classified as a COF even though a child receives more than 6 hours of care per week. For example, if a child is in a pre-1978 building 2 hours per day for 5 days a week, for a total of 10 hours per week, the building would not be classified as a COF. Similarly, if a child is in a pre-1978 building 8 hours one day a week and 2.75 hours the other 6 days a week, for a total of 24.5 hours per week, the building would also not be classified as a COF. There are of course other scenarios in which day-care would occur for more than 6 hours a week but where the building would not be considered to be a COF. Thus, although this analysis assumes that children spend an average of 6 hours per week in RCTH, this is not the upper bound for the time that children spend in RCTH.

Table 5-11 presents the calculated benefits under Option A from removing the opt-out provision for children under the age of six receiving childcare at an RCTH where LBP is disturbed during an RRP event.

Table 5-11: Calculated IQ Benefits from Opt-Out Provision Removal for Children in Opt-Out Eligible RCTH Where LBP is Disturbed During an RRP Event					
Scenario	**Annual Number Of Children <6**	**Average IQ Benefit Per Child <6 in Target Housing Childcare (2005$)**	**First Year Benefits**	**Annualized Benefits (3 percent)**	**Annualized Benefits (7 percent)**
			(millions, 2005$)		
Scenario 1	16,215	$442.99	$7.2	$6.9	$7.3
Scenario 2	16,215	$1,771.97	$28.7	$27.5	$29.2
Notes: 1. Assumes a 75% compliance rate. 2. Average benefit based only on avoided IQ loss.					

5.2.5 Summary of Calculated Benefits

Table 5-12 presents the Scenario 1 results and Table 5-13 presents the Scenario 2 results at 3 percent and 7 percent discount rates. Table 5-14 shows both scenarios using a 3 percent discount rate, and Table 5-15 shows similar information using a 7 percent discount rate.

The results do not include other populations that will benefit from the rule, such as individuals other than those in contiguous attached housing who live near a house renovated under the opt-out provision; or those who spend time in a friend's or relative's house renovated under the opt-out provision.

The benefits calculations for children under the age of 6 are based on avoided losses in expected earnings due to IQ drop, and the calculations for adults are based on the avoided medical costs (or other proxies for willingness to pay) for hypertension, coronary heart disease, stroke, and the resulting incidence of deaths. The quantified benefits to children do not include the avoided costs of other associated impacts of lead exposure such as aggression, attention deficit problems, hyperactivity, or other neurobehavioral impacts; additional education costs for special and remedial education; or medical costs to treat very high levels of lead. Nor do any of the calculations include the benefits of renal effects, immune system effects, reproductive and developmental effects, or various other health effects that can be caused by lead exposure. See Section 5.4 for a discussion of these health effects.

Table 5-12: Summary of Benefits for Option A – Final Rule (millions, 2005$) – Scenario 1						
Population	**Children Under 6 IQ Benefits**		**Adult Cardiovascular Benefits**		**Combined**	
	Annualized Benefits (3 percent)	**Annualized Benefits (7 percent)**	**Annualized Benefits (3 percent)**	**Annualized Benefits (7 percent)**	**Annualized Benefits (3 percent)**	**Annualized Benefits (7 percent)**
Calculated Benefits						
(1) Reside in housing renovated under opt-out provision	Not applicable – children under 6 do not reside in opt-out eligible housing		$656.5	$698.8	$656.5	$698.8
(2) Live contiguous to attached house renovated under opt-out provision	$15.4	$16.4	$119	$127	$134.4	$143.4
(3) Move into house renovated under opt-out provision	$68.2	$72.6	$45.1*	$48*	$68.2*	$726*
(4) Receive childcare in housing renovated under opt-out provision	$6.9	$7.3	Not applicable		$6.9	$7.3
Subtotal	**$90.5**	**$96.3**	**$775.5**	**$825.8**	**$866.0**	**$920.1**
Uncalculated Benefits						
(5) Live near house renovated under opt-out provision, other than contiguous attached house	Not estimated		Not estimated		Not estimated	
(6) Spend time in friend's or relative's house renovated under opt-out provision	Not estimated		Not estimated		Not estimated	
(7) Health effects for all populations other than IQ loss in children <6 and blood pressure effects in older individuals	Not estimated		Not estimated		Not estimated	
Total	Not estimated		Not estimated		Not estimated	

* Not included in subtotal because these benefits are assumed to be incorporated into row #1 above based on the exposure assumptions used.
Notes: 1. Assumes a 75% compliance rate.

Table 5-13: Summary of Benefits for Option A – Final Rule (millions, 2005$) – Scenario 2						
Population	**Children Under 6 IQ Benefits**		**Adult Cardiovascular Benefits**		**Combined**	
	Annualized Benefits (3 percent)	**Annualized Benefits (7 percent)**	**Annualized Benefits (3 percent)**	**Annualized Benefits (7 percent)**	**Annualized Benefits (3 percent)**	**Annualized Benefits (7 percent)**
Calculated Benefits						
(1) Reside in housing renovated under opt-out provision	Not applicable – children under 6 do not reside in opt-out eligible housing		$2,626	$2,795	$2,626	$2,795
(2) Live contiguous to attached house renovated under opt-out provision	$15.4	$16.4	$119	$127	$134.4	$143.4
(3) Move into house renovated under opt-out provision	$272.7	$290.3	$722*	$768*	$272.7*	$290.3*
(4) Receive childcare in housing renovated under opt-out provision	$27.5	$29.2	Not applicable		$27.5	$29.2
Subtotal	**$315.6**	**$335.9**	**$2,745**	**$2,922**	**$3,060.6**	**$3,257.9**
Uncalculated Benefits						
(5) Live near house renovated under opt-out provision, other than contiguous attached house	Not estimated		Not estimated		Not estimated	
(6) Spend time in friend's or relative's house renovated under opt-out provision	Not estimated		Not estimated		Not estimated	
(7) Health effects for all populations other than IQ loss in children <6 and blood pressure effects in older individuals	Not estimated		Not estimated		Not estimated	
Total	Not estimated		Not estimated		Not estimated	

* Not included in subtotal because these benefits are assumed to be incorporated into row #1 above based on the exposure assumptions used.
Notes: 1. Assumes a 75% compliance rate.

Table 5-14: Summary of Benefits for Option A – Final Rule (millions of dollars, 3% discount rate)

Population	Children Under 6 IQ Benefits		Adult Cardiovascular Benefits		Combined	
	Scenario 1	**Scenario 2**	**Scenario 1**	**Scenario 2**	**Scenario 1**	**Scenario 2**
(1) Reside in housing renovated under opt-out provision	Not applicable – children under 6 do not reside in opt-out eligible housing		$656.5	$2,626	$656.5	$2,626
(2) Live contiguous to attached house renovated under opt-out provision	$15.4	$15.4	$119	$119	$134.4	$134.4
(3) Move into house renovated under opt-out provision	$68.2	$272.7	$45*	$722*	$68.2*	$272.7*
(4) Receive childcare in housing renovated under opt-out provision	$6.9	$27.5	Not applicable		$6.9	$27.5
Subtotal	**$90.5**	**$315.6**	**$775.5**	**$2,745**	**$866.0**	**$3,060.6**
Uncalculated Benefits (5) Live near house renovated under opt-out provision, other than contiguous attached house; (6) Spend time in friend's or relative's house renovated under opt-out provision; (7) Health effects for all populations other than IQ loss in children <6 and blood pressure effects in older individuals.						
* Adult component not included in subtotal because these benefits are assumed to be incorporated into row #1 above based on the exposure assumptions used.						

Table 5-15: Summary of Benefits for Option A – Final Rule (millions of dollars, 7% discount rate)

Population	Children Under 6 IQ Benefits		Adult Cardiovascular Benefits		Combined	
	Scenario 1	**Scenario 2**	**Scenario 1**	**Scenario 2**	**Scenario 1**	**Scenario 2**
(1) Reside in housing renovated under opt-out provision	Not applicable – children under 6 do not reside in opt-out eligible housing		$698.8	$2,795	$698.8	$2,795
(2) Live contiguous to attached house renovated under opt-out provision	$16.4	$16.4	$127	$127	$143.4	$151.6
(3) Move into house renovated under opt-out provision	$72.6	$290.3	$48*	768*	$72.6*	$290.3*
(4) Receive childcare in housing renovated under opt-out provision	$7.3	$29.2	Not applicable		$7.3	$29.2
Subtotal	**$96.3**	**$335.9**	**$825.8**	**$2,922**	**$920.1**	**$3,257.9**

Uncalculated Benefits
(5) Live near house renovated under opt-out provision, other than contiguous attached house;
(6) Spend time in friend's or relative's house renovated under opt-out provision;
(7) Health effects for all populations other than IQ loss in children <6 and blood pressure effects in older individuals.

* Adult component not included in subtotal because these benefits are assumed to be incorporated into row #1 above based on the exposure assumptions used.

5.3 Benefits of Additional Recordkeeping Requirements

In promulgating the 2008 LRRP rule, EPA recognized the importance of education and outreach to teach consumers about lead-safe work practices and to encourage them to hire certified renovation firms. EPA's work on the education and outreach campaign for the LRRP program has continued to highlight the importance of an informed public to the success of the LRRP program in minimizing exposures to lead-based paint hazards that may be created by renovations.

EPA has determined that if renovators are required to provide the owners and occupants of renovated buildings with copies of the records renovation firms must maintain to document compliance with the rule's training and work practice requirements, it will serve to reinforce the information provided in EPA's "Renovate Right" brochure on the potential hazards of renovations and on the LRRP requirements. These records will enable building owners and occupants to better understand what the renovation firm did to comply with the rule and how the rule's provisions affected their specific renovation. Educating the owners and occupants in this way is likely to help them to be better able to protect themselves from lead-based paint hazards that may have been created by the renovation and improve their ability to assist the EPA in monitoring compliance with the LRRP rule. For example, the checklist may cause owners or occupants to question whether the containment used was sufficient, or whether cleaning verification was properly performed. Tenants may raise their concerns with their landlord, and owners may discuss their concerns with the renovation firm before making final payment for the renovation. These improvements in education and monitoring will improve compliance with the rule, which will ultimately protect children and adults from exposure to lead hazards due to renovation activities.

5.4 Lead-Related Health Effects and Ecological Effects

Lead exposure can cause many adverse health and ecological effects. This section supplements the benefits chapter by providing a broader, qualitative discussion of lead-related effects (including adult effects and ecological effects), based on EPA's Air Quality Criteria for Lead.

The information provided in this section is an excerpt from the Executive Summary of the document Air Quality Criteria for Lead (United States Environmental Protection Agency, October 2006, EPA/600/R-5/144aF, this document is available at http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=158823). Specifically, the information provided in this section is directly from the following sections of the Executive Summary:

E.4 Health Effects Associated with Lead Exposure

E.5 Human Population Groups at Special Risk and Potential Public Health Impacts

E.6 Environmental Effects of Lead

5.4.1 Background

The purpose of the 2006 Lead Air Quality Criteria document (AQCD) is to critically assess the latest scientific information on lead. The final version of the revised Lead AQCD mainly assesses pertinent literature published or accepted for publication through December 2005.

The First External Review Draft (dated December 2005) of the revised Lead AQCD underwent public comment and was reviewed by the Clean Air Scientific Advisory Committee (CASAC) at a public meeting held in Durham, NC on February 28-March 1, 2006. The public comments and CASAC recommendations received were taken into account in making appropriate revisions and incorporating them into a Second External Review Draft (dated May, 2006) which was released for further public

comment and CASAC review at a public meeting held June 28-29, 2006. In addition, still further revised drafts of the Integrative Synthesis chapter and the Executive Summary were then issued and discussed during an August 15, 2006 CASAC teleconference call. Public comments and CASAC advice received on these latter materials, as well as Second External Review Draft materials, were taken into account in making and incorporating further revisions into this final version of the Lead AQCD.

5.4.2 Health Effects Associated with Lead Exposure

Both epidemiologic and toxicological studies have shown that environmentally relevant levels of lead affect many different organ systems. Research completed since the 1986 AQCD/Addendum and 1990 Supplement indicates that lead effects occur at blood-lead levels even lower than those previously reported for many endpoints. Remarkable progress has been made since the mid-1980s in understanding the Pb effects on health. Recent studies have focused on details of the associations, including the shapes of concentration-response relationships, especially at levels well within the range of general population exposures, and on those biological and/or socio-environmental factors that either increase or decrease an individual's risk. Key findings and conclusions regarding important outcomes of newly available toxicological and epidemiologic studies of Pb health effects are highlighted below.

5.4.2.1 Neurotoxic Effects

- Neurobehavioral effects of Pb-exposure early in development (during fetal, neonatal, and later postnatal periods) in young infants and children ($\leq$7 years old) have been observed with remarkable consistency across numerous studies involving varying study designs, different developmental assessment protocols, and diverse populations. Negative Pb impacts on neurocognitive ability and other neurobehavioral outcomes are robust in most recent studies even after adjustment for numerous potentially confounding factors (including quality of care giving, parental intelligence, and socioeconomic status). These effects generally appear to persist into adolescence and young adulthood.

- The overall weight of the available evidence provides clear substantiation of neurocognitive decrements being associated in young children with blood-Pb concentrations in the range of 5-10 μg/dL, and possibly somewhat lower. Some newly available analyses appear to show Pb effects on the intellectual attainment of preschool and school age children at population mean concurrent blood-Pb levels ranging down to as low as 2 to 8 μg/dL. A decline of 6.2 points in full scale IQ for an increase in concurrent blood Pb levels from 1 to 10 μg/dL has been estimated, based on a pooled analysis of results derived from seven well-conducted prospective epidemiologic studies.

- In the limited literature examining the effects of environmental Pb exposure on adults, mixed evidence exists regarding associations between Pb and neurocognitive performance. No associations were observed between cognitive performance and blood Pb levels; however, significant associations were observed in relation to bone Pb concentrations, suggesting that long-term cumulative Pb exposure may contribute to neurocognitive deficits in adults.

- Animal toxicology data indicate that developmental Pb exposures creating steady-state blood-Pb concentrations of ~10 μg/dL result in behavioral impairments that persist into adulthood in rats and monkeys. No evident threshold has yet been found; and Pb-induced deficits, for the most part, have been found to be very persistent, even with various chelation treatments. However, experimental studies indicate that environmental enrichment during development can partially mitigate the effects of Pb on cognitive function. In rats, neurobehavioral deficits that persisted well into adulthood were observed with prenatal, preweaning, and postweaning Pb exposure. In monkeys, such neurobehavioral deficits were observed both with in utero-only exposure and with

early postnatal-only exposure when peak blood-Pb levels did not exceed 15 μg/dL and steady-state levels were ~11 μg/dL.

- Learning impairment has been observed in animal studies at blood levels as low as 10 μg/dL, with higher level learning showing greater impairment than simple learning tasks. The mechanisms associated with these deficits include: response preservation; insensitivity to changes in reinforcement density or contingencies; deficits in attention; reduced ability to inhibit inappropriate responding; impulsivity; and distractibility.
- Lead affects reactivity to the environment and social behavior in both rodents and nonhuman primates at blood Pb levels of 15 to 40 μg/dL. Rodent studies also show that Pb exposure potentiates the effects of stress in females.
- Auditory function has also been shown to be impaired at blood Pb levels of 33 μg/dL, while visual functions are affected at 19 μg/dL.
- Neurotoxicological studies in animals clearly demonstrated that Pb mimics calcium and affects neurotransmission and synaptic plasticity.
- Epidemiologic studies have identified genetic polymorphisms of two genes that may alter susceptibility to the neurodevelopmental consequences of Pb exposure in children. Variant alleles of the ALAD gene are associated with differences in absorption, retention, and toxicokinetics of Pb. Polymorphisms of the vitamin D receptor gene have been shown to affect the rate of resorption and excretion of Pb over time. These studies are only suggestive, and parallel animal studies have not been completed.

5.4.2.2 Cardiovascular Effects

- Epidemiologic studies have consistently demonstrated associations between Pb exposure and enhanced risk of deleterious cardiovascular outcomes, including increased blood pressure and incidence of hypertension. A meta-analysis of numerous studies estimates that a doubling of blood-Pb level (e.g., from 5 to 10 μg/dL) is associated with ~1.0 mm Hg increase in systolic blood pressure and ~0.6 mm Hg increase in diastolic pressure. Studies have also found that cumulative past Pb exposure (e.g., bone Pb) may be as important, if not more, than present Pb exposure in assessing cardiovascular effects. The evidence for an association of Pb with cardiovascular morbidity and mortality is limited but supportive.
- Experimental toxicology studies have confirmed Pb effects on cardiovascular functions. Most have shown that exposures creating blood-Pb levels of ~20 to 30 μg/dL for long periods result in arterial hypertension that persists long after cessation of Pb exposure in genetically normal animals. One study reported blood pressure increases at blood-Pb levels as low as 2 μg/dL in rats. A number of in vivo and in vitro studies provide compelling evidence for the role of oxidative stress in the pathogenesis of Pb-induced hypertension. However, experimental investigations of cardiovascular effects of Pb in animals are unclear as to why low, but not high, levels of Pb exposure cause hypertension in experimental animals.

5.4.2.3 Renal Effects

- In the general population, both circulating and cumulative Pb was found to be associated with longitudinal decline in renal function. Effects on creatine clearance have been reported in human adult hypertensives to be associated with general population mean blood-Pb levels of only 4.2 μg/dL. The public health significance of such effects is not clear, however, in view of more

serious signs of kidney dysfunction being seen in occupationally exposed workers only at much higher blood-Pb levels (>30-40 μg/dL).

- Experimental studies using laboratory animals demonstrated that the initial accumulation of absorbed Pb occurs primarily in the kidneys. This takes place mainly through glomerular filtration and subsequent reabsorption, and, to a small extent, through direct absorption from the blood. Both low dose Pb-treated animals and high dose Pb-treated animals showed a "hyperfiltration" phenomenon during the first 3 months of Pb exposure. Investigations into biochemical alterations in Pb-induced renal toxicity suggested a role for oxidative stress and involvement of NO, with a significant increase in nitrotyrosine and substantial fall in urinary excretion of NOx.

- Iron deficiency increases intestinal absorption of Pb and the Pb content of soft tissues and bone. Aluminum decreases kidney Pb content and serum creatinine in Pb-intoxicated animals. Age also has an effect on Pb retention. There is higher Pb retention at a very young age and lower bone and kidney Pb at old age, attributed in part to increased bone resorption and decreased bone accretion and, also, kidney Pb.

5.4.2.4 Immune System Effects

- Findings from recent epidemiologic studies suggest that Pb exposure may be associated with effects on cellular and humoral immunity. These include changes in serum immunoglobulin levels. Studies of biomarkers of humoral immunity in children have consistently found significant associations between increasing blood-Pb concentrations and serum IgE levels at blood-Pb levels <10 μg/dL.

- Toxicologic studies have shown that Pb targets immune cells, causing suppression of delayed type hypersensitivity response, elevation of IgE, and modulation of macrophages into a hyper-inflammatory phenotype. These types of changes can cause increased risk of atopy, asthma, and some forms of autoimmunity and reduced resistance to some infectious diseases. Lead exposure of embryos resulting in blood-Pb levels <10 μg/dL can produce persistent later-life immunotoxicity.

5.4.2.5 Effects on Heme Synthesis

- Lead exposure has been associated with disruption of heme synthesis in both children and adults. A 10% probability of anemia (hematocrit <35%) is estimated to be associated with a blood-Pb level of ~20 μg/dL at age 1 year. Increases in blood Pb concentration of about 20-30 μg/dL are sufficient to halve erythrocyte ALAD activity and sufficiently inhibit ferrochelatase to double erythrocyte protoporphyrin levels.

- Toxicological studies demonstrated that Pb intoxication interferes with red blood cell (RBC) survival and alters RBC mobility. Hematological parameters, such as mean corpuscular volume, mean corpuscular hemoglobin, and mean corpuscular hemoglobin concentration, are also significantly decreased upon exposure to Pb. These effects are due to internalization of Pb by RBC. The transport of Pb across the RBC membrane is energy-independent and carrier-mediated; and the uptake of Pb appears to be mediated by an anion exchanger through a vanadate-sensitive pathway.

- Erythrocyte ALAD activity ratio (ratio of activated/non activated enzyme activity) has been shown to be a sensitive, dose-responsive measure of Pb exposure, regardless of the mode of administration of Pb. Competitive enzyme kinetic analyses in RBCs from both humans and Cynomolgus monkeys indicated similar inhibition profiles by Pb.

5.4.2.6 Effects on Bones and Teeth

- Experimental studies in animals demonstrate that Pb substitutes for calcium and is readily taken up and stored in the bone and teeth of animals, potentially allowing bone cell function to be compromised both directly and indirectly by exposure. Relatively short-term exposure of mature animals to Pb does not result in significant growth suppression. However, chronic Pb exposure during times of inadequate nutrition has been shown to adversely influence bone growth, including decreased bone density, decreased trabecular bone, and growth plates.
- Exposure of developing animals to Pb during gestation and the immediate postnatal period has clearly been shown to significantly depress early bone growth in a dose-dependent fashion, though this effect is not manifest below a certain threshold.
- Systemically, Pb has been shown to disrupt mineralization of bone during growth, to alter calcium binding proteins, and to increase calcium and phosphorus concentration in the blood stream, in addition to potentially altering bone cell differentiation and function by altering plasma levels of growth hormone and calciotropic hormones such as vitamin D3 [1,25- (OH2)D3.
- Periods of extensive bone remodeling, such as occur during weight loss, advanced age, altered metabolic state, and pregnancy and lactation are all associated with mobilization of Pb stores from bone of animals.
- Numerous epidemiologic studies and, separately, animal studies (both post-eruptive Pb exposure and pre- and perinatal Pb exposure studies) suggest that Pb is a caries-promoting element. However, whether Pb incorporation into the enamel surface compromises the integrity and resistance of the surface to dissolution, and ultimately increases risk of dental decay, is unclear.
- Increased risk of dental caries has been associated with Pb exposure in children and adults. Lead effects on caries were observed in populations whose mean blood-Pb levels were less than 10 μg/dL.

5.4.2.7 Reproductive and Developmental Effects

- Epidemiologic evidence suggests small associations between Pb exposure and male reproductive outcomes, including perturbed semen quality and increased time to pregnancy. There are no adequate epidemiologic data to evaluate associations between Pb exposure and female fertility. Most studies have yielded no associations, or weak associations, of Pb exposure with thyroid hormone status and male reproductive endocrine status in highly exposed occupational populations.
- New toxicologic studies support earlier conclusions, presented in the 1986 Lead AQCD, that (a) Pb can produce both temporary and persisting effects on male and female reproductive function and development and (b) Pb disrupts endocrine function at multiple points along the hypothalamic-pituitary-gonadal axis. Although there is evidence for a common mode of action, consistent effects on circulating testosterone levels are not always observed in Pb-exposed animals. Inconsistencies in reports of circulating testosterone levels complicate derivation of a dose-response relationship for this endpoint.
- Lead-induced testicular damage (ultrastructural changes in testes of monkeys at blood-Pb >35 to 40 μg/dL) and altered female sex hormone release, imprinting during early development, and altered female fertility all suggest Pb-induced reproductive effects. However, Pb exposure does not generally produce total sterility. Pre- and postnatal exposure to Pb has been demonstrated to result in fetal mortality and produce a variety of sublethal effects in the offspring. Many of the

Pb-induced sublethal developmental effects occur at maternal blood-Pb levels that do not result in clinical (overt) toxicity in the mothers. Teratogenic effects resulting from Pb exposure reported in a few studies appear to be confounded by maternal toxicity.

5.4.2.8 Effects on Other Organ Systems

- Lead impacts the hypothalamic-pituitary-adrenal axis, elevating corticosterone levels and altering stress responsivity. This may be a potential mechanism contributing to Pb-induced hypertension, with further possible roles in the etiology of diabetes, obesity and other disorders.
- Studies of hepatic enzyme levels in serum suggest that liver injury may be present in Pb workers; however, associations specifically with Pb exposures are not evident. Children exposed to relatively high levels of Pb (blood Pb >30 μg/dL) exhibit depressed levels of circulating 1,25-dihydroxy vitamin D (1,25-OH-D). However, associations between serum vitamin D status and blood Pb were not evident in a study of calcium-replete children who had average lifetime blood-Pb concentrations <25 μg/dL.
- Field studies that evaluated hepatic enzyme levels in serum suggest that liver injury may be present in Pb workers; however, associations specifically with Pb exposures have not been well established.
- Simultaneous induction of the activities of phase II drug metabolizing enzymes and decreased phase I enzymes with a single exposure to Pb nitrate in rat liver suggest that Pb is capable of causing biochemical phenotype similar to hepatic nodules.
- Newer studies examined the induction of GST-P at both transcriptional and translational levels using in vitro systems and indicated a role for Pb-nitrate and Pb-acetate in the induction process.
- Lead-induced alterations in cholesterol metabolism appear to be mediated by the induction of several enzymes related to cholesterol metabolism and the decrease of 7 α-hydroxylase, a cholesterol-catabolizing enzyme. This regulation of cholesterol homeostasis is modulated by changes in cytokine expression and related signaling.
- Newer experimental evidence suggests that Pb-induced alterations in liver heme metabolism involve perturbations in ALAD activity, porphyrin metabolism, alterations in Transferrin gene expression, and associated changes in iron metabolism.
- Gastrointestinal (GI) absorption of Pb is influenced by a variety of factors, including chemical and physical forms of the element in ingested media, age at intake, and various nutritional factors. The degeneration of intestinal mucosal epithelium leading to potential malabsorption and alterations in the jejunal ultrastructure (possibly associated with distortion of glycocalyx layer) have been reported in the intestine of Pb-exposed rats.
- Nutritional studies that varied Pb, Ca, and vitamin D levels in the diet have demonstrated competition of Pb with Ca absorption. Supplementation with vitamin D has been reported to enhance intestinal absorption of Ca and Pb. Physiological amounts of vitamin D, when administered to vitamin D-deficient rats, resulted in elevated Pb and Ca levels. In the case of severe Ca deficiency, Pb ingestion results in a marked decrease in serum 1,25 hydroxy vitamin D.

5.4.2.9 Genotoxic and Carcinogenic Effects

- Epidemiologic studies of highly exposed occupational populations suggest a relationship between Pb and cancers of the lung and the stomach; however the evidence is limited by the presence of various potential confounders, including metal coexposures (e.g., to arsenic, cadmium), smoking,

and dietary habits. The 2003 NTP and 2004 IARC reviews concluded that Pb and Pb compounds were probable carcinogens, based on limited evidence in humans and sufficient evidence in animals. Similarly, Pb and Pb compounds would likely be classified as likely to be carcinogenic to humans according to the new 2005 EPA Cancer Assessment Guidelines for Carcinogen Risk Assessment, based on animal data even though the human data are inadequate.

- Studies of genotoxicity consistently find associations of Pb exposure with DNA damage and micronuclei formation; however, the associations with the more established indicator of cancer risk, chromosomal aberrations, are inconsistent.
- Pb is an animal carcinogen and extends our understanding of mechanisms involved to include a role for metallothionein. Specifically, the recent data show that metallothionein may participate in Pb inclusion bodies and, thus, serves to prevent or reduce Pb-induced tumorigenesis.
- In vitro cell culture studies that evaluated the potential for Pb to transform rodent cells are inconsistent, and careful study of a time course of exposure is necessary to determine whether Pb actually induces transformation in cultured rodent cells. There is increased evidence suggesting that Pb may be co-carcinogenic or promotes the carcinogenicity of other compounds. Cell culture studies do support a possible epigenetic mechanism or co-mutagenic effects.

5.4.2.10 Lead-Binding Proteins

- Proteins depending upon sulfur-containing side chains for maintaining conformity or activity are vulnerable to inactivation by Pb, due to its strong sulfur-binding affinity.
- The enzyme, ALAD, a 280 kDa protein, is inducible and is the major Pb-binding protein within the erythrocyte.
- The Pb-binding protein in rat kidney has been identified as a cleavage product of α-2-microglobulin. The low molecular weight Pb-binding proteins in human kidney have been identified as thymosin β 4 (molecular weight 5 kDa) and acyl-CoA binding protein (molecular weight 9 kDa). In human brain, Pb-binding proteins include thymosin β4 and an unidentified protein of 23 kDa.
- Animal toxicology studies with metallothionein-null mice demonstrated a possible role for metallothionein as a renal Pb-binding protein.

5.4.2.11 Human Population Groups At Special Risk And Potential Public Health Impacts

- Children, in general and especially low SES (often including larger proportions of African-American and Hispanic) children, have been well-documented as being at increased risk for Pb exposure and Pb-induced adverse health effects. This is due to several factors, including enhanced exposure to Pb via ingestion of soil-Pb and/or dust-Pb due to normal hand-to-mouth activity and/or pica.
- Even children with low Pb exposure levels (having blood Pb of 5-10 μg/dL or, possibly, somewhat lower) are at notable risk, due to apparent non-linear dose-response relationships between blood Pb and neurodevelopmental outcomes. It is hypothesized that initial neurodevelopmental lesions occurring at blood-Pb levels <10 μg/dL may disrupt different developmental processes in the nervous system than more severe high level exposures.
- Adults with idiosyncratic exposures to Pb through occupations, hobbies, make-up use, glazed pottery, native medicines, and other sources are at risk for Pb toxicity. Certain ethnic and racial groups are known to have cultural practices that involve ingestion of Pb-containing substances,

e.g., ingestion of foods or beverages stored in Pb-glazed pottery or imported canned food from countries that allow Pb-soldered cans.

- Cumulative past Pb exposure, measured by bone Pb, may be a better predictor of cardiovascular effects than current blood-Pb levels. African-Americans are known to have substantially higher baseline blood pressure than other ethnic groups, so Pb's impact on an already higher baseline could indicate a greater susceptibility to Pb for this group.
- Effects on adults of low-level Pb exposures also include some renal effects (i.e., altered creatinine clearance) at blood-Pb levels <5 ug/dL. Lead exposure combined with other risk factors, such as diabetes, hypertension, or chronic renal insufficiency may result in clinically relevant effects in individuals with two or more other risk factors.
- At least two genetic polymorphisms, of the ALAD and the vitamin D receptor gene, have been suggested to play a role in susceptibility to Pb. In one study, African-American children were found to have a higher incidence of being homozygous for alleles of the vitamin D receptor gene thought to contribute to greater Pb blood levels. This work is preliminary and further studies will be necessary to determine implications of genetic differences that may make certain populations more susceptible to Pb exposure.
- What was considered "low" for Pb exposure levels in the 1980s is an order of magnitude higher than the current mean level in the U.S. population, and current average blood-Pb levels in U.S. populations remain perhaps as much as two orders of magnitude above preindustrial "natural" levels in humans. There is no level of Pb exposure that has yet been identified, with confidence, as being clearly not being associated with possible risk of deleterious health effects. Some recent studies of Pb neurotoxicity in infants have observed effects at population average blood-Pb levels of only 1 or 2 μg/dL; and some cardiovascular, renal, and immune outcomes have been reported at blood-Pb levels below 5 μg/dL.
- Public health interventions have resulted in declines, over the last 25 years, of more than 90% in the mean blood-Pb level within all age and gender subgroups of the U.S. population, substantially decreasing the numbers of individuals at likely risk for Pb-induced toxicities. Nevertheless, estimates of the magnitude of potential public health impacts of Pb exposure can be substantial for the U.S. population. For example, in estimating the effect of Pb exposure on intelligence, it was projected that the fraction of individuals with an IQ >120 would decrease from ~9% with no Pb exposure to less than 3% at a blood-Pb level of 10 μg/dL. Also, the fraction of individuals with an IQ >130 points was estimated as being likely to decrease from 2.25% to 0.5% with a blood-Pb level change from 0 to 10 μg/dL. In addition, an estimate of hypertension-related risk for serious cardiovascular events (coronary disease, stroke, peripheral artery disease, cardiac failure) indicates that a decrease in blood Pb from 10 to 5 μg/dL could result in an annual decrease of 27 events per 100,000 women and 39 events per 100,000 men.

5.4.3 Environmental Effects of Lead

5.4.3.1 Terrestrial Ecosystems

Methodologies Used in Terrestrial Ecosystem Research

- Electron probe microanalysis (EPMA) techniques provide the greatest information on metal speciation. Other techniques, such as EXAFS (extended X-ray absorption fine structure) and EXANES (extended X-ray absorption near edge spectroscopy), show great promise and will be important in solving key mechanistic questions.

- In situ methodologies have been developed to lower soil-Pb relative bioavailability. These amendments typically fall within the categories of phosphate, biosolid, and Al/Fe/Mn-oxide amendments. Some of the drawbacks to soil amendment include phosphate toxicity to plants and increased arsenic mobility at high soil phosphate concentrations. The use of iron (III) phosphate seems to mitigate arsenic mobility, however increased concentrations of phosphate and iron limit their application when drinking water quality is a concern.

Distribution of Atmospherically Delivered Lead in Terrestrial Ecosystems

- Total Pb deposition during the 20th century has been estimated at 1 to 3 g Pb m^{-2}, depending on elevation and proximity to urban areas. Total contemporary loadings to terrestrial ecosystems are ~1 to 2 mg m^{-2} $year^{-1}$. This is a relatively small annual flux of Pb compared to the reservoir of ~0.5 to 4 g m^{-2} of gasoline additive-derived Pb already deposited in surface soils over much of the United States.
- Dry deposition can account for 10% to >90% of total Pb deposition. Because Clean Air Act Legislation has preferentially reduced Pb associated with fine particles, relative contributions of dry deposition have changed in the last few decades.
- Although inputs of Pb to ecosystems are currently low, Pb export from watersheds via groundwater and streams is substantially lower than inputs. Therefore, even at current input levels, watersheds are accumulating anthropogenic Pb.
- Species of Pb delivered to terrestrial ecosystems can be inferred by emission source. For example, Pb species emitted from automobile exhaust are dominated by particulate Pb halides and double salts with ammonium halides (e.g., PbBrCl, $PbBrCl_2NH_4Cl$), while Pb emitted from smelters is dominated by Pb-sulfur species. Halides from automobile exhaust break down rapidly in the atmosphere, via redox reactions in the presence of atmospheric acids. Lead phases in the atmosphere, and presumably the compounds delivered to the surface of the earth (i.e., to vegetation and soils), are suspected to be in the form of PbSO4, PbS, and PbO.
- The importance of humic and fulvic acids and hydrous Mn- and Fe-oxides for scavenging Pb in soils was discussed in some detail in the 1986 Lead AQCD. The importance of these Pb binding substrates is reinforced by studies reported in the more contemporary literature.
- The amount of Pb that has leached into mineral soil appears to be on the order of 20 to 50% of the total anthropogenic Pb deposition.
- The vertical distribution and mobility of atmospheric Pb in soils was poorly documented prior to 1986. Techniques using radiogenic Pb isotopes have been developed to differentiate between gasoline-derived Pb and natural, geogenic (native) Pb. These techniques provide more accurate determinations of the depth-distribution and potential migration velocities for atmospherically delivered Pb in soils.
- Selective chemical extractions have been used extensively over the past 20 years to quantify amounts of a particular metal phase in soil or sediment rather than total metal concentration. However, some problems persist with the selective extraction technique: (a) extractions are rarely specific to a single phase; and (b) in addition to the nonselectivity of reagents, significant metal redistribution has been found to occur during sequential chemical extractions. Thus, although chemical extractions provide some useful information on metal phases in soil or sediment, the results should be treated as "operationally defined," e.g., "H_2O_2-liberated Pb" rather than "organic Pb."

- Soil solution dissolved organic matter content and pH typically have very strong positive and negative correlations, respectively, with the concentration of dissolved Pb species.

Effects of Lead on Natural Terrestrial Ecosystems

- Atmospheric Pb pollution has resulted in the accumulation of Pb in terrestrial ecosystems throughout the world. In the United States, anthropogenically-derived Pb represents a significant fraction of the total Pb burden in soils, even in sites remote from smelters and other industrial plants. However, few significant effects of Pb pollution have been observed at sites that are not near point sources of Pb.
- Evidence from precipitation collection and sediment analyses indicates that atmospheric deposition of Pb has declined dramatically (>95%) at sites unaffected by point sources of Pb, and there is little evidence that Pb accumulated in soils at these sites represents a threat to ground water or surface water supplies.
- The effects of Pb and other chemical emissions on terrestrial ecosystems near smelters and other industrial sites decrease downwind from the Pb source. Several studies using the soil burden as an indicator have shown that much of the contamination occurs within a radius of 20 to 50 km around the emission source. Elevated metal concentrations around smelters have been found to persist despite significant reductions in emissions. The concentrations of Pb in soils, vegetation, and fauna at these sites can be two to three orders of magnitude higher than in reference areas. Assessing the risks specifically associated with Pb is difficult, because these sites also experience elevated concentrations of other metals and because of effects related to SO2 emissions. The confounding effect of other pollutants makes the assessment of Pb-specific exposure-response relationships impossible at the whole ecosystem level.
- In the most extreme cases, near smelter sites, the death of vegetation causes a near-complete collapse of the detrital food web, creating a terrestrial ecosystem in which energy and nutrient flows are minimal.
- More commonly, stress in soil microorganisms and detritivores can cause reductions in the rate of decomposition of detrital organic matter. Although there is little evidence of significant bioaccumulation of Pb in natural terrestrial ecosystems, reductions in microbial and detritivorous populations can affect the success of their predators. Thus, at present, industrial point sources represent the greatest Pb-related threat to the maintenance of sustainable, healthy, diverse, and high-functioning terrestrial ecosystems in the United States.

Terrestrial Species Response/Mode of Action

- Plants take up Pb via their foliage and through their root systems. Surface deposition of Pb onto plants may represent a significant contribution to the total Pb in and on the plant, as has been observed for plants near smelters and along roadsides.
- There are two possible mechanisms (symplastic or apoplastic) by which Pb may enter the root of a plant. The symplastic route is through the cell membranes of root hairs; this is the mechanism of uptake for water and nutrients. The apoplastic route is an extracellular route between epidermal cells into the intercellular spaces of the root cortex. The symplastic route is considered the primary mechanism of Pb uptake in plants.
- Recent work supports previous conclusions that the form of metal tested, and its speciation in soil, influence uptake and toxicity to plants and invertebrates. The oxide form of Pb is less toxic than the chloride or acetate forms, which are less toxic that the nitrate form of Pb. However, these

results must be interpreted with caution, as the counter ion (e.g., the nitrate ion) may also be contributing to the observed toxicity.

- Lead may be detoxified in plants by deposition in root cell walls, and this may be influenced by calcium concentrations. Other hypotheses put forward recently include the presence of sulfur ligands and the sequestration of Pb in old leaves as detoxification mechanisms. Lead detoxification has not been studied extensively in invertebrates. Glutathione detoxification enzymes were measured in two species of spider. Lead may be stored in waste nodules in earthworms or as pyromorphite in the nematode.
- Lead effects on heme synthesis (as measured primarily by ALAD activity and protoporphyrin concentration) were documented in the 1986 Lead AQCD and continue to be studied. However, researchers caution that changes in ALAD and other enzyme parameters are not always related to adverse effects, but may simply indicate exposure. Other effects on plasma enzymes, which may damage other organs, have been reported. Lead also may cause lipid peroxidation, which may be alleviated by vitamin E, although Pb poisoning may still result. Changes in fatty acid production have been reported, which may influence immune response and bone formation.
- Insectivorous mammals may be more exposed to Pb than herbivores, and higher trophic-level consumers may be less exposed than lower trophic-level organisms. Nutritionally deficient diets (including low calcium) cause increased uptake of Pb and greater toxicity in birds.
- Interactions of Pb with other metals are inconsistent, depending on the endpoint measured, the tissue analyzed, the animal species, and the metal combination.

Exposure/Response of Terrestrial Species

- Recent critical advancements reported in the current Lead AQCD in understanding toxicity levels relies heavily on the work completed by a multi-stakeholder group, consisting of federal, state, consulting, industry, and academic participants, led by the EPA to develop Ecological Soil Screening Levels (Eco-SSLs).
- Eco-SSLs are concentrations of contaminants in soils that would result in little or no measurable effect on ecological receptors. The Eco-SSLs are intentionally conservative in order to provide confidence that contaminants that could present an unacceptable risk are not screened out early in the evaluation process. That is, at or below these levels, adverse effects are considered unlikely. Due to conservative modeling assumptions (e.g., metal exists in most toxic form or highly bioavailable form, high food ingestion rate, high soil ingestion rate) that are common to screening processes, several Eco-SSLs are derived below the average background soil concentration for a particular contaminant.
- The Eco-SSLs for terrestrial plants, birds, mammals, and soil invertebrates are 120, 11, 56, and 1700 mg Pb/kg soil, respectively.

5.4.3.2 Aquatic Ecosystems

Methodologies Used in Aquatic Ecosystem Research

- Many of the terrestrial methods can also be applied to suspended solids and sediments collected from aquatic ecosystems. Just as in the terrestrial environment, the speciation of Pb and other trace metals in natural freshwaters and seawater plays a crucial role in determining their reactivity, mobility, bioavailability, and toxicity. Many of the same speciation techniques employed for the speciation of Pb in terrestrial ecosystems are applicable in aquatic ecosystems.

- There is now a better understanding of the potential effects of sampling, sample handling, and sample preparation on aqueous-phase metal speciation. Thus, a need has arisen for dynamic analytical techniques that are able to capture a metal's speciation, in-situ and in real time.
- With few exceptions, ambient water quality criteria (AWQC) are derived based on data from aquatic toxicity studies conducted in the laboratory. In general, both acute (short term) and chronic (long term) AWQCs are developed. Depending on the species, the toxicity studies considered for developing acute criteria range in length from 48 to 96 hours.
- Acceptable chronic toxicity studies should encompass the full life cycle of the test organism, although for fish, early life stage or partial life cycle toxicity studies are considered acceptable. Acceptable endpoints include reproduction, growth and development, and survival, with the effect levels expressed as the chronic value.
- The biotic ligand model (BLM), which considers the binding of free metal ion to the site of toxic action and competition between metal species and other ions, has been developed to predict the toxicity of several metals under a variety of water quality conditions. However, there are limitations to this tool in deriving AWQC because, currently, limited work has been conducted in developing chronic BLMs (for any metals, let alone Pb) and the acute BLMs to date do not account for dietary metal exposures.

Distribution of Lead in Aquatic Ecosystems

- Atmospheric Pb is delivered to aquatic ecosystems primarily through deposition (wet and/or dry) or through erosional transport of soil particles.
- A significant portion of Pb in the aquatic environment exists in the undissolved form (i.e., bound to suspended particulate matter). The ratio of Pb in suspended solids to Pb in filtrate varies from 4:1 in rural streams to 27:1 in urban streams.
- The oxidation potential of Pb is high in slightly acidic solutions, and Pb^{2+} binds with high affinity to sulfur-, oxygen-, and nitrogen-containing ligands. Therefore, speciation of Pb in the aquatic environment is controlled by many factors (e.g., pH, redox, dissolved organic carbon, sulfides). The primary form of Pb in aquatic environments is divalent (Pb^{2+}), while Pb^{4+} exists only under extreme oxidizing conditions. Labile forms of Pb (e.g., Pb^{2+}, $PbOH^{+}$, $PbCO_3$) are a significant portion of the Pb inputs to aquatic systems from atmospheric washout. Lead is typically present in acidic aquatic environments as $PbSO_4$, PbCl4, ionic Pb, cationic forms of Pb-hydroxide, and ordinary Pb-hydroxide ($Pb(OH)_2$). In alkaline waters, common species of Pb include anionic forms of Pb-carbonate ($Pb(CO_3)$) and $Pb(OH)_2$.
- Lead concentrations in lakes and oceans were generally found to be much lower than those measured in the lotic waters assessed by NAWQA. In open waters of the North Atlantic the decline of Pb concentrations has been associated with the phasing out of leaded gasoline in North America and Western Europe. However, in estuarine systems, it appears that similar declines following the phase-out of leaded gasoline are not necessarily as rapid.
- Based on a synthesis of NAWQA data from the United States, Pb concentrations in surface waters, sediments, and fish tissues (whole body) respectively range from: 0.04 to 30 µg/L (mean = 0.66, median = 0.50, 95th %tile = 1.1); 0.5 to 12,000 mg/kg (mean = 120, median = 28, 95th %tile = 200); and 0.08 to 23 mg/kg (mean = 1.03, median = 0.59, 95th %tile = 3.24).

Effects of Lead on Natural Aquatic Ecosystems

- Lead exposure may adversely affect organisms at different levels of organization, i.e., individual organisms, populations, communities, or ecosystems. Generally, however, there is insufficient information available for single materials in controlled studies to permit evaluation of specific impacts on higher levels of organization (beyond the individual organism). Potential effects at the population level or higher are, of necessity, extrapolated from individual level studies. Available population, community, or ecosystem level studies are typically conducted at sites that have been contaminated or adversely affected by multiple stressors (several chemicals alone or combined with physical or biological stressors). Therefore, the best-documented links between Pb and effects on the environment are with effects on individual organisms.
- Natural systems frequently contain multiple metals, making it difficult to attribute observed adverse effects to single metals. For example, macro invertebrate communities have been widely studied with respect to metals contamination and community composition and species richness. In these studies, multiple metals were evaluated and correlations between observed community level effects were ascertained. The results often indicate a correlation between the presence of one or more metals (or total metals) and the negative effects observed. While, correlation may imply a relationship between two variables, it does not imply causation of effects.
- In simulated microcosms or natural systems, environmental exposure to Pb in water and sediment has been shown to affect energy flow and nutrient cycling and benthic community structure.
- In field studies, Pb contamination has been shown to significantly alter the aquatic environment through bioaccumulation and alterations of community structure and function.
- Exposure to Pb in laboratory studies and simulated ecosystems may alter species competitive behaviors, predator-prey interactions, and contaminant avoidance behaviors. Alteration of these interactions may have negative effects on species abundance and community structure.
- In natural aquatic ecosystems, Pb is often found coexisting with other metals and other stressors. Thus, understanding the effects of Pb in natural systems is challenging given that observed effects may be due to cumulative toxicity from multiple stressors.

Aquatic Species Response/Mode of Action

- Recent research has suggested that due to the low solubility of Pb in water, dietary Pb (i.e., Pb adsorbed to sediment, particulate matter, and food) may contribute substantially to exposure and toxicity in aquatic biota.
- Generally speaking, aquatic organisms exhibit three Pb accumulation strategies: (1) accumulation of significant Pb concentrations with a low rate of loss, (2) excretion of Pb roughly in balance with availability of metal in the environment, and (3) weak net accumulation due to very low metal uptake rate and no significant excretion.
- Protists and plants produce intracellular polypeptides that form complexes with Pb. Macrophytes and wetland plants that thrive in Pb-contaminated regions have developed translocation strategies for tolerance and detoxification.
- Like aquatic plants and protists, aquatic animals detoxify Pb by preventing it from being metabolically available, though their mechanisms for doing so vary. Invertebrates use lysosomal-vacuolar systems to sequester and process Pb within glandular cells. They also accumulate Pb as deposits on and within skeletal tissue, and some can efficiently excrete Pb. Fish scales and mucous chelate Pb in the water column, and potentially reduce visceral exposure.

- Numerous studies have reported the effects of Pb exposure on blood chemistry in aquatic biota. Plasma cholesterol, blood serum protein, albumin, and globulin concentrations were identified as bioindicators of Pb stress in fish.
- Nutrients affect Pb toxicity in aquatic organisms. Some nutrients seem capable of reducing toxicity. Exposure to Pb has not been shown to reduce nutrient uptake ability, though it has been demonstrated that Pb exposure may lead to increased production and loss of organic material (e.g., mucus and other complex organic ligands).
- Avoidance responses are actions performed to evade a perceived threat. Some aquatic organisms have been shown to be quite adept at avoiding Pb in aquatic systems, while others seem incapable of detecting its presence.
- The two most commonly reported Pb-element interactions are between Pb and calcium and between Pb and zinc. Both calcium and zinc are essential elements in organisms and the interaction of Pb with these ions can lead to adverse effects both by increased Pb uptake and by a decrease in Ca and Zn required for normal metabolic functions.

Exposure/Response of Aquatic Species

- The 1986 Lead AQCD reviewed data in the context of sublethal effects of Pb exposure. The document focused on describing the types and ranges of Pb exposures in ecosystems likely to adversely impact domestic animals. As such, the 1986 AQCD did not provide a comprehensive analysis of the effects of Pb to most aquatic primary producers, consumers, and decomposers.
- Waterborne Pb is highly toxic to aquatic organisms, with toxicity varying with the species and life stage tested, duration of exposure, form of Pb tested, and water quality characteristics.
- Among the species tested, aquatic invertebrates, such as amphipods and water fleas, were the most sensitive to the effects of Pb, with adverse effects being reported at concentrations as low as 0.45 μg/L (range: 0.45 to 8000 μg/L).
- Freshwater fish demonstrated adverse effects at concentrations ranging from 10 to >5400 μg/L, depending generally upon water quality parameters.
- Amphibians tend to be relatively Pb tolerant; however, they may exhibit decreased enzyme activity (e.g., ALAD reduction) and changes in behavior (e.g., hypoxia response behavior).

5.4.3.3 Critical Loads for Lead in Terrestrial and Aquatic Ecosystems

- Critical loads are defined as threshold deposition rates of air pollutants that current knowledge indicates will not cause long-term adverse effects to ecosystem structure and function. A critical load is related to an ecosystem's sensitivity to anthropogenic inputs of a specific chemical.
- The critical loads approach for sensitive ecosystems from acidification has been in use throughout Europe for about 20 years. Its application to Pb and other heavy metals in Europe is more recent. European critical load values for Pb have been developed but are highly specific to the bedrock geology, soil types, vegetation, and historical deposition trends in each European country. To date, the critical loads framework has not been used for regulatory purposes in the United States for any chemical. Considerable research is necessary before critical load estimates can be formulated for ecosystems extant in the United States.
- Speciation strongly influences the toxicity of Pb in soil and water and partitioning between dissolved and solid phases determines the concentration of Pb in soil drainage water, but it has not been taken into account in most of the critical load calculations for Pb performed to date.

- Runoff of Pb from soil may be the major source of Pb into aquatic systems. However, little attempt has been made to include this source into critical load calculations for aquatic systems due to the complexity of including this source in the critical load models.

In summary, due to the deposition of Pb from past practices (e.g., leaded gasoline, ore smelting) and the long residence time of Pb in many aquatic and terrestrial ecosystems, a legacy of environmental Pb burden exists, over which is superimposed much lower contemporary Pb loadings. The potential for ecological effects of the combined legacy and contemporary Pb burden to occur is a function of the bioavailability or bioaccessibility of the Pb, which, in turn, is highly dependent upon numerous site factors (e.g., soil organic carbon content, pH, water hardness). Moreover, while the more localized ecosystem impacts observed around smelters are often striking, these perturbations cannot be attributed solely to Pb. Many other stressors (e.g., other heavy metals, oxides of sulfur and nitrogen) can also act singly or in concert with Pb to cause such notable environmental impacts.

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6. Estimated Impacts of the Lead, Renovation, Repair, and Painting Rule Revisions

In addition to the cost and benefit analyses presented in Chapters 4 and 5, several other types of impacts are important to consider in evaluating the effects of a regulation. This chapter presents the incremental impact of the revisions to the Lead Renovation, Repair and Painting (LRRP) Rule on:

- paperwork burden,
- the financial condition of small entities,
- whether the regulation has a disproportionate effect on low-income and or minority persons,
- the environmental health risk or safety risk to children due to the regulation,
- State, local, and Tribal governments, and the private sector,
- federalism,
- the relationship between the Federal government and the Indian tribes, or on the distribution of power and responsibilities between the Federal government and Indian tribes,
- energy effects, and
- whether voluntary consensus standards are used in its regulatory activities.

The demand for certified firms and renovators is predicted to increase as a result of the elimination of the opt-out provision, and therefore more firms and renovators are expected to seek certification and training as a result of the revisions. Separate impacts are estimated for these firms and individuals that are not projected to have sought certification and training without the elimination of the opt-out provision. Hereafter these entities are referred to as "opt-out entities." Likewise, those firms and individuals that were estimated to have sought certification and training without the elimination of the opt-out provision are referred to as "currently regulated entities." The impacts of the revisions to the rule on the opt-out entities include all the costs associated with the requirements of the revised LRRP rule. In contrast, the only impacts of the rule on the currently regulated entities are those associated with the recordkeeping checklist requirement.

6.1 Paperwork Reduction Act

The Paperwork Reduction Act of 1995 (PRA) (superseding the PRA of 1980), as implemented by the Office of Management and Budget (OMB), requires that agencies submit a supporting statement to OMB for any information collection that solicits the same data from more than nine parties. The PRA seeks to ensure that Federal agencies balance their need to collect information with the paperwork burden imposed on the public by the collection.

The definition of "information collection" includes activities required by regulations such as permit development, monitoring, recordkeeping, and reporting. The term "burden" refers to the "time, effort, or financial resources" the public expends to provide information to or for a Federal agency, or to otherwise fulfill statutory or regulatory requirements. PRA paperwork burden is measured in terms of annual time and financial resources the public devotes to meet one-time and recurring information requests (44 U.S.C. 3502(2); 5 C.F.R. 1320.3(b)).

Information collection activities may include:

- reviewing rule requirements;
- using technology to collect, process, and disclose information;

- adjusting existing practices to comply with requirements;
- searching data sources;
- completing and reviewing the response; and
- transmitting or disclosing information.

Agencies must provide information to OMB on the parties affected, the annual reporting burden, and the annualized cost of responding to the information collection.

6.1.1 RRP Entity Paperwork Burden

6.1.1.1 Certification and Recordkeeping

LRRP contractors performing regulated RRP work are estimated to spend approximately half an hour to fill out and mail the Application for Renovator Certification when they are applying for initial certification or re-certification (which occurs every five years). It is estimated that these entities will spend an average of three hours to familiarize themselves with the RRP rule's requirements when becoming certified. Entities performing RRP tasks on target housing units will spend, on average, about five hours annually for recordkeeping tasks. These activities add up to an average burden in the first year of 7.8 hours per contractor. At a loaded wage rate of $31.64, the paperwork cost in the first year will average $263 per firm (See Table 6-1). Additional costs are minor; these costs include an application printout, one photocopy for personal records, an envelope, and a stamp. The total first year information collection cost is estimated to average $263 per contractor. Every five years entities must complete the certification form to apply for re-certification as well as keep records that demonstrate compliance with the RRP Rule. The total time required during a re-certification year is 5.3 hours at a cost of $168 per contractor. In years when entities do not need to apply for certification or re-certification, contractors will only incur the five-hour recordkeeping burden at a cost of $152.

Table 6-1: Costs to Firms Associated with Information Collection ($2005)

	Opt-Out Residential Contractors		
	First Year/Initial Certification Year	**Re-Certification Year**	**Other Years**
Rule familiarization (3 hours)	$94.93	$0	$0
Certification form (0.5 hours)	$15.82	$15.82	$0
Recordkeeping (4.8 hours per entity)	$151.89	$151.89	$151.89
2 photocopies	$0.16	$0.16	$0
1 envelope	$0.02	$0.02	$0
1 stamp[1]	$0.37	$0.37	$0
Total[2]	**$263**	**$168**	**$152**

1. Costs have not been updated from 2005 dollars in order to facilitate comparison with previous information collection requests, which were also in 2005 dollars. Consistent with this, postage costs have not been updated to 2009.
2. Rounded to nearest dollar.
Source: EPA Calculations and U.S. Bureau of Labor Statistics 2005.

6.1.1.2 Recordkeeping Checklist Provision Requirements

The revisions to the 2008 LRRP rule would require all renovation firms to provide a copy of the records demonstrating compliance with the training and work practice requirements of the RRP rule to the owner and, if different, the occupant of the building being renovated or the operator of the child-occupied facility. Specifically, renovation firms would have to provide this information to owners and occupants in a short, easily-read checklist or other form within thirty days of the completion of work. If optional dust clearance is performed in lieu of cleaning verification, the renovation firm must provide a copy of the dust wipe sampling report(s) to the owner of the building that was renovated as well as to the occupants, if different. For renovations occurring in common areas of target housing or child-occupied facilities, the renovation firm can post instructions to tenants on how to obtain this information.

6.1.1.3 Recordkeeping Checklist Provision Unit Costs

Labor Costs

Under a separate requirement of the 2008 LRRP rule, renovation firms must complete and retain a copy of the checklist for enforcement purposes. Therefore, renovation firms would only incur the incremental labor costs of photocopying and distributing the checklist as a result of the additional recordkeeping checklist provision requirement. EPA assumed this burden to be three minutes at a loaded wage rate of $31.64 per hour.

Material Costs

The recordkeeping checklist provision would require renovation firms to supply a copy of the checklist to the owner of the affected building, or if different, the occupant of the affected target housing unit or operator of the child-occupied facility, and to post the checklist in a common area. Therefore, renovation firms performing work in target housing or public and commercial buildings would incur an incremental cost of eight cents per page to photocopy materials.

Table 6-2 shows the costs per event of the checklist provision requirements.

Table 6-2: Cost of the Recordkeeping Checklist Provision per Event

	Target Housing Events		Public and Commercial Building Events		
	Owner	**Renter**	**In-house / Landlord** [b]	**Contractor – Owner** [c]	**Contractor – Renter** [d]
Labor Cost [a]	$1.58	$1.58	$1.58	$1.58	$1.58
Material Cost [e]	$0.08	$0.16	$0.08	$0.16	$0.24
Total Cost	$1.66	$1.74	$1.66	$1.74	$1.82

[a] Based on a burden of 3 minutes, at a wage rate of $31.64, based on Bureau of Labor Statistics (SOC 47-1011)
[b] RRP is performed by the owner of a public or commercial building.
[c] RRP is performed by a contractor in an owner-occupied public or commercial building.
[d] RRP is performed by a contractor in a renter-occupied public or commercial building.
[e] The average price of a photo copy at Copy Cop, Kinko's, Staples, and Office Max is eight cents; [c]the average cost of a business envelope at Staples, Office Max, and Office Depot
Source: EPA Calculations.

6.1.1.4 Number of Events Affected by the Recordkeeping Checklist Provision

The recordkeeping checklist provision would apply to firms affected by the 2008 LRRP rule and to firms predicted to seek certification as a result of the elimination of the opt-out provision. Under Option A, the

entire stock of firms necessary to meet demand, including those working in target housing and public or commercial building COFs, would incur recordkeeping checklist costs starting in the first year. Firms performing work in owner-occupied target housing would be required to distribute one copy of the checklist while firms performing work in renter-occupied target housing would be required to provide copies to the owner and occupant. If the work occurs in the common area of an apartment building, the checklist, or information on how to obtain the checklist, can be posted on a sign in the common area.

The recordkeeping checklist provision also applies to firms performing work in public or commercial building COFs. Child-occupied facilities that perform work with their own staff must post the checklist, or information on how to obtain the checklist, on a sign that is accessible to parents or guardians of the children. Similarly, landlords who perform work with their own staff would have to supply one copy of the checklist attached to a sign in the area where the work is being performed. Contractors who perform work in owner-occupied COFs must provide two copies of the checklist: one copy to the operator of the COF and one copy to be posted on a sign in the COF. In addition to the two copies required in owner-occupied events, contractors working in renter-occupied COFs must also provide the owner of the building with a third copy of the checklist.

Table 6-3 presents the number of events affected by the checklist provision in the first and second years of the revisions' implementation by event type under Option A.

Table 6-3: Number of Events Affected by the Checklist Provision Under Option A by Event Type

		Target Housing Events		Public and Commercial Building Events		
	All Events	Owner	Renter	In-house / Landlord [b]	Contractor – Owner [c]	Contractor – Renter [d]
Year 1						
Option A	18,684,176	8,731,495	9,572,191	100,057	267,533	12,900
Year 2 [a]						
Option A	18,607,571	8,695,696	9,532,945	99,647	266,436	12,847

[a] Assumed to decline by 0.41 percent each year after the second year, accounting for the decline in the stock of pre-1978 structures.
[b] RRP is performed by the owner of a public or commercial building.
[c] RRP is performed by a contractor in an owner-occupied public or commercial building.
[d] RRP is performed by a contractor in a renter-occupied public or commercial building.
See Table 4-1 for options descriptions.

6.1.2 Training Provider Paperwork Burden

EPA has also estimated the information collection burden imposed on Training Providers. No Training Providers are estimated to become accredited as a result of the revisions to the 2008 LRRP rule; therefore, they would not incur an incremental paperwork burden of accreditation and re-accreditation. However, since the elimination of the opt-out provision implies an increase in training course demand, it is estimated that training providers would incur an incremental paperwork burden related to course notification. To comply with the 2008 LRRP rule, Training Providers must keep records on both the courses they provide and the students they train. In addition, they must notify EPA before offering each course (to facilitate EPA's enforcement activities) and after each course (so EPA has a record of the individuals who have completed the course).

6.1.2.1 Burden Associated with Notification Requirements

It is assumed that the pre-notification for each class requires an average of 0.15 hours and that each post-notification requires 1.54 hours. The post notifications are more time consuming because the Training Provider must send records pertaining to each student who attended the course. Approximately 12 percent of courses will also require a re-notification, which is also estimated to take 0.15 hours. These activities add up to an average of 1.7 clerical hours per course. The number of courses offered per year depends on the number of individuals who need to be trained. As the revisions to the 2008 LRRP rule would eliminate the opt-out provision, more renovators are predicted to seek training. It is assumed that under Option A, Training Providers would offer an extra 30 courses in the first year, or a total of 90 hours, for the added renovator demand. It is assumed that each notification requires one photocopy, one envelope, and one stamp; thus approximately two of each of these items are required per course. Under Option A, the incremental cost of notifications in the first year is approximately $2,772 per Training Provider. There would be approximately 6 extra courses offered per Training Provider in the second and third years, with a notification cost of about $550 per year.

6.1.2.2 Total Burden and Cost per Training Provider

As shown in Table 6-4, accredited training providers would incur an incremental $2,772 of paperwork costs in the first year due to added demand resulting from the elimination of the opt-out provision under Option A.

Table 6-4: Incremental Costs to Training Providers Associated with Information Collection, Option A

Notification Costs						
	Year 1 of the RRP Rule (30 Courses)		**Year 2 of the RRP Rule (6 Courses)**		**Year 3 of the RRP Rule (6 Courses)**	
Notification Activities	**Burden Hours**	**Cost**	**Burden Hours**	**Cost**	**Burden Hours**	**Cost**
Clerical time burden [a]	90	$2,120	18	$424	18	$422
Photocopies [b]		$5.13		$1.03		$1.02
Envelopes [c]		$1.28		$0.26		$0.26
Stamps [d]		$23.71		$4.74		$4.72
Digital Photos		$621.85		$124.37		$123.86
Total		$2,772		$554		$552

* Rounded to nearest dollar.

Sources: [a]Wages: Bureau of Labor Statistics (Major Occupational Group D: Administrative Support Occupations, Including Clerical); [b] The average price of a photo copy at Copy Cop, Kinkos, Staples, and Office Max is eight cents; [c]The average cost of a business envelope at Staples, Office Max, and Office Depot [d]U.S. Postal Service

6.1.3 Total Paperwork Burden on RRP Firms and Training Providers

Table 6-5 presents the total paperwork burden incurred by all RRP firms and training providers in the first and second years of the revisions' implementation. For training providers, total notification burden was estimated by multiplying the per-entity burden estimates in Table 6-4 by the number of training providers in each year. For RRP firms, total certification and recordkeeping burden was estimated by multiplying the per firm burden estimates in Table 6-1 by the number of firms undergoing certification or re-certification, or not becoming certified in each year. For checklist costs, the number of events per firm was first estimated by dividing the events shown in Table 6-3 by the total number of firms complying with the checklist provision in each year. Second, this number was multiplied by the estimated checklist

labor burden of three minutes (0.05 hours) to produce hours per RRP firm. Finally, this number was multiplied by the total number of firms, yielding the total checklist burden.

Table 6-5: Total Paperwork Burden Resulting from the Revisions to the 2008 LRRP Rule

Type of Entity	Activity	Burden Hours per Entity	Number of entities	Total Burden Hours
Year 1				
Training Providers	Notification	90	168	15,127
RRP Entities Certified as a Result of Eliminating the Opt-Out Provision	Certification Year Firms	8.3	111,426	924,836
	Re-Certification Firms	5.3	0	0
	Non-Certification Firms	4.8	0	0
	Checklist	3.3	111,426	363,578
RRP Entities Regulated under the 2008 LRRP Rule	Checklist	2.7	211,721	570,631
Year 1 Total - All Firms and Training Providers			**323,315**	**1,874,172**
Year 2				
Training Providers	Notification	18	167	3,013
RRP Entities Certified as a Result of Eliminating the Opt-Out Provision	Certification Year Firms	8.3	19,974	165,788
	Re-Certification Firms	5.3	2,219	11,763
	Non-Certification Firms	4.8	88,775	426,122
	Checklist	3.3	110,969	362,087
RRP Entities Regulated under the 2008 LRRP Rule	Checklist	2.7	210,853	568,291
Year 2 Total – All Firms and Training Providers			**321,990**	**1,537,064**
Year 3				
Training Providers	Notification	18	167	3,001
RRP Entities Certified as a Result of Eliminating the Opt-Out Provision	Certification Year Firms	8.3	19,893	165,108
	Re-Certification Firms	5.3	2,210	11,715
	Non-Certification Firms	4.8	88,411	424,374
	Checklist	3.3	110,514	360,603
RRP Entities Regulated under the 2008 LRRP Rule	Checklist	2.7	209,989	565,961
Year 3 Total – All Firms and Training Providers			**320,670**	**1,530,762**
3 Year Average				
Training Providers	Notification	42	168	7,047
RRP Entities Certified as a Result of Eliminating the Opt-Out Provision	Certification Year Firms	8.3	50,431	418,577
	Re-Certification Firms	5.3	1,477	7,826
	Non-Certification Firms	4.8	59,062	283,499
	Checklist	3.3	110,970	362,089
RRP Entities Regulated under the 2008 LRRP Rule	Checklist	2.7	210,855	568,295
3 Year Average Total – All Firms and Training Providers			**321,992**	**1,647,332**

6.2 Regulatory Flexibility Act

The Regulatory Flexibility Act (RFA) of 1980, amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA) of 1996, requires regulators to assess the effects of regulations on small entities

including businesses, nonprofit organizations, and governments. In some instances, agencies are also required to examine regulatory alternatives that may reduce adverse economic effects on significantly impacted small entities. The RFA requires agencies to prepare an initial and final regulatory flexibility analysis for each rule unless the Agency certifies that the rule will not have a significant economic impact on a substantial number of small entities. The RFA, however, does not specifically define "a significant economic impact on a substantial number" of small entities. Sections 603 and 604 of the RFA require that regulatory flexibility analyses identify the types and estimate the numbers of small entities to which the rule will apply. It also requires a description of the rule requirements to which small entities will be subject and any regulatory alternatives, including exemptions and deferral, which would lessen the rule's burden on small entities.

The 2008 LRRP Rule requires that all entities that perform renovation, repair and painting work for compensation in target housing or public and commercial buildings with COFs become certified by EPA, ensure that their employees are trained as either renovators or workers, and use lead-safe work practices when disturbing lead-based paint, other than events that qualify for the minor maintenance exception.

This analysis considers the incremental impacts of the revisions to the 2008 LRRP rule on small entities in the affected construction, real estate, and child-occupied facility industry sectors. The revisions to the 2008 LRRP rule eliminates the opt-out provision for entities performing work in owner-occupied target housing units that are not COFs and where no child under the age of 6 or pregnant woman resides. It is predicted that this revision would result in additional firms and renovators seeking certification and training. Therefore, only those small entities that would not have otherwise obtained certification ("opt-out entities") would incur certification, training, work practice, and cleaning verification costs under the revisions.

In addition, the revisions to the 2008 LRRP rule include a new recordkeeping checklist provision requirement. The checklist provision requires that renovation firms working in target housing provide the owner and, if a rental unit, the occupant with a copy of the RRP compliance checklist. Firms working in public or commercial building COFs must provide the owner and, if necessary, the operator of the COF with a copy of the checklist, as well as post the compliance information in a location visible to parents or guardians. The requirements of the checklist provision apply both to firms affected by the 2008 LRRP rule and to firms that would be affected by the elimination of the opt-out provision.

Therefore, the revisions to the 2008 LRRP rule affect small entities that provide childcare for compensation including private sector firms (e.g. daycare centers and family daycare); small governments (particularly school districts) and non-profit organizations; small construction-related contracting firms that provide RRP services to residences or public or commercial buildings containing COFs; and property managers and lessors who lease space to COFs and use their own staff to conduct RRP work in their buildings.

The impacts on training providers are not analyzed because the rule will result in an increased demand for their services. Therefore training providers will incur positive rather than negative impacts. Although the rule may also result in additional costs for training providers (i.e. costs of additional recordkeeping and submitting notifications), training providers are expected to recoup these costs via tuition fees. These tuition fees are accounted for elsewhere in the analysis in the estimation of training costs that are incurred by the other entities subject to the rule.

6.2.1 Definitions of Small Entity

The Regulatory Flexibility Act defines a small government as a government of a city, county, town, school district or special district with a population of less than 50,000. A small non-profit organization is defined as any not-for-profit enterprise which is independently owned and operated and is not dominant

in its field. The RFA relies on the definition of a "small business" found in the Small Business Act, which authorizes the Small Business Administration (SBA) to develop definitions for "small business." For this analysis, EPA uses SBA's definition of a small business for each industry.

For many industry sectors, the SBA definition of a small business is based on revenues, where revenue standards vary by industry. In establishing revenue standards, SBA considers a number of economic and market characteristics that may allow a firm to exercise dominance in an industry. These standards represent the maximum revenue that a for-profit enterprise may have and still qualify as a small business.

The twelve NAICS codes listed in Table 6-6 are the general and specialty contractors this rule will likely impact. Their respective SBA thresholds are also listed. The twelve NAICS codes are followed with two NAICS codes for residential real estate industries, two NAICS codes for nonresidential real estate industries, and one NAICS code for child day care services that are also likely to be affected by the rule.

Table 6-6: SBA Revenue Thresholds for Small Business by NAICS Code

NAICS	Industry Description	SBA Revenue Threshold (Millions $)
General and Specialty Contractor Industries		
236118	Residential remodelers	$33.5
236220	Commercial Building Construction	$33.5
238170	Siding contractors	$14
238350	Finish carpentry contractors	$14
238290	Other building equipment contractors	$14
238390	Other building finishing contractors	$14
238340	Tile and terrazzo contractors	$14
238220	Plumbing and HVAC contractors	$14
238150	Glass and glazing contractors	$14
238320	Painting and wall covering contractors	$14
238210	Electrical contractors	$14
238310	Drywall and insulation contractors	$14
Property Owners and Managers		
531120	Lessors of nonresidential buildings (except miniwarehouses)	$7
531312	Nonresidential property managers	$2
531311	Residential Property Managers	$2
531110	Lessors of Residential Buildings and Dwellings	$7
Providers of Day Care Services, Pre-Kindergarten and Kindergarten		
624410	Child day care services	$7
Source: U.S. Small Business Administration, 2008		

The RFA classifies small entities as small businesses, small non-profit organizations, or small governments. Property managers and lessors, and construction-related contractors, are all assumed to be for profit operations. All daycare providers operating in individual homes (frequently referred to as family daycare) are assumed to be for-profit operations. Daycare centers can be operated by for-profit or non-profit organizations. Kindergartens and pre-kindergartens refer to facilities in either public schools (governmental) or in private schools (assumed to be non-profits). These classifications are summarized in the following table.

Table 6-7: Small Entity Classifications			
Type of Entity	**Business**	**Non-Profit**	**Governmental**
Day Care Centers	X	X	--
Kindergartens and Pre-Kindergartens in Public Schools	--	--	X
Kindergartens and Pre-Kindergartens in Private Schools	--	X	--
Property Managers and Lessors	X	--	--
Construction-Related Contractors	X	--	--

6.2.2 General Assumptions and Approach

This analysis measures the potential incremental impacts of the revisions to the 2008 LRRP Rule on small businesses in terms of annual compliance costs as a percentage of annual revenues, referred to as the cost impact ratio.[1] This approach is based on the premise that the cost impact percentage is an appropriate measure of an entity's ability to afford the costs attributable to a regulatory change. For purposes of determining small entity impacts, comparing annual compliance costs to annual revenues provides a reasonable indication of the magnitude of the regulatory burden relative to a commonly available and objective measure of a company's business volume. Where regulatory costs represent a very small fraction of a typical establishment's revenue, the impacts of a regulation are likely to be minimal.

This analysis considers eight different groups of entities: public school districts, private schools, daycare centers, family daycare, construction contractors (residential and non-residential), and property lessors and managers (residential and non-residential). The goal of this analysis is to evaluate the incremental impacts of the revisions to the 2008 LRRP Rule on small entities in a typical year. In order to develop a realistic portrayal of the long-term effects of the rule on small entities, annualized costs of the rule, rather than first-year costs, are used to measure its impacts. Furthermore, when presenting the number of businesses affected, the analysis presents the annual average number of businesses, rather than first or second year estimates of affected businesses.

The SBA size standards are measured at the firm or parent company level. Conceptually, the small entity analysis would also be conducted at that level. Due to data limitations, this small entity analysis is conducted at the establishment level rather than at the firm or parent company level for most sectors. Census information was available primarily at the establishment level, making a firm or parent company analysis unfeasible. The only sectors where firm-level data are used are non-residential managers and lessors, and public schools. Because establishments, and not organizations, are analyzed, an assumption is made that none of the small establishments are subsidiaries of larger organizations. This assumption leads to an overestimate of the number of small independent establishments affected by the rule. Furthermore, since organization-level revenues of multi-establishment businesses are higher than establishment revenues, the use of establishment data may result in higher cost-impact ratios than actually exist.

The cost-impact ratios estimated for the residential and non-residential real estate industries (NAICS 531110, 531311, 531120, 531312) in this small entity analysis are based on employment and revenue data for employer establishments only. It is assumed that the majority of non-residential property lessors and

[1] For private schools, where adequate revenue data were not available, costs are compared to annual expenditures.

managers are businesses with employees. Further, the analysis assumes that a self-employed lessor or manager is likely to hire a contractor to perform work on his property, particularly in a non-residential building.

6.2.2.1 Costs Incurred by Small Establishments

This small entity analysis evaluates the incremental impacts of the revisions to the 2008 LRRP rule on small entities under Option A, as it has the highest cost impact implications (see Section 4.1 for option definitions). To estimate the costs incurred by the small entities subject to the requirements of the rule, this analysis calculates the number of people trained, certifications sought, and events performed by each of the small entities in a typical year under Option A. As explained at the beginning of this section, only opt-out contractors would incur incremental costs for certification, training, work practices, and cleaning verification under the revisions. However, all entities, currently regulated and opt-out, would incur recordkeeping checklist provision costs. Therefore, the following sections present costs for currently regulated and opt-out entities separately.

Average Annualized Unit Cost Estimates

Unit training costs were calculated by annualizing the total 50-year costs of training renovators and workers performing RRP projects in opt-out housing under Option A, then dividing this total by the average annual number of renovators and workers trained by these establishments. Similarly, the annualized total costs of maintaining certification, complying with work practice standards, and disseminating the checklist under Option A were divided by the average annual number of firms certified, and events, respectively. This single set of average annualized unit costs was used to calculate total costs to small entities working in opt-out housing. Annualized unit checklist costs for entities currently regulated under the 2008 LRRP rule were similarly calculated. The use of annual numbers of firms, individuals, and events in calculating average annualized costs takes into account the fact that the pre-1978 housing and building stock is expected to decrease by 0.41 percent per year due to demolition of a portion of the building stock.

The numbers of events, individuals, and firms were averaged over the 50 years covered in this analysis using the following formula:

$$\text{Annual Average} = \frac{[A1+(A2*(1-r^n))/(1-r)]}{50}$$

Where:

A1 = First year number of events, individuals or firms

A2 = Second year number of events, individuals or firms

r = (1 – 0.41% demolition rate), or 0.9959

n = 50 years covered by the analysis

Table 6-8 presents these calculations and the resulting average annualized unit costs.

Table 6-8: Average Annualized Unit Cost Calculations under Option A			
	Total Annualized 50-Year Cost	**50-year Average Number of Individuals Trained, Entities Certified or Events Performed**	**Average cost per individual, entity, or event**
Entities Certified/Events Performed as a Result of Eliminating the Opt-Out Provision			
Renovator training	$15,170,737	114,987 individuals trained	$132 per individual
Worker training	$4,896,824	171,867 individuals trained	$28 per individual
Firm certification	$26,174,511	100,933 entities certified	$259 per entity
Work practices [a]	$218,315,631	6,586,819 events performed	$33 per event
Checklist Costs	$11,552,179	6,586,819 events performed	$2 per event
Entities/Events Regulated under the 2008 LRRP Rule			
Checklist Costs	$18,885,435	10,337,937 events performed	$2 per event
a. Work practice costs include the cost of posting a project-specific sign and pamphlet.			

6.2.3 Residential Contractors and Real Estate Industries

Establishments that perform RRP work in opt-out housing will incur the costs of training and certification, as well as the cost of using lead-safe work practices during projects that disturb lead-based paint. In order to distribute the total costs of the rule between small and large establishments, EPA assumed that the compliance cost incurred by each establishment is a function of the number of regulated renovation events that the establishment performs in a typical year. For each of eleven residential contractor NAICS groups and two residential real estate NAICS groups, EPA calculated the average annualized numbers of small opt-out entities seeking certification, workers being trained by small opt-out entities, and events being performed by small opt-out entities. These averages were calculated separately for non-employer and employer firms. Using the average annualized unit costs, EPA calculated the average annualized total costs to small opt-out entities affected by the revisions. The use of annualized costs provides a more accurate representation of the long-term (typical year) impacts of the rule than would be provided by first or second year costs.

The following six steps were used to calculate the cost-impact ratios for the target housing contractor and residential real estate industries. To estimate the impacts of the revisions on small opt-out entities in the affected industries, the following calculations were performed for each NAICS industry:

Step 1: Certified establishments were classified as either small or large businesses depending on their revenues. Self-employed contractors were considered separately from small employer establishments, and therefore there are two small business categories for each residential contractor NAICS group.

Step 2: Census data were used to characterize a "typical" small establishment (in terms of revenues and number of employees) in each of the affected industry sectors.

Step 3: The average number of regulated events performed by an establishment each year was estimated by multiplying the ratio of regulated events to trained personnel by the establishment employment size.

Step 4: An average work practice compliance cost per event[2], certification cost per firm, training cost per renovator, certification per worker, and checklist cost per event were calculated for Option A using the

[2] The work practice cost per event includes the cost to landlords and contractors of complying with the pre-renovation education regulations.

total annualized 50-year costs to entities working in owner-occupied, opt-out target housing and the incremental 50-year average number of renovation events, renovators/workers trained, and firms certified as a result of the revisions to the 2008 LRRP rule. For currently regulated entities, numbers were only generated for checklist costs.

Step 5: For opt-out entities (i.e., those working in housing previously eligible for the opt-out provision), total establishment compliance costs were calculated by multiplying the number of events performed, the number of renovators trained, and the number of firms becoming certified by the corresponding average annualized cost under Option A. For currently regulated entities, numbers were only generated for checklist costs.

Step 6: Cost-impact ratios were calculated for a typical small establishment in each industry sector by dividing the total compliance costs incurred by the establishment (Step 5) by the establishment's revenues (Step 2). These cost impact ratios were calculated both for non-employer and small employer NAICS groups separately and combined.

6.2.3.1 Number of Small Residential Contractors and Real Estate Entities Affected by the Revisions

The data used in this analysis were drawn primarily from the 2002 U.S. Economic Census. As discussed in Chapter 2, Census data were used to estimate the number of non-employer establishments (self-employed contractors) in the affected construction industries. The 2002 Census also provides data on the number, revenue and employment of establishments with payroll by revenue bracket for each of the eleven construction industry sectors affected by the rule. In Chapter 2, these data were used to classify construction establishments into two main size classes – establishments with annual revenues of less than $10 million, and establishments with annual revenues of $10 million or more. The percent of establishments, employees, net value of construction and total value of business contributed by establishments in each revenue bracket can be found in Chapter 2.

Because 2002 Census data on the number of establishments by revenue bracket was not available at the time the estimates were developed, 1997 Census data was used to estimate the percent of establishments in each industry that qualify for small business status. These percentages, as well as the percent of industry revenues and employment contributed by small and large establishments, are presented in Chapter 2.

The Small Business Administration revenue thresholds for establishments in the construction sectors are currently set at $33.5 million for Residential Remodelers and at $14 million for the ten specialty contractor industries. However, in applying the U.S. Economic Census data to the SBA definition of small business, it is not possible to estimate the exact number of construction establishments that have revenues below the SBA threshold because the U.S. Economic Census groups all establishments with revenues of $10 million or more into one revenue bracket. Applying the U.S. Economic Census data therefore requires either under or overestimating the number of small businesses affected by the rule. On the one hand, using data for the entire industry would overestimate the number of small businesses affected by the rule. It would also underestimate the rule's impact on small businesses because the impacts would be calculated using the revenues of large businesses in addition to small businesses. On the other hand, applying the closest, albeit lower, revenue bracket would underestimate the number of small businesses affected by the rule while at the same time overestimating the impacts. For example, because the $10 million cut-off is below the SBA threshold for the Residential Remodeler industry, using the U.S. Economic Census data may lead to an underestimate of the number of small businesses in this

sector, although likely a small underestimate.[3] At the same time, using these data may lead to a slight overestimate of the impacts of the rule, as the average revenues of small businesses will appear smaller when larger establishments (those with revenues of $10 to $33.5 million) are left out. See Section 6.2.2 for a discussion of assumptions that may result in an overestimation of the number of affected small businesses. Moreover, using data on all businesses regardless of size would defeat the purpose of estimating impacts on small business. EPA has chosen to be more conservative in estimating the cost impacts of the rule on small businesses by using the $10 million threshold for construction industry sectors.

As with the Residential Remodelers and the ten specialty contractor industries discussed above, it is not possible to estimate the exact number of small Residential Property Manager establishments or Lessor of Residential Buildings and Dwellings establishments because Census-defined revenue brackets group establishments with revenues of $1 million to $5 million and $5 million to $10 million, respectively. For the same reasons set forth above (the Agency had the choice to either overestimate or underestimate the impacts), the Agency has chosen to overestimate the impacts. Thus, EPA has applied the U.S. Economic Census data for establishments with revenues of less than $1 million to Residential Property Managers, and the U.S. Census Economic data for establishments with revenues of less than $5 million to Lessor of Residential Buildings.[4]

In order to estimate the number of certified small establishments with paid employees, EPA assumed that the number of certified small employers is proportional to the total number of small employer establishments in the industry. The total number of certified establishments in each industry (calculated in Chapter 4) was multiplied by the percentage of establishments in that industry with revenues below the revenue thresholds described above. For the eleven residential construction industry sectors, the resulting number of small employer establishments was added to the total number of certified self-employed contractors to obtain the total number of small certified establishments.

Table 6-9 shows the 50-year average number of small businesses affected by the revisions. The number of affected businesses is predicted to decrease proportionally to the number of regulated events, which in turn decline at an annual rate of 0.41 percent (see Chapter 4 for discussion).

[3] Because 99.7 percent of Residential Remodeler establishments earn less than $10 million per year, any underestimate of the number of establishments is likely to be minimal.

[4] Approximately 85 percent of Residential Property Manager establishments earn less than $1 million per year, and about 99 percent of Lessor of Residential Buildings and Dwellings establishments earn less than $5 million per year.

Table 6-9: 50-Year Average Number of Small Residential Contractors and Real Estate Establishments Affected, Option A	
Entities Certified as a Result of Eliminating the Opt-Out Provision	
Non-Employer Establishments [a]	74,821
Employer Establishments	25,841
Total Small Establishments	**100,662**
Entities Regulated under the 2008 LRRP Rule [b]	
Non-Employer Establishments [a]	96,422
Employer Establishments	55,096
Total Small Establishments	**151,517**

a. Also referred to as "self-employed" individuals.
b. These entities are currently regulated under the 2008 LRRP rule. Under the revisions, they only incur checklist costs.
Source: EPA Calculations

6.2.3.2 Training and Certification Costs – Residential Contractors

Number of Firms Certified and Individuals Trained – Residential Contractors

As described above, the number of certified small establishments with paid employees was estimated assuming that the number of certified small employers is proportional to the total number of small employer establishments in the industry. The total number of certified establishments in each industry (calculated in Chapter 4) was multiplied by the percentage of establishments in that industry with revenues below the revenue thresholds described above in section 6.2.3. The number of small employer establishments in each NAICS group estimated to obtain certification as a result of eliminating the opt-out provision is presented in Table 6-10.

In order to estimate the number of renovators trained by each small employer establishment, the estimated number of certified firms in each sector was multiplied by the expected number of renovators per establishment for that sector. See Section 4.4.1.1 for a description of how the expected number of renovators per establishment was estimated.

In order to estimate the number of employees of an average small establishment in each affected industry, EPA used U.S. Economic Census data to determine the portion of each industry's employees that work for small businesses. This percentage was applied to the estimated number of trained renovators and workers in each sector to calculate the number of trained renovators and workers employed by small certified establishments. For each of the construction industry sectors, the total number of employees (including non-employers[5] who are trained as renovators) was divided by the total number of small establishments to calculate an average small business employment size.

Table 6-10 presents the 50-year average number of renovators trained by small certified employer firms, the percent of the workforce employed by small establishments,[6] and the estimated numbers of trained workers employed by small certified establishments in each NAICS group under Option A. Only entities that would seek certification as a result of the elimination of the opt-out provision would incur additional certification and training costs.

[5] Also referred to as "self-employed" individuals.

[6] See Section 2.5.1 of Chapter 2 for discussion of these percentages.

Table 6-10: 50-Year Average Number of Firms Certified and Professionals Trained by Small Residential Contractor Employer Establishments, Option A

NAICS	Description	Number of Small Employer Firms Certified	Number of Certified Renovators Per Employer Firm	Number of Renovators Trained by Employer Firms	Workforce Employed by Small and Large Certified Firms	% Workforce Employed by Small Employers [a,b]	Number of Workers Trained by Small Employer Firms [c]
236118	Residential remodelers	9,571	1	9,571	38,097	95%	26,624
238170	Siding contractors	684	1	684	4,563	90%	3,437
238350	Finish carpentry contractors	3,619	1	3,619	20,392	86%	13,901
238290	Other building equipment contractors	395	3	1,185	8,866	60%	4,175
238390	Other building finishing contractors	228	3	683	3,503	81%	2,153
238340	Tile and terrazzo contractors	516	1	516	3,781	91%	2,912
238220	Plumbing and HVAC contractors	4,791	2	9,582	58,288	70%	31,332
238150	Glass and glazing contractors	280	2	561	2,773	82%	1,726
238320	Painting and wall covering contractors	2,011	1	2,011	13,996	92%	10,827
238210	Electrical contractors	2,918	2	5,835	41,548	68%	22,421
238310	Drywall and insulation contractors	828	3	2,485	16,588	64%	8,138
Total, Small Construction Establishments		**25,841**		**36,732**	**212,396**		**127,646**

a. EPA applied U.S. Economic Census data regarding: entities with less than $10 million in revenues to establishments in the 11 construction sectors; entities with less than $1 million in revenues to Residential Property Manager establishments; and entities with less than $5 million in revenues to Lessors of Residential Real Estate.

b. Percentages shown for presentation purposes only. Calculations used unrounded ratio of small establishment data to industry data.

c. Total number of trained employees working for small construction establishments is the sum of trained personnel working for small employers and the total number of certified self-employed contractors. The number of workers trained by small employer firms is calculated as the workforce employed by small and large certified firms multiplied by the percentage of the workforce employed by small employers, less the number of renovators trained by small employer establishments.

Source: U.S. Census Bureau 2000d; U.S. Census Bureau 2004; U.S. Census Bureau 2005 b-e,g,h; U.S. Small Business Administration 2005

Table 6-11 presents the 50-year average number of certified firms and renovators trained for non-employer residential contractor establishments. Since non-employer establishments consist of single individuals, each self-employed individual must obtain a firm certification and renovator training.

Table 6-11: 50-Year Average Number of Firms Certified and Renovators Trained by Small Residential Contractor Non-Employer Establishments, Option A

NAICS	Description	Number of Small Non-Employer Firms Certified and Renovators Trained
236118	Residential remodelers	22,522
238170	Siding contractors	1,651
238350	Finish carpentry contractors	19,170
238290	Other building equipment contractors	664
238390	Other building finishing contractors	1,222
238340	Tile and terrazzo contractors	2,739
238220	Plumbing and HVAC contractors	6,162
238150	Glass and glazing contractors	685
238320	Painting and wall covering contractors	10,639
238210	Electrical contractors	4,869
238310	Drywall and insulation contractors	4,497
Total, Small Construction Establishments		**74,821**
Source: U.S. Census Bureau 2000e, U.S. Small Business Administration 2005.		

Total Certification and Training Costs to Small Residential Contractor Establishments

To estimate small residential contractor training and certification costs, the numbers of individuals and firms in Table 6-9 and Table 6-10 were multiplied by the average annualized costs of training a single certified renovator and worker and maintaining certification from Table 6-8. The resulting average annualized training and certification costs are presented in Table 6-12.

Table 6-12: Average Annualized Training and Certification Costs for Small Residential Contractors and Real Estate Establishments, Option A

Regulatory Option	Certified Renovator Training Cost[a]	Worker Training Cost[a]	Certification Cost[a]	Total Training/ Certification Cost[a]	Average Training and Certification Cost/ Establishment
Option A	$14,717,780	$3,636,882	$26,104,233	$44,458,895	$442
a. Total costs are calculated using unrounded unit costs.					

6.2.3.3 Work Practice Costs – Small Residential Contractors and Real Estate Establishments

Number of Events Performed Annually by Small Residential Contractor and Real Estate Establishments

As discussed in Section 6.2.2 and the beginning of this section, this analysis attributes the work practice costs of the rule to establishments on a per-event basis. In order to estimate the total number of events performed by establishments in each of the affected industries and in order to distribute these events between small and large establishments, EPA assumed that the number of events performed by each establishment is proportional to the number of people the establishment employs. Furthermore, EPA

assumed that the number of events performed by each trained employee will be the same across all industries including Residential Property Managers and Lessors of Residential Buildings and Dwellings. If property managers and lessors perform fewer events than estimated here, the impacts on these establishments will be slightly smaller and the impacts on construction firms will be larger.

The number of events per small establishment in a particular industry was calculated as follows:

Number of Events = (Events/Employee) X (Establishment Employment Size)

EPA estimated the 50-year average number of events per certified renovator or worker by calculating the ratio of the total number of regulated RRP events to the total number of trained personnel (using the 50-year averages). Because the number of people trained, as estimated in Chapter 4, was assumed to be proportional to the regulated housing stock and the number of regulated events, the number of RRP events per employee does not change over time and is approximately the same across options.

To estimate the average number of events performed by a small establishment in a given industry, the establishment's average employment size was multiplied by the average number of events per person.

Table 6-13 presents the 50-year average estimated number of events per small establishment.

Table 6-13: 50-Year Average Annual Number of Events performed by Small Residential Contractors and Real Estate Establishments, by Option

Regulatory Option	Average Small Employment Size	Average Number of Annual Events Per Employee	Total Number of Small Establishments	Total Annual Number of Events Per Small Establishment
Entities Certified as a Result of Eliminating the Opt-Out Provision				
Option A	2.4	23.0	100,662	54.6
Entities Regulated under the 2008 LRRP Rule				
Option A	2.2	23.0	151,517	51.1

Total Work Practice Compliance Costs – Residential Contractors and Real Estate Establishments

Table 6-8 presents the annualized average per event costs of the rule. For opt-out entities, these costs include the cost of using lead-safe work practices and complying with the recordkeeping checklist provision requirements. For entities currently regulated under the 2008 LRRP rule, costs are limited to meeting the checklist provision requirements. Multiplying the average work practice and checklist cost per small establishment by the total 50-year average number of small entities (see Section 6.2.3 for a description of the derivation of this number) yields the total annualized work practice costs above and beyond the 2008 LRRP rule. These costs are presented in Table 6-14.

Table 6-14: Average Annualized Work Practice and Checklist Costs for Small Residential Contractors and Real Estate Establishments

Regulatory Option	Avg. Events per Small Estab.	Annualized Average WPC per Event [b]	50-year Avg. Number of Small Estab.	Total Work Practice Costs [a]	Avg. Work Practice Costs per Small Estab.
Entities Certified as a Result of Eliminating the Opt-Out Provision					
Option A	55	$35	100,662	$191,680,462	$1,904
Entities Regulated under the 2008 LRRP rule [c]					
Option A	51	$2	151,517	$14,158,517	$93

a. Total costs are calculated using unrounded unit costs.
b. Includes the cost of using lead-safe work practices and complying with the recordkeeping checklist provision requirements.
c. These entities are currently regulated under the 2008 LRRP rule. Under the revisions, they only incur checklist costs.

6.2.3.4 Residential Contractors and Real Estate Industry Revenues

Cost-impact ratio analysis compares the cost of a regulation to a firm's (in this case, establishment's) total revenues, not just to its revenues from the regulated activity. As such, for construction establishments, the costs of the rule were compared to the total value of business done rather than just to the total value of construction work. For real estate establishments, total revenues were used. Because no revenue data are available specifically for establishments expected to seek certification under the regulations, EPA assumed that average revenues of these businesses do not differ significantly from industry averages.

EPA calculated the revenues of a small certified construction business as a weighted average of small employer and non-employer revenues. The 2002 U.S. Economic Census presents data on the number and total value of business done by construction establishments with total annual revenues of $0 to $10 million and $10 million or more. To estimate the average revenues of small employers in each of the affected construction sectors, the total value of business done by establishments in the $0 to $10 million bracket was divided by the total number of establishments in that bracket. Since the Census presents revenue figures in year 2002 dollars, the resulting average revenues were inflated to 2005 dollars using the Consumer Price Index.[7] Per-establishment revenues for non-employers were estimated for the cost impact ratio analysis by dividing non-employer revenues (inflated to 2005 dollars) by the number of non-employer establishments in each industry. Average revenues of certified small establishments are presented in Table 6-15. Because 2002 data on the number of establishments by revenue bracket was not available at the time the estimates were developed, 1997 data was used to estimate the percent of establishments in each industry that qualify for small business status. EPA also used 1997 Census data to calculate the percent of industry revenues contributed by these establishments. These percentages were then applied to the 2002 numbers of establishments and industry revenue figures to estimate the number and revenues of small and large employers in each industry. Average small and large employer revenues (calculated by dividing the revenues of establishments in each industry and revenue bracket by the corresponding number of establishments) were inflated to 2005 dollars using the Consumer Price Index.[8] The resulting estimates are presented in Table 6-15.

[7] All items, US city average, Series Id: CUUR0000SA0. Used annual data for 2002 and half-year data for 2005.

[8] All items, US city average. Series Id: CUUR0000SA0.

Table 6-15: Average Revenues of Small Businesses Affected by the Revisions to the 2008 LRRP Rule

NAICS	Industry Description	Small Business Revenues (2005$)
236118	Residential remodelers	$182,932
238170	Siding contractors	$201,569
238350	Finish carpentry contractors	$100,713
238290	Other building equipment contractors	$585,771
238390	Other building finishing contractors	$231,442
238340	Tile and terrazzo contractors	$130,097
238220	Plumbing and HVAC contractors	$432,677
238150	Glass and glazing contractors	$336,858
238320	Painting and wall covering contractors	$86,839
238210	Electrical contractors	$351,694
238310	Drywall and insulation contractors	$240,488
Total	**Average, Construction Establishments**	**$200,654**
531311	Residential Property Managers	$342,477
531110	Lessors of Residential Real Estate	$821,350
Total	**Average, All Industries**	**$270,621**

Weighted average of employer and non-employer revenues.
Source: EPA Calculations; U.S. Census Bureau 2005b,d,e; U.S. Small Business Administration 2005; U.S. Census Bureau 2004; U.S. Census Bureau 2000d.

6.2.3.5 Impacts on Small Residential Contractors and Real Estate Establishments

Impacts of the rule on small residential contractors and real estate industries are measured by comparing the costs of the rule incurred by an establishment to the establishment's revenues. The impacts on small residential contractors and real estate establishments were estimated by first summing the total annualized work practice, training, certification, and checklist costs incurred by these entities under Option A and dividing these total costs by the number of establishments. Average costs per establishment were then divided by average revenues to calculate a cost-to-revenue ratio. These calculations, and the resulting cost-to-revenue ratios, are presented in Table 6-16.

Table 6-16: Cost-to-Revenue Ratios for Small Residential Contractors and Real Estate Industries

Regulatory Option	Total Regulated Small Entities	Total Cost of Rule to Small Entities, Annualized	Average Cost of Rule per Small Entity	Estimated Average Small Entity Revenues	Cost-to-Revenue Ratio
Entities Certified as a Result of Eliminating the Opt-Out Provision					
Option A	100,662	$236,139,357	$2,346	$200,654	1.17%
Entities Regulated under the 2008 LRRP rule					
Option A	151,517	$14,158,517	$93	$270,621	0.03%

Table 6-17 and Table 6-18 present the impacts of the rule on small residential contractors and real estate industries, by NAICS group, for non-employer and employer establishments both separately and combined. Impact estimates for non-employers should be interpreted with caution, as some non-

employers may have issues related to under-reporting of income, which would tend to tend to exaggerate the average impact ratio for this class of small entities. According to GAO, many sole proprietors underreport their income, with a small proportion accounting for the bulk of understatements (GAO 1994 and 2007). According to IRS estimates reported by GAO, sole proprietors underreported their net income by 57 percent in 2001 (GAO 2007). The IRS estimates address net income (i.e., revenues minus expenses), while the small entity analysis compares compliance costs to revenues. According to IRS figures, underreporting of gross income makes up at least half of the misreporting of net income. A key reason for this underreporting is that the income of the self-employed is not subject to withholding and only a portion of that income is subject to information reporting by third parties (GAO 2007). The IRS estimates that at least 61 percent of sole proprietors underreported their income, and the IRS recognizes that these are underestimates because detecting underreported income is difficult, especially cash receipts (GAO 2007). Although at least 61 percent of sole proprietors had understated taxes, the amounts were skewed with half of sole proprietors understating less than $903.

Table 6-17: Cost-to-Revenue Ratios: Small Residential Opt-Out Contractors					
NAICS	**Industry Description**	**Number of Small Entities**	**Costs**	**Revenues**	**Cost-Impact Ratio**
Non-Employers					
236118	Residential remodelers	22,522	$26,859,669	$770,756,554	3.48%
238170	Siding contractors	1,651	$1,968,998	$53,964,403	3.65%
238350	Finish carpentry contractors	19,170	$22,862,741	$584,426,239	3.91%
238290	Other building equipment contractors	664	$792,106	$26,185,272	3.03%
238390	Other building finishing contractors	1,222	$1,457,683	$93,180,896	1.56%
238340	Tile and terrazzo contractors	2,739	$3,266,353	$104,907,180	3.11%
238220	Plumbing and HVAC contractors	6,162	$7,348,212	$355,583,972	2.07%
238150	Glass and glazing contractors	685	$817,238	$41,699,973	1.96%
238320	Painting and wall covering contractors	10,639	$12,687,560	$268,203,516	4.73%
238210	Electrical contractors	4,869	$5,807,332	$196,163,184	2.96%
238310	Drywall and insulation contractors	4,497	$5,363,614	$411,012,261	1.30%
Total, Small Construction Establishments		**74,821**	**89,231,508**	**$2,906,083,450**	**3.07%**
Employers					
236118	Residential remodelers	9,571	$33,508,732	$5,100,156,306	0.66%
238170	Siding contractors	684	$3,666,976	$416,601,038	0.88%
238350	Finish carpentry contractors	3,619	$15,851,721	$1,710,792,708	0.93%
238290	Other building equipment contractors	395	$4,672,804	$594,195,609	0.79%
238390	Other building finishing contractors	228	$2,483,098	$242,376,493	1.02%
238340	Tile and terrazzo contractors	516	$3,032,663	$318,585,066	0.95%
238220	Plumbing and HVAC contractors	4,791	$36,185,129	$4,383,307,838	0.83%
238150	Glass and glazing contractors	280	$2,027,869	$283,550,692	0.72%
238320	Painting and wall covering contractors	2,011	$11,382,881	$830,281,509	1.37%
238210	Electrical contractors	2,918	$24,808,785	$2,542,547,280	0.98%
238310	Drywall and insulation contractors	828	$9,287,190	$869,800,401	1.07%
Total, Small Construction Establishments		**25,841**	**$146,907,849**	**$17,292,194,938**	**0.85%**
Employers and Non-Employers Combined					
236118	Residential remodelers	32,093	$60,368,402	$5,870,912,860	1.03%
238170	Siding contractors	2,335	$5,635,975	$470,565,440	1.20%
238350	Finish carpentry contractors	22,790	$38,714,462	$2,295,218,947	1.69%
238290	Other building equipment contractors	1,059	$5,464,910	$620,380,881	0.88%
238390	Other building finishing contractors	1,450	$3,940,781	$335,557,389	1.17%
238340	Tile and terrazzo contractors	3,255	$6,299,016	$423,492,246	1.49%
238220	Plumbing and HVAC contractors	10,953	$43,533,341	$4,738,891,810	0.92%
238150	Glass and glazing contractors	966	$2,845,108	$325,250,665	0.87%
238320	Painting and wall covering contractors	12,650	$24,070,441	$1,098,485,025	2.19%
238210	Electrical contractors	7,787	$30,616,117	$2,738,710,465	1.12%
238310	Drywall and insulation contractors	5,326	$14,650,805	$1,280,812,661	1.14%
Total, Small Construction Establishments		**100,662**	**$236,139,357**	**$20,198,278,388**	**1.17%**

Table 6-18: Cost-to-Revenue Ratios: Small Residential Currently Regulated Contractors and Real Estate Industries

NAICS	Industry Description	Number of Small Entities	Costs	Revenues	Cost-Impact Ratio
Non-Employers					
236118	Residential remodelers	29,024	$1,217,671	$993,273,413	0.12%
238170	Siding contractors	2,128	$89,264	$69,543,887	0.13%
238350	Finish carpentry contractors	24,705	$1,036,472	$753,149,670	0.14%
238290	Other building equipment contractors	856	$35,910	$33,744,941	0.11%
238390	Other building finishing contractors	1,575	$66,083	$120,082,153	0.06%
238340	Tile and terrazzo contractors	3,530	$148,079	$135,193,807	0.11%
238220	Plumbing and HVAC contractors	7,940	$333,128	$458,240,807	0.07%
238150	Glass and glazing contractors	883	$37,049	$53,738,725	0.07%
238320	Painting and wall covering contractors	13,710	$575,185	$345,633,677	0.17%
238210	Electrical contractors	6,275	$263,273	$252,795,354	0.10%
238310	Drywall and insulation contractors	5,796	$243,157	$529,671,202	0.05%
531311	Residential Property Managers	0	$0	$0	n.a.
531110	Lessors of Residential Real Estate	0	$0	$0	n.a.
Total		**96,422**	**$4,045,271**	**$3,745,067,637**	**0.11%**
Employers					
236118	Residential remodelers	12,335	$1,392,431	$6,572,567,737	0.02%
238170	Siding contractors	881	$151,354	$536,873,456	0.03%
238350	Finish carpentry contractors	4,664	$642,342	$2,204,697,324	0.03%
238290	Other building equipment contractors	509	$197,176	$765,739,451	0.03%
238390	Other building finishing contractors	293	$106,696	$312,350,411	0.03%
238340	Tile and terrazzo contractors	665	$123,918	$410,560,343	0.03%
238220	Plumbing and HVAC contractors	6,174	$1,525,317	$5,648,765,636	0.03%
238150	Glass and glazing contractors	361	$86,568	$365,411,571	0.02%
238320	Painting and wall covering contractors	2,592	$465,307	$1,069,983,179	0.04%
238210	Electrical contractors	3,760	$1,039,851	$3,276,578,839	0.03%
238310	Drywall and insulation contractors	1,068	$390,767	$1,120,911,146	0.03%
531311	Residential Property Managers	5,824	$1,247,867	$1,994,528,285	0.06%
531110	Lessors of Residential Real Estate	15,970	$2,743,652	$13,117,019,660	0.02%
Total		**55,096**	**$10,113,246**	**$37,395,987,038**	**0.03%**
Employers and Non-Employers Combined					
236118	Residential remodelers	41,359	$2,610,103	$7,565,841,150	0.03%
238170	Siding contractors	3,008	$240,617	$606,417,342	0.04%
238350	Finish carpentry contractors	29,369	$1,678,815	$2,957,846,994	0.06%
238290	Other building equipment contractors	1,365	$233,085	$799,484,392	0.03%
238390	Other building finishing contractors	1,868	$172,779	$432,432,564	0.04%
238340	Tile and terrazzo contractors	4,195	$271,997	$545,754,150	0.05%
238220	Plumbing and HVAC contractors	14,114	$1,858,444	$6,107,006,443	0.03%
238150	Glass and glazing contractors	1,244	$123,617	$419,150,296	0.03%
238320	Painting and wall covering contractors	16,302	$1,040,492	$1,415,616,856	0.07%
238210	Electrical contractors	10,035	$1,303,124	$3,529,374,192	0.04%
238310	Drywall and insulation contractors	6,863	$633,924	$1,650,582,349	0.04%
531311	Residential Property Managers	5,824	$1,247,867	$1,994,528,285	0.06%
531110	Lessors of Residential Real Estate	15,970	$2,743,652	$13,117,019,660	0.02%
Total		**151,517**	**$14,158,517**	**$41,141,054,675**	**0.03%**

6.2.4 Non-Residential Contractors

Non-residential contractors (i.e., those working in public or commercial building COFs) are currently regulated under the 2008 LRRP Rule and are not affected by the removal of the opt-out provision. However, these entities would incur recordkeeping checklist provision costs under the revisions to the 2008 LRRP rule. Since this analysis estimates the incremental costs of the revisions, the following sections present the potential cost impacts of the checklist provision only.

Jobs that are not performed in-house by public and private schools, non-residential property managers/lessors, and daycare centers will be performed by general and specialty contractors including painters, electricians, plumbers/HVAC specialists, and non-residential building contractors. Under the revisions to the 2008 LRRP rule, 3,223 establishments are expected to incur checklist costs in the first year as a result of the checklist provision for projects in public or commercial building COFs. Because different contractors are generally expected to work in public or commercial buildings and target housing, this analysis considers impacts on these groups of establishments separately.

This analysis assumes that only contractors with employees will work on COFs in public or commercial buildings.[9] Furthermore, the types of jobs performed in public or commercial building COFs are generally less varied than those in target housing. Events in COFs are assumed to consist primarily of painting, window/door replacement, and plumbing and electrical projects. As such, it is likely that most of these projects will be performed by painting, plumbing/HVAC, electrical and commercial contractors (NAICS 236320, 238210, 238320 and 236220, respectively).

6.2.4.1 Number of Small Non-Residential Contractors Affected by the Revisions

To estimate the number of construction establishments working in public or commercial building COFs, the percentage of newly trained workers and supervisors that those establishments employ, the number of jobs they perform and their average revenues, the following assumptions are made:

- The number of additional contractors obtaining training and certification in each sector is proportional to the number of jobs likely to be performed by each type of contractor. For example, since painting jobs are estimated to make up 5 percent of all jobs performed by contractors in public or commercial building COFs, 5 percent of the 3,223 contractor establishments estimated to incur checklist costs are assumed to be painting contractors. Table 6-19 presents the distribution of jobs by job type, describes the assumptions made to assign these jobs to each type of contractor, and presents estimates of the number of contractor establishments incurring checklist costs in the first year under Option A.
- These currently regulated contractors are only assumed to perform projects in public or commercial building COFs. In reality, however, these additional contractors may perform some residential work and some commercial work, while contractors with employees that were included in the residential contractor section of this analysis may also do some of the non-residential COF work. As such, to define the size and revenue of the average small firm working in public or commercial building COFs, the numbers of certified non-residential contractors with employees were added to the pool of pre-existing certified residential employer establishments in the corresponding sectors. The percent of small establishments in each sector, percent of workers employed (and thus jobs performed) by these establishments, and percent of total value of business earned by these establishments were calculated using 2002 Economic Census data on the number of small establishments and employees working for small establishments (U.S. Census

[9] In contrast, the analysis of target housing contractors assumes that both employer and non-employer (i.e., self-employed) contractors will work on COFs in target housing.

Bureau 2005a). Average revenues of small establishments were estimated by dividing the total value of business earned by establishments with revenues below $10 million in each sector by the total number of establishments with revenues below $10 million in that sector. The results of these calculations are presented for Option A in Table 6-20. Note that because only establishments with employees are assumed to work in public or commercial building COFs, average revenues of small establishments in Table 6-20 are higher than the average revenues of residential construction establishments, which include self-employed contractors.

Table 6-19: Estimated Number of Non-Residential Contractors by NAICS Sector

Type of Event	Type of Contractor performing Event	Number of Events	Percent of all Contractor Events	Estimated first-year number of contractors
Painting	NAICS 238320 - Painting Contractors	13,448	4.8%	155
Window/ Door	NAICS 236220 - Commercial Building Contractors	6,943	2.5%	80
Unscheduled maintenance (Non-plumbing/ electrical)[a]	NAICS 236220 - Commercial Building Contractors	2,192	0.8%	25
Plumbing (Routine and unscheduled)[b]	NAICS 238210 - Plumbing/HVAC contractors	128,926	46.0%	1,482
Electrical (Routine and unscheduled) [b]	NAICS 238220 - Electrical Contractors	128,926	46.0%	1,482
Total Jobs		280,434		3,223

a. The majority of unscheduled maintenance events are expected to be plumbing or electrical events, which must be performed by a specialized contractor. It is assumed, however, that every other year, one of the unscheduled maintenance events in each building will be a painting or window/door project (for example, a soccer ball may break a window that will then need to be replaced).

b. To simplify the analysis, it is assumed that half of the scheduled plumbing and electrical projects and all other unscheduled maintenance projects will be performed by plumbers and the other half by electricians.

Table 6-20: Estimated Numbers and Characteristics of Small Non-Residential Contractors

NAICS Contractor Description	Estab., Residential	Estab., Non-Residential	Est., Total	Percent Small	Number Small	Percent Workers at Small Estab.	Average Revenues of Small Estab.
238220 - Plumbing/ HVAC	11,200	1,482	12,681	97.9%	12,410	70.1%	$850,881
238210 - Electrical contractors	6,824	1,482	8,306	97.9%	8,132	67.9%	$809,692
236220 - Commercial building contractors	0	105	105	88.1%	93	41.4%	$1,750,332
238320 - Painting/ wall covering	4,615	155	4,770	99.7%	4,757	91.5%	$380,165
Total/ Weighted Avg. Small Non-Residential Contractor Firm	**22,639**	**3,223**	**25,862**	**98.2%**	**25,391**	**69.2%**	**$752,783**

6.2.4.2 Recordkeeping Checklist Costs – Non-Residential Contractors

Number of Events Performed by Small Establishments – Non-Residential Contractors

On average, 98 percent of the 3,223 non-residential construction contractor establishments that will incur checklist costs in the first year as a result of the revisions to the LRRP Rule under Option A are small businesses. Since the number of jobs performed by an establishment is proportional to the number of people that establishment employs, these small businesses are expected to perform 69 percent of the non-residential COF contractor jobs as a result of the 2008 LRRP rule. Table 6-21 presents the total number of small contractor establishments incurring recordkeeping checklist costs and the number of events in the first year under Option A.

Table 6-21: First Year Number of Small Non-Residential Contractor Establishments and Jobs Performed

	Total, non-residential COF contractor		Small, non-residential COF contractor	
	Establishments	Events	Establishments	Events
Option A	3,223	280,434	3,164	193,957

To estimate typical annual small businesses impacts this analysis estimated the 50-year average number of certified firms and regulated events given that the number of certified firms is expected to decrease proportionally to the size of the regulated housing stock. These estimates are presented in Table 6-22.

Table 6-22: 50-Year Average Annual Number of Small Certified Establishments and Jobs Performed

Regulatory Option	Number of Firms with Checklist Costs	Number of Jobs Performed
Option A	2,300	175,693

Total Recordkeeping Checklist Costs

To estimate total checklist costs incurred by small non-residential construction establishments working in public or commercial buildings housing COFs, the 50-Year average annual number of events performed by these establishments (approximately 61 per firm) was multiplied by the sum of average annualized recordkeeping checklist cost per event ($2; see Table 6-8). Table 6-23 presents the resulting annualized total and average checklist costs to small non-residential construction establishments.

Table 6-23: Average Annualized Checklist Costs for Non-Residential Contractors

Regulatory Option	Average Annual Events Performed	Annualized Avg. Checklist Cost per event	Total Checklist Costs [a]	Average Checklist Costs per Small Establishment
Option A	175,693	$2	$320,957	$112

a. Total costs are calculated using unrounded unit costs.

6.2.4.3 Impacts of the Revisions on Non-Residential Contractors

Impacts of the rule on small non-residential contractors are measured by comparing the costs of the rule incurred by an establishment to the establishment's revenues. The impacts on small non-residential contractors were estimated by first dividing the total checklist costs under Option A by the number of establishments. Average costs per establishment were then divided by average revenues to calculate a cost-to-revenue ratio. These calculations, and the resulting cost-to-revenue ratios, are presented in Table 6-24.

Table 6-24: Cost-to-Revenue Ratios for Non-Residential Contractors

Regulatory Option	Total Small Contractor Establishments	Total Cost of Rule to Small Contractor Establishments	Average Cost of Rule per Small Contractor Establishments	Average Small Contractor Establishment Revenues	Cost-to-Revenue Ratio
Option A	2,866	$320,957	$112	$752,783	0.01%

6.2.5 Non-Residential Property Lessors and Managers

Non-residential property lessors and managers are currently regulated under the 2008 LRRP Rule and are not affected by the removal of the opt-out provision. However, these entities would incur recordkeeping checklist provision costs under the revisions to the 2008 LRRP rule. As this analysis estimates the incremental costs of the revisions, the following sections present the potential cost impacts of the checklist provision, only.

Lessors and managers of pre-1978 public or commercial (non-residential) buildings that rent space to daycare centers and perform regulated projects on their own properties will incur recordkeeping checklist costs under the revision to the 2008 LRRP rule. As discussed in Chapter 4, this analysis estimates that 13,279 daycare centers will rent space in pre-1978 non-residential buildings in the first year. On average (over 50 years), 12,028 daycare centers are expected to rent space in pre-1978 buildings each year under Option A. Because daycare centers are only one of many types of establishments renting non-residential space and because the LRRP Rule applies only to centers in buildings constructed prior to 1978, the analysis also assumes that each property manager or lessor firm owns only one non-residential building containing a COF. As such, the number of affected lessor/manager firms is equivalent to the number of

affected daycare centers renting space or 12,028 firms under Option A. Due to the lack of data on the extent to which these firms perform renovation work in their own buildings, this analysis assumes that they will behave similarly to the operators of other public or commercial buildings with child-occupied facilities, namely that they will perform all of their own painting and window/door carpentry projects as well as an average of one unscheduled maintenance project per building every year.

6.2.5.1 Number of Non-Residential Property Lessors and Managers Affected by the Revisions to the 2008 LRRP Rule

Lessors and managers of non-residential properties fall under NAICS 531120 and 531312, respectively. In order to estimate the number of regulated firms in each of these sectors, it is assumed that the percent of regulated firms in each industry is equivalent to the total percent of firms in that industry. In other words, since Lessors of Non-Residential Buildings (NAICS 531120) make up 73 percent of establishments in NACIS 531120 and 531312 combined, 73 percent of the 12,028 lessor/manager firms affected by the rule under Option A are also assumed to fall in this sector, while the remaining 27 percent are assumed to fall under NAICS 531312 (Calculated based on U.S. Census Bureau 2005f).

As discussed Section 2.4.2 of Chapter 2, 96 percent of Lessors of Non-Residential Real Estate, and 81 percent of Non-Residential Property Managers qualify for small business status under the SBA definition of a small business in these sectors (U.S. Census Bureau 2005f). This analysis assumes that the size distribution of regulated firms mirrors the size distribution of the entire non-residential property lessor and manager industry. Table 6-25 presents the resulting estimates of the number of small non-residential property lessors and managers affected by the revisions to the 2008 LRRP rule under Option A in a typical year.

Table 6-25: Average Annual Number of Small Non-Residential Property Lessors and Managers

	Option A
A. Total number of firms leasing to daycare centers	12,028
B. Number of firms in NAICS 531120 (73% of A)	8,782
C. Number of firms in NAICS 531312 (27% of A)	3,246
D. Number of firms in NAICS 531120 that are small (96% of B)	8,417
E. Number of firms in NAICS 531312 that are small (81% of C)	2,639
Total Number of Regulated Small Firms (D+E)	11,056
Regulated Small Firms as % of All Regulated Firms	**92%**

6.2.5.2 Recordkeeping Checklist Costs – Non-Residential Property Lessors and Managers

The estimation of checklist costs incurred by each property lessor or manager is based on the average number of events per building and the average checklist costs per event.

Total Checklist Compliance Costs – Non-Residential Property Lessors and Managers

The annual number of events performed by each of these firms is estimated to be 0.71 events per year. This average number of events was multiplied by the 50-year average number of small lessor/manager firms to estimate the number of regulated projects performed by these businesses in a typical year. The total number of regulated events, in turn, was multiplied by the annualized checklist costs per event (see Table 6-8) to calculate these firms' total annualized checklist costs. Table 6-26 presents these estimates, as well as the average checklist costs per small firm.

Table 6-26: Checklist Costs of Non-Residential Property Lessors and Managers				
Regulatory Option	**Total In-House Events**	**Annualized Avg. Checklist Costs per event**	**Total Checklist Costs** [a]	**Average Checklist Costs per Small Firm**
Option A	7,895	$2	$14,422	$1
a. Total costs are calculated using unrounded unit costs.				

6.2.5.3 Impacts of the Revisions on Non-Residential Property Lessors and Managers

This small entity analysis measures the incremental impacts of the revision to the 2008 LRRP rule on small non-residential property lessors and managers by comparing rule costs incurred by these firms to the weighted average revenue of small firms in NAICS 531120 and 531312, calculated based on 2002 Census Data. The weighted average revenue figure of $111,460 was inflated to 2005 dollars using the Consumer Price Index to obtain estimated revenues of $126,256. The impacts on small non-residential property lessors and managers were estimated by first dividing checklist costs incurred by these entities under Option A by the number of establishments. Average costs per establishment were then divided by average revenues to calculate a cost-to-revenue ratio.

The average annual numbers of businesses affected, average annualized per-business costs and revenues, and the resulting cost-to-revenue ratio are presented in Table 6-27.

Table 6-27: Cost-to-Revenue Ratios for Non-Residential Property Managers and Lessors					
Regulatory Option	**Total Small Lessor/ Manager Firms**	**Total Cost of Rule to Small Lessor/ Manager Firms**	**Average Cost of Rule per Small Lessor/ Manager Firm**	**Average Small Lessor/ Manager Firm Revenues**	**Cost-to-Revenue Ratio**
Option A	11,056	$14,422	$1	$126,256	0.001%

6.2.6 Daycare Centers (Small Non-Profits)

Daycare centers are currently regulated under the 2008 LRRP Rule and are not affected by the removal of the opt-out provision. However, these entities would incur recordkeeping checklist provision costs under the revisions to the 2008 LRRP rule. As this analysis estimates the incremental costs of the revisions, the following sections present the potential cost impacts of the checklist provision, only.

6.2.6.1 Number of Small, Non-Profit Daycare Centers Affected by the Revisions to the 2008 LRRP Rule

As discussed in Chapter 2, there are an estimated 87,840 daycare centers in the United States. These daycare centers include facilities that provide day care outside of a residential home and outside of schools. Assuming a 75% compliance rate, and adjusting the total number of centers for building age using HUD data on the age of education buildings, an estimated 38,210 daycare centers will be affected by the revisions to the 2008 LRRP Rule in the first year under Option A.[10] As discussed in Chapter 4, because of their locations, for-profit daycare centers are expected to hire outside contractors to perform their renovations and repairs or to have their landlord handle these activities. The costs and impacts for these events are accounted for in the sections of this chapter dealing with contractors and landlords.

[10] Based on 2003 HUD data, 58 percent of all education buildings were constructed before 1978, and 55 percent of the pre-1978 buildings were constructed before 1960.

Daycare centers located in religious establishments such as churches or synagogues, however, frequently use their own staff to perform some of their RRP events. According to the HUD survey of child care centers (HUD 2003), approximately 73 percent of daycare centers located in churches and other religious establishments use their own (or the religious organization's) staff to perform painting projects. This analysis assumes that, similar to public school districts and private schools, these establishments will also use their own staff to perform all window/door carpentry work as well as one unscheduled maintenance project every year.

The number of daycare centers located in religious establishments was estimated with data from the HUD survey of child care centers (HUD 2003). According to these data, 41 percent of all daycare centers are situated in churches or other similar organizations. (In contrast, the US Census reports that about 35 percent of daycare centers located outside of schools are non-profits (U.S. Census Bureau 2005c).) The other 59 percent of daycare centers are assumed to use outside contractors for their RRP work rather than in-house staff. Because the estimate of centers that are in religious settings is relatively large and there is no independent data on other non-profits, this analysis estimates that about 30 percent of daycare centers (0.73*0.41=.299) will perform their own renovation work and thus incur direct work practice, training, and certification costs.[11] Because all of these establishments are treated as though they are operated by religious organizations, all daycare centers considered in the small entity analysis are considered to be non-profit organizations. As the RFA defines independently owned and operated not-for-profit enterprises that are not dominant in their field as "small organizations," all the non-profit organizations operating these day care centers are assumed to qualify as small entities. This assumption may overestimate the number of impacted small non-profits, since some of these non-profit organizations may not be small entities.

Table 6-28 presents the number of daycare centers regulated under Option A in a typical year, the total number of daycare centers operated by non-profit organizations (based on the number in religious organizations), and the number expected to perform some renovation work in-house. The estimation of annual average numbers of centers accounts for the fact that, after the first year, the number of regulated daycare centers is expected to decrease by 0.41 percent per year due to building demolition.

Table 6-28: Average Annual Number of Non-Profit Daycare Centers Performing their Own Work

Regulatory Option	(A) Total Number of Daycare Centers	(B) Number of Centers in Non-Profit Organizations (41% of A)	(C) Number of Centers Doing RRP Work In-house (73% of B)
Option A	34,612	14,339	10,481

6.2.6.2 Recordkeeping Checklist Costs – Non-Profit Daycare Centers

The estimation of work practice costs incurred by each daycare center is based on the average number of events per-building performed in-house and the average work practice costs per event.

[11] Given the small size of the HUD survey sample, and the difference between the HUD and Census figures, the estimate may include some non-profits operating daycare facilities that are not in religious settings but perform their own repair work. Other non-profit daycare facilities may be hiring outside contractors, the same as for-profit daycare facilities are assumed to do.

Total Checklist Compliance Costs – Non-Profit Daycare Centers

Staff in non-profit daycare centers (such as those operated by religious establishments) are expected to perform in-house all painting and window/door carpentry work in their building as well as one unscheduled maintenance event every year. Center staff are expected to perform 0.71 events per year in-house.

As discussed in 6.2.2, the average annualized checklist cost per event in COFs in public and commercial buildings is $2 under Option A (see Table 6-8). Multiplying this average cost by the total 50-year average annual number of events in daycare centers that perform their own work yields the total annualized checklist costs incurred by these centers in an average year. The total annual number of events is the product of 0.71 and the number of centers doing in-house RRP work from Table 6-28. These costs, and average per-center checklist costs, are presented in Table 6-29.

Table 6-29: 50-Year Average Annualized Work Practice Costs for Non-Profit Daycare Centers

Regulatory Option	Total In-House Events	Annualized Avg. Checklist per event	Total Checklist Costs [a]	Average Checklist Costs per Small Center
Option A	7,484	$2	$13,672	$1

a. Total costs are calculated using unrounded unit costs.

6.2.6.3 Non-Profit Daycare Center Expenditures

In analyzing impacts of the revisions to the 2008 LRRP rule on an entity, the analysis conceptually should compare rule costs to the revenues or expenditures of an entire organization. As such, costs of the rule to non-profit daycare centers should be compared to the revenues or expenditures of the parent organization (such as the religious organization that operates them), rather than a single center. Due to a lack of data both on the structure of these organizations and on their finances, such a comparison was not possible. Instead, this analysis is based on daycare center revenues. Ten state childcare industry impact studies were reviewed to obtain daycare center revenue data.[12] Nine of these studies did not differentiate between revenues of non-profit and for-profit centers. The Virginia *Economic Impact of the Child Care Industry* report (Voices of Virginia's Children 2004), however, provided revenue data specific to religiously affiliated daycare centers. The state reported annual total revenues of $236 million for its 929 religious daycare facilities or average revenues (inflated to 2005$) of $287,605 (U.S. Bureau of Labor Statistics 2006). This figure was used to measure the incremental impacts of the revisions to the 2008 LRRP rule on non-profit centers.

6.2.6.4 Impacts on Non-Profit Daycare Centers

The impacts on non-profit daycare centers were estimated by first dividing total annualized checklist costs incurred by these entities under Option A by the number of centers. Average costs per center were then divided by average revenues to calculate a cost-to-revenue ratio. These calculations and the resulting ratios are presented in Table 6-30.

[12] Data were available for the following states: Oklahoma, New Jersey, Iowa, Hawaii, Ohio, Kansas, South Carolina, West Virginia, Louisiana, Virginia, New York, South Dakota, Indiana, Maine and Massachusetts.

Table 6-30: Cost-to-Revenue Ratios for Non-Profit Daycare Centers					
Regulatory Option	**Total Daycare Centers Doing Work**	**Total Cost of Rule to Daycare Centers**	**Average Cost of Rule per Daycare Center**	**Estimated Average Daycare Center Revenues**	**Cost-to-Revenue Ratio**
Option A	10,481	$13,672	$1	$287,605	0.0005%

6.2.7 Public Schools (Small Governments)

The RFA defines a small government jurisdiction as the government of a city, county, town, school district or special district with a population of less than 50,000. This economic analysis relies on National Center for Education Statistics (NCES) Common Core of Data (CCD) survey data to estimate the number of school districts that have schools with pre-kindergarten or kindergarten programs, the number of such schools per district, and district revenues.[13] Furthermore, for most districts, a cross-reference system with the 2000 Decennial Census provides a means for estimating the size of the population served by the district.

Public schools are currently regulated under the 2008 LRRP Rule and would seek certification before the removal of the opt-out provision. However, these entities would incur recordkeeping checklist provision costs under the revisions to the 2008 LRRP rule. As this analysis estimates the incremental costs of the revisions, the following sections present only the potential cost impacts of the checklist provision.

6.2.7.1 Number of Small Public School Districts Affected by the Revisions to the 2008 LRRP Rule

Number of Small Public School Districts

As discussed in Chapter 2, there are approximately 18,000 public school districts in the United States. Based on CCD data, 14,473 of these school districts have at least one school with a kindergarten or pre-K program; in total, these districts have 52,129 such schools (NCES 2006b,c). Of the 14,473 school districts, 13,330 serve a population of fewer than 50,000 people. These 13,330 districts have a total of 26,779 schools with kindergartens or pre-kindergartens (NCES 2006b,c,g). These counts are not limited to pre-1978 schools.

Since the Regulatory Flexibility Analysis is only concerned with the direct costs of regulation, this small entity analysis only considers the costs that school districts will incur if they perform regulated renovation, repair, or painting projects using their own maintenance staff instead of hiring a contractor. Costs and impacts associated with work performed by a contractor are accounted for in the contractor section of this analysis.

As discussed in Chapter 4, this analysis assumes that public schools will perform all painting and carpentry events using in-house staff. In addition, they are assumed to perform one of the unscheduled maintenance events in each building using in-house staff each year.[14] Thus, all small school districts that have at least one pre-1978 building will incur recordkeeping checklist costs under the revisions to the 2008 LRRP rule.

[13] It is possible that government agencies also operate some of the childcare facilities included in the daycare center counts throughout this economic analysis. Due to insufficient data, it was not possible to estimate the number of such government-run facilities, or the number or size of the agencies that operate them. As such, this small government impact analysis is limited to public school districts.

[14] The analysis assumes that all electrical, plumbing and HVAC work, as well as the remaining unscheduled maintenance projects, are contracted out.

Number of Small Public Schools Affected by the Revisions to the 2008 LRRP Rule

The number of small school districts with at least one regulated building was estimated based on the number of school buildings in the district and the likelihood that any one of the buildings is old enough to be regulated. Using 2003 HUD data, 58 percent of school buildings are estimated to have been built before 1978, and 55 percent of the pre-1978 buildings are estimated to have built before 1960 (U.S. HUD 2003). Thus, for example, under Option A the probability that any particular school building was built after 1978 is 0.42 (1-0.58). The likelihood that a district has no pre-1978 buildings is a function of the number of buildings and 0.42 as follows[15]:

(0.42)^X, where X is the number of schools with kindergarten or pre-kindergarten in the district

For example, a district with three buildings has a (0.42)*(0.42)*(0.42) = 0.074 probability of containing no pre-1978 buildings. Using this approach, 92.6 percent of districts with three buildings are estimated to have at least one building that is pre-1978. To estimate the average number of pre-1978 buildings in a 3-building district with at least one pre-1978 building, the total number of buildings in 3-building districts was multiplied by the percent of all schools constructed before 1978 (58 percent) and divided by the number of districts with at least one pre-1978 building.

Table 6-31 presents the 50-year average numbers of small school districts with at least one pre-1978 building and the average number of buildings in these districts under Option A. The use of 50-year average, rather than first or second year numbers accounts for the fact that, after the first year, the numbers of regulated districts and pre-1978 schools are expected to decrease by 0.41 percent per year due to building demolition.

Table 6-31: Number of Regulated Small School Districts and Public School Buildings

Regulatory Option	Number of Small School Districts with at Least 1 Regulated Building [a]	Total Number of Regulated Buildings in Small Districts	Average Number of Regulated Buildings per Small District
Option A	6,492	10,552	1.6

a. A regulated building is defined as having a kindergarten or pre-kindergarten program.

6.2.7.2 Recordkeeping Checklist Costs – Public Schools

The estimation of checklist costs incurred by each district is based on the number of regulated buildings in these districts, the average number of events per-building performed in-house, and the average checklist costs per event.

Number of Events Performed Annually by Schools in Small Districts – Public Schools

Public and private schools (except for private schools with less than 100 students) are expected to perform in-house all painting and window/door carpentry work as well as an average of one unscheduled maintenance event per building every year using their own staff. (Private schools with fewer than 100 students are assumed to contract out all of their RRP work instead of doing RRP work in-house.) School maintenance staffs are expected to perform 2.9 maintenance events per building per year.

[15] It is assumed that the age of each building is independent of the age of all other buildings in the district. This may somewhat overestimate the number of districts that have at least one pre-1978 buildings. But data are not available to calculate the joint probabilities.

Table 6-32 presents the total and average numbers of events performed by public school districts in a typical year under Option A.

Table 6-32: Average Annual Number of Events performed by Public School Staff

Regulatory Option	Number of Small Districts	Total Number of Buildings in Small Districts	Average In-house Events per Building	Total In-House Events	Average Number of In-house Events per District
Option A	6,492	10,552	2.87	30,246	4.7

Total Checklist Compliance Costs

As discussed in 6.2.2, the average annualized checklist cost per event in COFs in public or commercial buildings is $2 (see Table 6-8). Multiplying this average cost by the average annual number of events in small school districts yields the total annualized checklist costs incurred by small districts in a typical year. These costs, and resulting checklist costs per district, are presented in Table 6-33.

Table 6-33: Average Annualized Checklist Costs for Public Schools

Regulatory Option	Total In-House Events	Annualized Avg. Checklist Cost per Event	Total Checklist Costs [a]	Average Checklist Costs per Small District
Option A	30,246	$2	$55,254	$9
a. Total costs are calculated using unrounded unit costs.				

6.2.7.3 Public School Revenues

The impact of the revisions to the 2008 LRRP rule on small government jurisdictions is estimated by comparing the estimated incremental costs of the revisions to the annual government revenues of small regulated jurisdictions. Revenue data for school districts is available from NCES's *Common Core of Data* "Local Education Agency (School District) Finance Survey (F-33)" dataset (NCES 2006d). Small districts include local school boards, supervisory unions, regional education agencies, and other agencies, which primarily include charter schools. Revenue data are available for the vast majority of districts. Average revenues for all small districts were estimated by a) calculating the average revenues of each type of district based on available data, b) multiplying the average revenues by the total number of districts of that type, then c) summing the resulting total revenues and dividing by the total number of small districts. This approach presumes that there is no non-response bias among districts within each category.

Table 6-34 presents small district revenue calculations and resulting estimates.

Table 6-34: Estimated Annual Revenues for Small Public School Districts

District Type	Total Small Districts	Small Districts w/ Revenue Data	Total Small District Revenues Reported (Million $)	Average Reported Revenues (Million $)	Estimated Total Revenues (Million $)	Estimated Average Revenues (Million $)
Local School District (A)[a]	10,930	10,868	$179,530	$16.5	$180,554	$16.5
Local School District (B)[a]	1,200	1,197	$13,926	$11.6	$13,961	$11.6
Supervisory Union	84	76	$1,186	$15.6	$1,311	$15.6
Regional Education Agency	167	158	$7,612	$48.2	$8,046	$48.2
Other (Charter School)	949	773	$2,074	$2.7	$2,546	$2.7
Total	**13,330**	**13,072**	**$204,329**	**$15.6**	**$206,419**	**$15.5**

a. There are two different types of local school districts in NCES data – independent districts and districts that are connected to a supervisory union office. These local school districts are combined in Chapters 2 and 4, but are treated separately in estimating weighted average revenues.

6.2.7.4 Impact of the Revisions to the 2008 LRRP Rule on Small Public School Districts

Table 6-33 presents the total annualized recordkeeping checklist costs incurred by small public school districts as well as the average annualized costs per small district. Average annualized costs are then divided by annual district revenues, as calculated in Table 6-35, to obtain a cost-to-revenue ratio.

Table 6-35: Cost-to-Revenue Ratios for Small Public Schools

Regulatory Option	Total Regulated Small Districts	Total Cost of Rule to Small Districts	Average Cost of Rule per Small District	Estimated Average Small District Revenues (Million $)	Cost-to-Revenue Ratio
Option A	6,492	$55,254	$9	$15.5	0.0001%

6.2.8 Private Schools (Small Non-Profits)

Private schools are currently regulated under the 2008 LRRP Rule and are not affected by the removal of the opt-out provision. However, these entities would incur recordkeeping checklist provision costs under the revisions to the 2008 LRRP rule. As this analysis estimates the incremental costs of the revisions, the following sections present the potential cost impacts of the checklist provision, only.

6.2.8.1 Number of Small Private Schools

As discussed in Chapter 2, according to the 2003-2004 NCES *Private School Universe Survey* Data, there are a total of 26,531 private schools with kindergarten or pre-kindergarten programs in the United States (NCES 2006e,f). Based on HUD data, 58 percent, or 15,387 of these schools were constructed before 1978, and 55 percent of the pre-1978 buildings, or 8,463 schools, were constructed before 1960. Because no data source providing the number of private schools at different revenue levels was identified, all private schools are considered to be small entities. In other words, the analysis assumes that each private school is independently run and is not part of a larger organization. As such, the analysis may overestimate the number of affected non-profit organizations and the impacts of the rule on these entities.

Similar to public schools, private schools will only incur direct costs as a result of this rule if they use their own maintenance staff to perform regulated RRP work. Schools that perform regulated jobs in-house will incur recordkeeping checklist costs as a result of the revisions to the 2008 LRRP rule. This analysis assumes that private schools with fewer than 100 students will contract out all of their renovation and repair work because of their small size, and costs and impacts associated with work performed by a contractor are accounted for in the contractor section of this analysis. Private schools serving more than 100 students are assumed to use their own staff to perform all painting and window/door carpentry work as well as perform an average of one unscheduled maintenance event every two years and to hire contractors to perform all other renovation, addition, and alteration projects.

As discussed in detail in Chapter 2, based on NCES's Private School Universe survey data, 41 percent of private schools with a kindergarten and/or pre-kindergarten have fewer than 100 students. Table 6-36 presents the total number of private schools regulated under Option A in a typical year, the number of schools with fewer than 100 students, and the number of schools with more than 100 students. The use of average annual numbers accounts for the fact that after the first year, the numbers of pre-1978 schools are expected to decrease by 0.41 percent per year due to building demolition.

Table 6-36: Average Annual Number of Private Schools with Kindergarten or Pre-Kindergarten

Regulatory Option	Total Number of Private Schools with Kindergarten or Pre-Kindergarten	Percent of Private Schools with <100 Students	Number of Private Schools with <100 Students	Number of Private Schools with >100 Students
Option A	10,454	41%	4,280	6,174

6.2.8.2 Recordkeeping Checklist Costs – Private Schools

Schools are expected to perform an average of approximately 2.9 events in-house per year. Table 6-37 presents the total number of private schools regulated in the first year under Option A, the total number of events performed in these schools, and the total annualized checklist costs associated with these events. Total checklist costs are estimated by multiplying the average annual number of events by the average annualized checklist cost per event ($2; see Table 6-8). Average annualized checklist costs per private school are calculated by dividing total checklist costs by the number of affected schools.

Table 6-37: Average Checklist Costs for Private Schools

Regulatory Option	Number of Private Schools w>100 Students	Total Annual Number of In-house Events	Total Annualized Checklist Costs [a]	Average Annualized Checklist Costs per School
Option A	6,174	17,697	$32,329	$5
a. Total costs are calculated using unrounded unit costs.				

6.2.8.3 Impact of the Revisions to the 2008 LRRP Rule on Small Private Schools

Conceptually, impacts on non-profit establishments such as schools might be measured in terms of the ratio of rule costs to annual operating expenses. Due to the scarcity of data on private school operating expenditures (schools are excluded from the U.S. Economic Census, and NCES does not have a financial

data set for private schools), annual private school expenditures are approximated based on estimated operating expenses per student obtained from a 1995 study by NCES entitled *Estimates of Expenditures for Private K-12 Schools* and information on the number of students enrolled at each school as reported in NCES's 2003-2004 Private School Universe Survey data set.

Based on NCES data (1995), this analysis estimates that private school expenditures average about $3,377 (2005$) per child per year. Appendix 6A explains the derivation of this estimate in detail.

To estimate average private school expenditures for schools with over 100 students operating pre-kindergarten or kindergarten programs, the average number of students per school meeting this criteria was calculated based on 2003-2004 NCES survey data (NCES 2006f). Schools for which no total student enrollment data was available were assumed to have the average enrollment at schools with more than 100 students where student data was provided. Using these assumptions, the average private school with over 100 students was estimated to serve 283 students per year. As such, average expenditures for private schools are estimated to be $3,377*283, or $956,697.

Impacts on private schools were estimated by dividing the total annualized checklist costs incurred by these schools under Option A by the number of regulated schools. Average costs per school were then divided by average expenditures to calculate a cost-to-expenditure ratio. These calculations and the resulting ratio are presented in Table 6-38.

Table 6-38: Cost-to-Expense Ratios for Private Schools

Regulatory Option	Total Regulated Private Schools with > 100 kids	Total Cost of Rule to Private Schools	Average Cost of Rule per Private school	Estimated Average Small School Expenditures	Cost-to-Expenditure Ratio
Option A	6,174	$32,329	$5	$956,697	0.001%

6.2.9 Summary of the Revisions to the 2008 LRRP Rule Impacts on Small Governments, Non-Profit Organizations, and Small For-Profit Businesses

The vast majority of entities in the industries affected by the revisions to the 2008 LRRP rule are small. As a result of the revisions, approximately 289,250 small entities would incur costs under Option A, incremental to impacts associated with the 2008 LRRP rule. Of the total, 100,662 small residential contractors would seek certification as a result of the removal of the opt-out provision; therefore, they would incur training, certification, work practice, and checklist costs. The remaining 188,588 small entities, who are currently regulated by the 2008 LRRP rule, would only incur the incremental costs of the recordkeeping checklist provisions.

6.2.9.1 Incremental Impacts of the Revisions – Opt-Out Entities

The average annualized incremental cost of the revisions to a typical small opt-out entity is estimated to range from $1,700 to $5,200 under Option A, depending on the number of renovation, repair, and painting events undertaken by a small opt-out entity in the industry sector involved. As shown in Table 6-39, under Option A, the incremental cost impact of the revisions to the 2008 LRRP rule on small opt-out entities ranges from 0.87 percent to 2.19 percent of revenues depending on the industry sector.

Table 6-39: Typical-Year Number of Small Opt-Out Entities with RRP Events and Associated Cost-Impact Ratio			
		Option A	
	Entity Type	Number of Small Entities	Cost-Impact Ratio
Residential Contractors (working in target housing)			
Residential remodelers	Business	32,093	1.03%
Siding contractors	Business	2,335	1.20%
Finish carpentry contractors	Business	22,790	1.69%
Other building equipment contractors	Business	1,059	0.88%
Other building finishing contractors	Business	1,450	1.17%
Tile and terrazzo contractors	Business	3,255	1.49%
Plumbing and HVAC contractors	Business	10,953	0.92%
Glass and glazing contractors	Business	966	0.87%
Painting and wall covering contractors	Business	12,650	2.19%
Electrical contractors	Business	7,787	1.12%
Drywall and insulation contractors	Business	5,326	1.14%
Total		**100,662**	

Table 6-40 presents the total number of small for-profit businesses and the average cost-to-revenue ratio for that category. It is estimated that under Option A, a total of 100,662 small for profit businesses would be affected by the program with average impacts of 1.17 percent.

Table 6-40: Aggregate Small Opt-Out Entity Impacts		
	Total Number of Small Entities Affected	Average Impacts, All Small Entities
Option A		
Small For-Profit Businesses	100,662	1.17%
Total	**100,662**	

6.2.9.2 Incremental Impacts of the Revisions – Currently Regulated Entities

The average annualized incremental cost of the revisions to a typical small currently regulated entity is estimated to range from $1 to $214 under Option A depending on the number of renovation, repair, and painting events undertaken by a small entity in the industry sector involved. As shown in Table 6-41, under Option A, the incremental cost impact of the revisions to the 2008 LRRP rule on small currently regulated entities ranges from about .0001 percent to .07 percent of revenues, depending on the industry sector.

Table 6-41: Typical-Year Number of Small Entities with RRP Events Currently Regulated Under the 2008 LRRP Rule

		Option A	
Description	**Entity Type**	**Number of Small Entities**	**Cost-Impact Ratio**
Public School Districts	Government	6,492	0.0001%
Private Schools	Non-Profit	6,174	0.0005%
Daycare Centers	Non-Profit	10,481	0.0005%
Non-Residential Landlords	Business	11,056	0.0010%
Non-Residential Contractors (working in public or commercial building COFs)	Business	2,866	0.01%
Residential Contractors (working in target housing)			
Residential remodelers	Business	41,359	0.03%
Siding contractors	Business	3,008	0.04%
Finish carpentry contractors	Business	29,369	0.06%
Other building equipment contractors	Business	1,365	0.03%
Other building finishing contractors	Business	1,868	0.04%
Tile and terrazzo contractors	Business	4,195	0.05%
Plumbing and HVAC contractors	Business	14,114	0.03%
Glass and glazing contractors	Business	1,244	0.03%
Painting and wall covering contractors	Business	16,302	0.07%
Electrical contractors	Business	10,035	0.04%
Drywall and insulation contractors	Business	6,863	0.04%
Residential Property Managers	Business	5,824	0.06%
Lessors of Residential Real Estate	Business	15,970	0.02%
Total		**188,588**	

Table 6-42 presents the total number of small, currently-regulated governments, non-profit organizations, and small for-profit businesses, and the average cost-to-revenue ratios for each category. It is estimated that under Option A, a total of 188,588 small entities would be affected by the program, including 165,440 small businesses with average impacts of 0.03 percent, 16,655 small non-profits with average impacts less than 0.0005 percent, and 6,492 small governments with average impacts less than 0.001 percent.

Table 6-42: Aggregate Small Entity Impacts on Entities Currently Regulated Under the 2008 LRRP rule

	Total Number of Small Entities Affected	**Average Impacts, All Small Entities**
Option A		
Small Governments	6,492	0.0001%
Non-Profit Organizations	16,655	0.0005%
Small For-Profit Businesses	165,440	0.03%
Total	**188,588**	

6.2.9.3 Incremental Impacts of the Revisions – All Small Entities

Table 6-43 presents the total number of small governments, non-profit organizations, and small for-profit businesses, and the average cost-to-revenue ratios for each category. It is estimated that under Option A, a total of 289,250 small entities would be affected by the program, including 266,102 small businesses with average impacts of 0.39 percent, 16,655 small non-profits with average impacts of about 0.0005 percent, and 6,492 small governments with average impacts of about 0.0001 percent.

Table 6-43: Aggregate Impacts on All Small Entities

	Total Number of Small Entities Affected	Average Impacts, All Small Entities
Option A		
Small Governments	6,492	0.0001%
Non-Profit Organizations	16,655	0.0005%
Small For-Profit Businesses	266,102	0.39%
Total	**289,250**	

6.3 Unfunded Mandates Reform Act (UMRA)

Title II of the Unfunded Mandates Reform Act of 1995, Pub. L. 104-4, establishes requirements for Federal agencies to assess the effects of their regulatory actions on State, local, and Tribal governments, and the private sector. Under section 202 of the UMRA, EPA generally must prepare a written statement, including a cost-benefit analysis, for proposed and final rules with "Federal mandates" that might result in expenditures by State, local, and Tribal governments, in the aggregate, or by the private sector, of $100 million or more (when adjusted annually for inflation) in any one year.[16]

Before promulgating a regulation for which a written statement is needed, section 205 of the UMRA generally requires EPA to identify and consider a reasonable number of regulatory alternatives and adopt the least costly, most cost-effective, or least burdensome alternative that achieves the objectives of the rule. The provisions of section 205 do not apply when they are inconsistent with applicable law. Moreover, section 205 allows EPA to adopt an alternative other than the least costly, most cost-effective, or least burdensome alternative if the Administrator publishes with the rule an explanation of why that alternative was not adopted. Before EPA establishes any regulatory requirements that might significantly or uniquely affect small governments, including Tribal governments, it must have developed under section 203 of the UMRA a small government agency plan. The plan must provide for notifying potentially affected small governments, enabling officials of affected small governments to have meaningful and timely input in the development of EPA regulatory proposals with significant intergovernmental mandates, and informing, educating, and advising small governments on compliance with regulatory requirements. This section identifies the government entities that may be affected by the revisions to the 2008 LRRP rule.

[16] When the original $100 million UMRA threshold is adjusted for inflation from 1995 to 2005 dollars using an implicit price deflator for gross domestic product, the result is a threshold of $118 million.

6.3.1 Affected Government Entities

The revisions to the 2008 LRRP rule will affect activities in publicly owned child-occupied facilities, specifically publicly owned housing and public schools.[17] As with the private sector, the recordkeeping checklist provision will increase the cost of operating these facilities by requiring that a copy of the recordkeeping checklist be posted in an area available to parents of students. Each school district that uses its own in-house staff to perform RRP activities in regulated buildings is required to comply with the checklist provision. Thus, state and local governments will incur incremental costs of photocopying and posting the checklist during the renovation, repair, and painting of public school buildings.

While most of what is commonly referred to as public housing is owned by state or local governments and provided for the benefit of low-income and/or elderly households, other public entities (such as public colleges and universities) may provide housing regulated under the LRRP rule. As with the private sector, the revisions to the LRRP regulations will increase the cost of operating this housing by requiring that the recordkeeping checklist be made available to occupants. However, this is a very small cost, estimated to average $2 per renovation.

6.3.2 Expenditures by State, Local, and Tribal Governments – Public School Districts

State, local, and Tribal governments will incur the incremental costs imposed by the revisions to the 2008 LRRP rule when public school districts engage in certain RRP activities.[18] Based on available data and the economic analysis presented in Chapter 4 and Section 6.2, Section 6.3 assumes that all public school districts will perform all painting- and window/door carpentry tasks themselves, as well as some unscheduled maintenance and repairs. Public schools are assumed to hire third-party contractors to perform the remainder of their RRP work. Since all public school districts use their own staff to perform some of their RRP activities, all public school districts would need to comply with the recordkeeping checklist requirements outlined in Chapter 4.[19] Table 6-44 presents the estimated total annualized incremental costs of the revisions that would be incurred by public school districts under Option A.

Table 6-44: Total Annualized Incremental Costs to All Public School Districts, Option A

Average Annual Number of Districts Affected [a]	Average Annual Number of Buildings Affected [a]	Total Average Annual Number of Events [b]	Average Annualized Cost Per District (2005$)	Total Annualized Cost (2005$)
7,049	11,457	32,839	$9	$59,991

a. In the first year, the COF Rule is expected to affect 7,782 public school districts and 12,648 school buildings in these districts. Every year thereafter, the number of affected districts and schools is expected to decrease by 0.41 percent as older buildings are demolished. The use of 50-year average numbers of districts and schools captures this annual decrease.

b. Schools are expected to perform 2.87 events per year per building using their own maintenance staff (see Section 6.2 for more details).

[17] It is possible that government agencies also operate some of the childcare facilities included in the daycare center counts throughout this economic analysis. Due to insufficient data, it was not possible to estimate the number of such government-run facilities, or the number or size of the agencies that operate them. As such, this Unfunded Mandates Reform Act is limited to public school districts.

[18] As discussed in Chapter 4, states would be able to apply for, and receive authorization to administer these requirements, but would be under no obligation to do so.

[19] It is important to note that this analysis uses a 75 percent compliance rate. See Chapter 4 and the small entity analysis (Section 6.2) for a more comprehensive discussion of these cost estimates.

The cost to revenue ratio for affected school districts is 0.00003 percent under Option A. These calculations are summarized in Table 6-45.

Table 6-45: Cost-to-Revenue Ratios for Affected Public Schools

Regulatory Option	Average Annual Regulated Districts	Total Annualized Cost of Rule to Districts	Average Annualized Cost of Rule per District	Estimated Average District Revenues (mil)	Cost-to-Revenue Ratio
Option A	7,049	$59,991	$9	$31.9	0.00003%

6.4 Executive Order 13132 - Federalism

Executive Order 13132, entitled *Federalism* (64 FR 43255, August 10, 1999), directs federal agencies to consider whether a rule has federalism implications (i.e. whether it has substantial direct effects on the states, on the relationship between the national government and the states, or on the distribution of power and responsibilities among the various levels of government, as specified in Executive Order 13132).

As discussed in Chapter 4, states would be able to apply for and receive authorization to administer these requirements but would be under no obligation to do so. In the absence of a state authorization, EPA will administer these requirements. While the cost analysis assumes that EPA will administer and enforce the program in all places, it also assumes that states would incur similar costs if they administer and enforce the regulation. To the extent that they operate target housing or child-occupied facilities, states may incur costs due to the requirement that the recordkeeping checklist be made available to occupants. Given the low cost per event of providing the checklist, this rule is not expected to have a significant impact on states.

6.5 Executive Order 13175 - Tribal Implications

Executive Order 13175, entitled *Consultation and Coordination with Indian Tribal Governments* (59 FR 22951, November 6, 2000), directs federal agencies to consider whether a rule has tribal implications (i.e. whether it has substantial direct effects on tribal governments, on the relationship between the Federal government and the Indian tribes, or on the distribution of power and responsibilities between the Federal government and Indian tribes).

Under the revisions to the 2008 LRRP rule, Tribes would be able to apply for and receive authorization to administer these requirements on Tribal lands, but Tribes would be under no obligation to do so. In the absence of a Tribal authorization, EPA will administer these requirements.

To the extent that Tribes operate target housing or child-occupied facilities, they may incur costs due to the requirement that the recordkeeping checklist be made available to occupants. The number of Tribal authorities that conduct renovation work on regulated properties is not known. However, given the low cost per event for providing the checklist, this rule is not expected to have a substantial direct effect on Tribes.

6.6 Protection of Children from Environmental Health Risk and Safety Risks

Under Executive Order 13045, a regulation must be reviewed if the regulatory action is economically significant and concerns an environmental health risk or safety risk that may disproportionately affect children. Since children are particularly susceptible to the IQ loss and adverse health effects caused by exposure to lead dust, a significant objective of the revisions to the 2008 LRRP rule is the protection of

children's health. Removing the opt-out provision protects children under the age of six who spend a limited amount of time in housing (such as a relative or caregiver's house) where a renovation has been performed under the opt-out provision; children who move into such housing when their family purchases it after such a renovation has been performed; and children who live in a property adjacent or near to owner-occupied housing where renovation has been performed under the opt-out provision. This analysis looks at the number of children in one of these groups – children who receive regular care in a house that does not meet the definition of a child-occupied facility.

6.6.1 Target Housing Affected by the Elimination of the Opt-Out Provision

Children Receiving Regular Care in Target Housing that is not a COF

A target housing unit where a child visits regularly, but spends fewer that 6 hours a week is not considered a child-occupied facility. Therefore, these housing units, hereafter referred to as Regular Care Target Housing (RCTH) units, are eligible for the opt-out provision under the 2008 LRRP rule providing that there is no child under the age of six or pregnant woman that resides in the unit. Thus, children visiting RCTH may benefit from the elimination of the opt-out provision by reducing potential exposures to lead dust during these visits.

Table 6-46 presents the annual number of children visiting opt-out eligible RCTH where LBP is disturbed during RRP events that are protected by the removal of the opt-out provision.

Table 6-46: Annual Number of Children Visiting Opt-Out Eligible RCTH Where LBP is Disturbed During an RRP Event that are Protected by the Removal of the Opt-out Provision

Option	Number of Children Under the Age of 6 Protected by the Rule each Year[a]	
	First Year	Second Year[b]
A	16,215	16,149
B	8,108	16,149
C	0	16,149
D	13,597	16,149
E1 to E4[c]	16,215	16,149

a. Assumes a 75% compliance rate.

b. The stock of target housing, and therefore the number of individuals living in target housing, is assumed to decline by 0.41% per year (due to demolitions, conversions, etc,) based on Census data.

c. Options E1 to E4 cover the same target housing universe and have the same effective date as Option A, but do not provide the same level of protection because they do not require all of the work practice standards under 40 CFR 734.85.

Since the opt-out provision is eliminated under Option A as soon as the rule becomes effective, all children receiving care in opt-out eligible RCTH performing RRP that disturbs LBP are protected in the first year. Since the opt-out provision under Option B is eliminated six months later (halfway through the beginning of the first year the rule is in place), the number of individuals protected under Option B in the first year is half the number estimated for Option A. Under Option C, the opt-out provision is eliminated a

year later. Under Option D the opt-out provision is eliminated as soon as the rule becomes effective for housing built before 1960. Options E1 through E4 have the same effective dates and universe of regulated structures as Option A, but consider alternative work practice requirements. As indicated in Table 6-46, the majority of the children that would be protected by the elimination of the opt-out provision reside in housing built before 1960 because of the higher likelihood of LBP in these housing units. Options E1 through E4 have the same effective dates and universe of regulated structures as Option A, but consider alternative work practice requirements. In the second year (starting June 2011), the opt-out provision would be eliminated under all options.

6.7 Executive Order 13211 - Energy Effects

Executive Order 13211, entitled *Actions Concerning Regulations that Significantly Affect Energy Supply, Distribution, or Use* (66 FR 28355, May 22, 2001), directs federal agencies to identify actions that will have a significant adverse energy effect. Adverse effects are defined as:

- Reductions in crude oil supply in excess of 10,000 barrels per day;
- Reductions in fuel production in excess of 4,000 barrels per day;
- Reductions in coal production in excess of 5 million tons per year;
- Reductions in natural gas production in excess of 25 million mcf per year;
- Reductions in electricity production in excess of 1 billion kilowatt-hours per year or in excess of 500 megawatts of installed capacity;
- Increases in energy use required by the regulatory action that exceed any of the thresholds above;
- Increases in the cost of energy production in excess of one percent;
- Increases in the cost of energy distribution in excess of one percent; or
- Other similarly adverse outcomes.

The regulations under consideration will not significantly reduce energy production nor significantly increase energy costs.

6.8 National Technology Transfer and Advancement Act

Section 12(d) of the National Technology Transfer and Advancement Act of 1995 ("NTTAA"), Public Law No. 104-113, 12(d) (15 U.S.C. 272 note) directs federal agencies to use voluntary consensus standards in its regulatory activities unless to do so would be inconsistent with applicable law or otherwise impractical. Voluntary consensus standards are technical standards (e.g., materials specifications, test methods, sampling procedures, and business practices) that are developed or adopted by voluntary consensus standards bodies. The NTTAA directs federal agencies to provide Congress, through OMB, explanations when the Agency decides not to use available and applicable voluntary consensus standards.

This rulemaking does not involve technical standards. Therefore, EPA is not considering the use of any voluntary consensus standards.

6.9 Executive Order 12898 – Environmental Justice

Under Executive Order 12898, when promulgating a regulation, EPA investigates whether there are disproportionately high and adverse human health or environmental effects on minority and low-income populations. The LRRP regulation requires that renovators, when undertaking renovation activities in regulated facilities, reduce the risk of exposure to lead by employing the use of safe work practices. In addition, renovators are required to undertake cleaning verification at the end of each project. This environmental justice analysis first summarizes a few important points to consider when viewing the results. Next a summary of the impacts from the regulation on minority and low-income populations in

target housing units and child-occupied facilities is presented. Racial minorities and low-income households stand to accrue benefits as a result of the revision to the LRRP rule.

Following the work practice, cleaning, and cleaning verification steps specified in the rule will increase the costs for renovation, repair and painting activities that would be regulated as a result of the elimination of the opt-out provision from the 2008 LRRP rule. These additional costs may lead some lower income homeowners of properties in lower income neighborhoods to avoid using certified renovators or recommended practices. The incremental costs of the rule's work practices are typically below $200, and for many jobs the cost is significantly below this figure.[20] These costs are likely to be a small part of the total cost of the renovation, repair, and painting projects. EPA believes that these costs are unlikely to result in significant changes in consumer behavior. If however, the increased costs result in more projects being undertaken by uncertified firms or by do-it-yourselfers, the risks in these instances would be the same as in the baseline and would not constitute new risks resulting from the revisions. EPA believes that the revisions would result in new risks only if the increased costs caused individuals to delay work such as painting until lead-based paint began peeling and chipping, creating a lead hazard. Such delays are expected to occur infrequently given the revisions' low cost per event.

The revisions to the 2008 LRRP rule would only add recordkeeping checklist requirements for buildings that are ineligible for the opt-out provision. The checklist requirements are not expected to have disproportionately high and adverse human health or environmental effects on minority and low-income populations.

6.9.1 Target Housing Currently Eligible for the Opt-Out Provision

This section evaluates the distribution of renovation events in target housing units and the individuals protected across three race and two income groups. Although it would be preferable to perform a joint environmental justice analysis for the race and income groups, relevant data are not available to make these population inferences. Therefore, the analysis was performed separately for the race and income groups.

6.9.1.1 Low Income

EPA defines low income individuals as individuals whose income are below the level set by the federal government's official poverty definition. Based on data from the *2000 Decennial Census*, 12.4% of individuals were living below the poverty level (U.S. Census Bureau 2000a). The analysis evaluates whether the removal of the opt-out provision will have a disproportionately greater effect on low income individuals.

The data in Table 6-47 presents the numbers of households below the poverty level that own their home. As a result of the elimination of the opt-out provision from the 2008 LRRP rule, more owner-occupied target housing events would be performed using the work practices required by the 2008 LRRP rule. Only households built prior to 1978 would potentially be affected by the revisions. About 4.5 percent of pre-1980 owner-occupied housing units have residents below the poverty line.

[20] This estimate is adjusted for baseline work practices and assumes a 75% compliance rate. See Chapter 4.

Table 6-47: Number and Percentage of Householders Below Poverty by Year Housing Built by Tenure		
	Owner Occupied Housing	
Year Housing Built	**Total Below Poverty**	**Percentage of All Owner Housing Below Poverty**
Pre-2000	4,371,712	6.26%
Pre-1980	3,133,302	4.49%
Pre-1960	1,765,185	2.53%
Pre-1950	1,167,604	1.67%
Source: U.S. Census Bureau 2000b.		

6.9.1.2 Race:

This section of the environmental justice analysis considers the impacts of the revisions across three race categories. The data in Table 6-48 compares the percentages of owners and renters for three categories of race, "White Alone," "Black/African American Alone," and "Asian Alone." The 2000 Census data shows that Black/African American households and Asian households are almost as likely to reside in owner housing as rental housing. Because no data were available for race by age of housing unit, this analysis uses pre-2000 housing to provide a general idea of these proportions.

Table 6-48: Number and Percentage of Householders by Race by Tenure in 2000			
Race	**Total**	**Percentage Owner**	**Percentage Renter**
White Alone	83,715,168	71.27%	28.73%
Black/African American Alone	11,977,309	46.33%	53.67%
Asian Alone	3,117,356	53.24%	46.76%
Source: U.S. Census Bureau 2000c.			

6.9.2 Conclusions

The revisions to the 2008 LRRP rule seeks to minimize the exposure of children and adults to lead-based paint hazards created during renovation, repair, and painting activities in certain types of owner-occupied target housing that are currently eligible for the opt-out provision. As such, EPA concludes that the revisions to the rule will not lead to disproportionately high and adverse human health or environmental effects on minority and low income populations in target housing units that would become regulated.

APPENDIX 6A – Estimating average per-pupil expenditures of private schools

This appendix outlines the methodology used to estimate total annual private school expenditures for the small entity analysis. Total annual school expenditures were estimated based on per-student operating expense data and information on the number of students enrolled. This analysis used per-pupil expenditure values for 1991-92, first calculated in a working paper published by the National Center for Education Statistics (NCES) entitled "Estimates of Expenditures for Private K-12 Schools" (NCES 1995). The two mean per-pupil expenditure values (one for elementary schools and one for combined schools) presented were combined into one value - the private school per-pupil expenditure value - using selected weights. Finally, this value was inflated to 2005 dollars using the CPI. The inflated value was used to estimate the total expenditures of private schools with various sized student bodies.

The NCES working paper divided 1991-92 Private School Survey (PSS) data into 19 mutually exclusive and exhaustive sectors of schools based on grade level (elementary, secondary, and combined elementary and secondary), and religious or other affiliation. The paper relied on expenditure data collected by three school associations (The National Catholic Education Association (NCEA), the Lutheran Church-Missouri Synod (LCNS), and the National Association of Independent Schools (NAIS)) to calculate average annual per-student expenditures for their associated schools. Data from the three surveyed school associations accounted for 45% of the total private school as presented in the PSS (NCES 1995). For the remaining schools, NCES estimated two sets of per-student expenditures using data obtained from Catholic and Lutheran schools (referred to as the Catholic and Lutheran School Models, respectively). Table 6A-1 presents the number of schools and the annual per-student expenditures for the 19 sectors of schools using the Lutheran school data to estimate missing expenditure values.

Table 6A-1: Estimated Per-pupil Expenditures of Private Schools by School Level and School Type (Based on the Lutheran Model)		
School Level and School Type	**Number of Schools**	**Estimated Mean Per Pupil Expenditures**
Elementary Schools		
Catholic	7,645	$1,895
Lutheran	1,563	$2,003
NAIS Religious	124	$6,313
NAIS Non-Sectarian	325	$8,807
Other Religious	5,240	$2,003
Other Non-Sectarian	2,084	$2,003
Special Education	114	$8,807
All Schools	17,093	$2,125
Secondary Schools		
Catholic	1,244	$3,909
Lutheran	87	$4,527
NAIS Religious	91	$16,523
NAIS Non-Sectarian	208	$58,730
Other Religious	477	$4,527
Other Non-Sectarian	342	$4,527
Special Education	171	$17,261
All Schools	2,620	$5,510
Combined Schools		
NAIS Religious	95	$9,052
NAIS Non-Sectarian	346	$9,662
Other Religious	4,085	$4,527
Other Non-Sectarian	943	$4,527
Special Education	817	$9,662
All Schools	6,285	$5,766
Sources: NCES 1995		

The per-student expenditure estimates presented are based on the Lutheran School Model rather than the Catholic School Model because, based on the evidence presented in NCES's study, Lutheran school data are likely to be more accurate. Specifically, when assessing the quality of the data, the working paper authors express concern over potential non-response bias and sampling error in the Catholic elementary and secondary school data. In addition, a comparison of the total operating expenses of private elementary and secondary schools generated by each model with an alternate estimate calculated annually by NCES indicated that while that both the Catholic and the Lutheran School Model estimates are below the alternative NCES estimates, the Lutheran School Model is the closer of the two.[21] Therefore the Lutheran School Model was used in this analysis.

To estimate per-student expenditures for schools likely to be affected by the revisions to the LRRP Rule, the school sectors most likely to contain schools with pre-kindergarten and kindergarten programs were

[21] The NCES estimate inflates private school data collected in the late 1970's.

identified in the NCES study. Table 6A-2 shows Table 6A-1 with an additional column indicating whether or not the estimated mean for that sector was included in the calculation for mean per-private-school-pupil expenditure based on the assumptions made about the likelihood of that sector containing a kindergarten or pre-kindergarten program. An "x" indicates that the mean per-pupil expenditure value is included in the calculation.

Table 6A-2: Estimated Per-pupil Expenditures of Private Schools by School Level, School Type, and Inclusion in the Calculation (Based on Lutheran School Model)

School Level and School Type	Number of Schools	Estimated Mean Per-pupil Expenditures	Included in the Calculation
Elementary Schools			
Catholic	7,645	$1,895	
Lutheran	1,563	$2,003	x
NAIS Religious	124	$6,313	
NAIS Non-Sectarian	325	$8,807	
Other Religious	5,240	$2,003	x
Other Non-Sectarian	2,084	$2,003	x
Special Education	114	$8,807	
All Schools	17,093	$2,125	
Secondary Schools			
Catholic	1,244	$3,909	
Lutheran	87	$4,527	
NAIS Religious	91	$16,523	
NAIS Non-Sectarian	208	$58,730	
Other Religious	477	$4,527	
Other Non-Sectarian	342	$4,527	
Special Education	171	$17,261	
All Schools	2,620	$5,510	
Combined Schools			
NAIS Religious	95	$9,052	
NAIS Non-Sectarian	346	$9,662	
Other Religious	4,085	$4,527	x
Other Non-Sectarian	943	$4,527	x
Special Education	817	$9,662	
All Schools	6,285	$5,766	

Sources: NCES 1995

Of the 19 sectors, 6 are for secondary schools only. Since the working paper notes that secondary schools[22] spend more than twice as much as elementary schools spend per pupil, and are the least likely, by definition, to contain a COF, they are excluded from the calculation of the mean per-pupil expenditure value.

[22] Defined as having a highest grade less than or equal to 12th and a lowest grade of greater than or equal to 6th.

For elementary schools[23], the $2,003 mean per-pupil expenditure cost was selected. This value represents 8,887 of the 17,093 (52%) elementary schools presented in the working paper. Though Catholic schools represent approximately 45 percent of all elementary schools, their associated mean per-pupil expenditure estimate is not used due to the potential bias discussed above. The remaining elementary school per-pupil expenditure values are between 3 and 4 times larger than the chosen value; however these means represent schools unlikely to be affected by the LRRP rule. For example, the mean per-pupil expenditure values presented for NAIS schools (449 of the 561 remaining schools) are much higher since "a relatively large proportion of NAIS schools are boarding schools and expenditures for dormitories are apparently included in the total operating expenditures for these schools." It is unlikely that a COF would be found in a boarding school. The remaining 112 schools are special education elementary schools, which are more costly because of their unique needs and are also less likely to contain a COF. Furthermore, as the working paper notes, "preschool is probably less expensive than other grades," and therefore, it is likely that the average across all elementary schools ($2,125) would overstate expenditures.

For combined schools, the $4,527 mean per-pupil expenditure cost is used.[24] This value represents 5,028 of the 6,285 (80%) combined schools presented in the working paper. The other mean per-pupil values are roughly double this value, pulling the mean for all combined schools up to $5,766. This higher value is not used as it most likely overstates the expenditures given that boarding schools and special education schools are again included in the calculation.

In order to obtain one private school per-pupil expenditure value, the previously discussed elementary school and combined school data were weighted. The weights were based on the current proportions of elementary schools and combined schools with either a pre-kindergarten or kindergarten program. In order to calculate the weights, this analysis used the data set underlying the National Center for Education Statistics (NCES) report entitled "Characteristics of Private Schools in the United States: Results From the 2003-2004 Private School Universe Survey." Note that it was assumed that per-student expenditures at K-terminal schools were the same as in elementary schools.[25]

In 2003-2004, there were a total of 18,289 private elementary schools and 4,338 private combined schools with pre-K or kindergarten programs. Thus, a weight of 0.81 (18,289/22,627) was attached to the mean per-pupil elementary school expenditure value and a weight of 0.19 (4,338/22,627) was attached to the mean per-pupil combined school expenditure value. This calculation yields a final private school per-pupil expenditure value of $2,426.

Because the study is based on 1991-1992 PSS data, it was assumed that expenditure values were in 1992 dollars. Taking into account inflation, $2,426 in 1992 dollars is equivalent to $3,377 in 2006 dollars (U.S. Bureau of Labor Statistics 2006).

[23] Defined as having a highest grade of less than or equal to 8th.

[24] A combined school is defined as having a highest grade less than or equal to 12th and a lowest grade less than or equal to 5th.

[25] A K-terminal school is defined as a school for which kindergarten is the highest grade. In the 2003-2004 PSS, K-terminals represented an estimated 22% of all private schools with either a kindergarten or pre-kindergarten program.

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